Teaching Tradition in a Digital World: Technology's Role in Traditional (Hindustani) Music Pedagogy

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Abstract: **Music has always come under the influence of many factors immediately close to it. They include cultural, social, linguistic, regional, economic and developmental, etc. Times have been changing rapidly with globalization and modernization. One of the most talked-about topics in the field of music today is the advancement of technology, which has inevitably left its mark on the world of music as well. Everything in this world has unavoidable pros and cons to it. It is acceptable that while we can advance with the benefits, we ought to bear with the drawbacks of it too. The integration of technology with Hindustani music represents a significant juncture in its evolution, reflecting the adaptability of this ancient art form to contemporary contexts. This transition is noteworthy for its embrace of modern tools and platforms while upholding the essence of its traditional heritage. The system of Hindustani music is deeply entrenched in an oral tradition where the knowledge and expression are transmitted from a guru to the disciple across generations without relying on written records and it is now at the forefront of digital pedagogy, leveraging technology to propagate its aesthetic principles and intricacies. This shift plays a vital role in fostering awareness and appreciation for the art form, with pedagogical mediums serving as key conduits. Through innovations like high-quality audio and video recording, sophisticated music software, and online learning portals, Hindustani music transcends geographical barriers, granting access to esteemed instructors and invaluable resources worldwide. Digital platforms facilitate interactive learning experiences, preserving the essence of the traditional teacher-student dynamic while adapting to contemporary needs. Moreover, technology enables global collaborations, innovative performances, and broad audience engagement, nurturing a dynamic community of artists and enthusiasts. This harmonious integration of tradition and innovation propels Hindustani music into a vibrant future, ensuring its enduring relevance and allure in an ever-changing world.**

Keywords: **Hindustani music, pedagogy, technology, tradition, teaching**

I. INTRODUCTION

History has shown evolutions and revolutions in the field of Indian classical music since the beginning. However, the series of revolutions that transpired during the late 19th and 20th centuries especially in the field of Hindustani music had a profound and far-reaching impact. Before the groundbreaking contributions of musicologists like Vishnu Digambar Paluskar and Vishnu Narayan Bhatkhande, the learning and teaching of music relied entirely on the oral tradition and this occurred exclusively within musician families or through royal patronage. This period saw the establishment of music schools and colleges, such as the Bhatkhande Music Institute in Lucknow and the Gandharva Mahavidyalaya in Lahore (now in Mumbai), founded by pioneers like Vishnu Narayan Bhatkhande and Vishnu Digambar Paluskar. These institutions played a crucial role in systematizing the teaching of classical music, codifying ragas and compositions, and standardizing notation systems. That way the musicologists sought to make classical music more accessible to a broader audience. The period also witnessed the proliferation of music conferences and festivals, which provided platforms for performances and scholarly exchanges. These efforts collectively contributed to the preservation and dissemination of Indian classical music, ensuring its continuity and adaptation in a rapidly modernizing society. Owing to these pioneers andthe many who followed their paths, we are now able to study music in formal educational institutions. As a result, articles like this one can be written with thorough research and detailed analysis.

The reliance on conventional methods of transmission of knowledge in Indian classical music poses significant challenges in developing detailed historical analyses of its practices, their evolution, and their connections to broader cultural trends. Additionally, this approach does not entirely welcome standardisation in pedagogy, as the teaching and learning process is deeply personalized and varies greatly between traditions and practitioners. Hindustani music has traditionally been preserved

and propagated through an oral tradition, epitomized by the intimate *guru-shishya* (teacher-student) relationship. Today, technology is revolutionizing this tradition, creating unprecedented opportunities for learning, sharing, and preserving this classical heritage.

Digital platforms facilitate interactive learning experiences, allowing personalized instruction that mimic the traditional *guru-shishya* dynamic. Furthermore, technology enables the archiving of performances and lessons, ensuring that the nuances of this oral tradition are meticulously preserved for future generations. This digital documentation serves as a valuable resource for both novice learners and seasoned practitioners, providing a wellspring of knowledge and inspiration. Thanks to technology, compositions in Hindustani music could be now archived in audio formats which could be later picked by the music practitioners and artists without being taught by someone.

During Covid-19 pandemic, as people picked up new hobbies or revived long-lost hobbies such as music, the demand for music classes surged, accelerating the shift from traditional classrooms to online platforms. Numerous informative and interactive videos went live, while pre-recorded music appreciation content was shared on social media. Although music appreciation videos existed earlier, this period opened new possibilities and innovative ways to introduce Hindustani music to the masses. Musicians began creating videos for social media, leveraging its global reach to educate non-musicians and enthusiasts while raising awareness about the art. Although adapting to this new mode of dissemination took time and faced some scrutiny, the survival of this art and the flow of its knowledge remained unhindered, as change is never immediate. The music community feared that if it was not for the technological advancements, by the end of the pandemic, more artists would be left depressed, as their minds and souls truly come alive through live performances, yet knowing that the true essence of the music lies in the organic methods majorly.

Precisely, the influence of modern technology in relation with Indian music pedagogy is directly proportional to the latter adapting to the changing scenarios and hence finding strategies to flourish. It is implicit that music, no matter how primitive or traditional, will always find ways to preserve its essence. In embracing technology, Hindustani music continues to thrive, evolving with the times while staying rooted in its rich cultural heritage. The confluence of Hindustani music and modern technology marks a transformative chapter in the evolution of this ancient art form. With careful gauging, this synergy between tradition and innovation, promises a dynamic future for Hindustani music, ensuring its relevance and appeal in a rapidly changing world.

Hindustani music has two qualitative behaviors – a. Oral and aural tradition of passing on knowledge. b. Being an improvisational form of music, which means it has a tendency to change in different ways, gradually, if not immediately. Therefore, it makes it easier to implement any method to help the growth of music eventually if not immediately, because it is open to accept any change, considering the entire structure and system of this musical tradition. It is implicit that Hindustani Music is receptive and adaptive to any changes and history has proved it.

II.   PEDAGOGY

While music may seem intangible or fleeting, it carries deep historical significance and insights, making it a powerful tool for understanding the past. "…he [V N Bhatkhande] talked with musicians and musicologists, learning both their theoretical practical ideas, and collected a large number of traditional compositions which had typically been handed down in hereditary musical families, which at that time formed the core of musical practitioners in North India…he was able to collect over 2000 compositions, some dating back over two or three centuries. He carefully wrote them down, attended to correcting obvious interpolations and corruptions, and notated them with a notation system of his own devising. About 1500 of these, (together with some 300 of his own compositions) appear in the six volumes of the Kramik Pustak Malika." (Gangolli, n.d.) This is possibly one of the very first technologies devised in the aim of acquiring and protecting different compositions to save them from being lost in the oral tradition. "…notation can play a role in preserving, albeit sketchily, the musical intent of the composer has now come to be accepted by performing Hindustani musicians in India. This is evidenced by the appearance of published volumes of collected compositions of many individual musicians." *(Gangolli, n.d.)* In Hindustani music, the

notation system was initially developed as a safeguard, addressing the limitations of the conventional pedagogical methods where there was no written format of the teachings. It served as a method to archive and preserve '*bandishes*' (musical compositions) which further facilitated the learning process —a crucial first step towards the systematic retention of musical material.

As a traditional musical form, Hindustani music is evolving in response to change and it has been subject to change since its genesis (table 1). With the right methods and material of training, pedagogy plays a crucial role in creating awareness and appreciation of its aesthetics. The advent of online learning has revolutionized music education, making it more accessible, flexible, and inclusive than ever before. Technology is utilized for online videos, video call classes, digital tools for practice and performance, and various teaching methods. It involves a broad range of tools and platforms, ranging from good quality audio and video recording devices to advanced music softwares and online learning websites. These developments have enabled students to access tutorials, performances, and resources all over the world, democratising music and breaking the geographical and financial barriers. It also compels for the introduction of innovative teaching methods, fostering a global community of learners and educators. However, it also presents challenges, particularly in preserving the traditional essence and depth of personal mentorship inherent in disciplines like Hindustani vocal music.

The process of learning and teaching music has existed since the very beginning along with the concertising and pedagogy is possibly the most important medium through which the artform has survived through generations. Its methods and structures have evolved over time, adapting across generations in response to changes in the form of music itself.

Online music institutions have seen significant growth and evolution, particularly in recent years. Online music academies such as Shankar Mahadevan Academy, VoxGuru Academy, etc have made high-quality music education accessible to a global audience. These institutions offer a wide range of courses covering various aspects of music, from beginner to advanced levels, encompassing both theoretical and practical components. Practicing

equipment in Hindustani music has evolved with the adoption of technology. The *tanpura* (fig.1) helps practitioners maintain precise pitch and the *tablas* (fig.2) maintains the rhythmic cycle, ensuring the artist stays aligned with the chosen rhythm and tempo.

Table. 1

Aspect	Traditional method	Modern method
Attendance	Physical presence required both for learning and listening	Not necessary
Learning format	Oral Transmission	Compositions preserved in notation and audio can be learned by reading or listening.
Practice tools	Manual *tanpura*, tablas for practicing	Digital portable equipments and softwares
Performance venues	Small gatherings,	Small to large auditoriums, gatherings
Amplification	Recitals without sound system	With advanced sound systems
Archiving	Recitals experienced in the moment, transient performances, mortal	Digital recordings for future study, immortal

From manual *tanpuras* and *tablas,* musicians transitioned to electronic versions where the machines reproduced the sound of the *tanpura* and *tabla*, making practice and teaching more accessible, time-saving and cost-effective, especially for beginners. The electronic *tanpura* (fig. 2) could be tuned using the machine's knobs instead of its traditional pegs, while electronic *tablas* (fig. 3) digitally displayed the rhythmic beats, making it easier to understand *laya* and *taal*. These tools eliminated the need for purchasing manual *tanpuras* or hiring *tablas* accompanists, motivating these newcomers into regular practicing. These tools further evolved into mobile applications like

'iTablaPro' (fig. 3), 'Naadsadhana', etc offering even greater convenience, as they eliminated the bulkiness of electronic tanpuras and tablass, making them easily portable on a smartphone. However, the Gurus remain cautious about relying on them long-term, entitling the manual tanpuras as the living canvas. These electronic gadgets could be used in limited amounts to avoid over dependence. The Guru can timely guide the students when to detach themselves from these machines and parallelly begin using the natural instruments. Naadsadhana with its technology, helps you with keeping up your practice even in the absence of the Guru. In an interview, Sandeep Ranade, the founder of Naadsadhana explains that the Gurukul system required the tutor and pupil to live together, where along with the learning it ensured close supervision of practicing too. "Everytime you sing on your own, there has to be somebody telling you… [if you are out of tune - whether sharp or flat]". (Gadgets 360, 2019b) This is a great help for students new to learning music, especially in an era where distance and time pose challenges. Tutors and learners often cannot afford to spend extended time together or live with their gurus, making alternative learning methods essential. "You can perfect your notes, tempo, raga, taal and so on with precise audio-visual biofeedback, score and statistics." (Paul, 2021) Messaging platforms like WhatsApp are used for students to send their practice audios or videos to the teacher, who reviews them and provides feedback to ensure smooth and effective practice. This replicates the gurukul system with technological support, removing the need for physical presence.

fig. 1. Manual tanpura and tabla

fig. 2. electronic tanpua and tabla

fig. 3. iTablaPro - iOS mobile

Indian traditional music like Hindustani music which has an oral format of transferring of music knowledge, was not digitized until the early 21st century. It is now seeing development in preserving knowledge and information, both technical and practical aspects. It was difficult for a commoner who is very passionate about learning or knowing about at least the fundamentals of this music but do not want to pursue it as a career, because of the rigidity in the learning process. The Guru and the art itself demand a lot of time and effort from the students if they want to pursue music. For such enthusiasts there are several options on learning about the appreciation of music either online or offline platforms. Udemy offers a course on appreciation of music "Gandhar - a course in music appreciation" (*Gandhaar - a Course in Music Appreciation*, n.d.), which explains the fundamentals of this traditional music where one can not only be a knowledgeable listener but also get inspired to start to learn music irrespective of the age and location. Speaking about the conventional methods of training, Pratibha, the founder of VoxGuru, points out that classical music has often been taught in a way that feels exclusive, requiring a certain aptitude and making it intimidating for many learners. "Traditionally classical music has been a restricted eco system where students are expected to have a certain degree of musical aptitude to understand and grasp things taught by a Guru. This causes many people to fear classical music because it feels unapproachable and not very friendly in its teaching methods." (*P. Parthasarthy, personal communication, August 2024*)

VoxGuru academy has devised innovative methods using technology to make classical music more accessible. Their approach simplifies complex concepts without compromising the depth of the subject, ensuring that more learners can engage with and appreciate the art form with confidence. They have used various visual aids like, (fig. 4) "showcasing *swaras* on a staircase to help students understand the ups and downs of the notes, using clocks as a concept to understand *taal* which is nothing but a similar repeating rhythm," (*P. Parthasarthy, personal communication, August 2024)* and so on. It could be gathered from this that pedagogy is one of the very crucial and efficient devices and mediums to help disseminate the musical knowledge and create awareness of the art form not only to generate new musicians but new connoisseurs. With the rise of trending pop culture and its music, each generation drifts further away,

causing the essence of this beautiful art to fade, leaving it confined to only a few musicians.

fig. 4. visual representation of swara placement in VoxGuru's tutorial app.

The pedagogy in Hindustani music through online platforms is witnessing a shift towards new methods and techniques that simplify complex concepts, much like how platforms such as Byju's, Vedantu, Unacademy, etc have transformed academic learning. Music educators are also able to reach the audiences easily with the help of social platforms like YouTube, Instagram, Facebook, etc. Pratibha explains that by breaking down intricate musical ideas through visualization, interactive modules, and step-by-step explanations, these approaches make it easier for students to grasp the nuances of ragas, talas, and musical phrasing. (*P. Parthasarthy, personal communication, August 2024*) A defining feature of this evolving approach is the integration of logical and scientific analysis into the study of traditional musical concepts. Rather than relying solely on the age-old method of unquestioning acceptance, where students used to absorb the guru's teachings without challenge, modern pedagogy encourages critical thinking and exploration. This shift not only deepens understanding but also nurtures a more meaningful and personal connection to the art form, allowing students to appreciate the underlying structure and expressive potential of Hindustani music in greater detail. As quoted by D. B Williams explained in Cremata's paper, "…online learning and other efforts to integrate more contemporary pedagogies in music education context has the potential to capture broader learnerships, students of all backgrounds, and embrace all forms of music…". *(Cremata, 2021)* The world is undergoing a significant shift toward technological integration, and music education is poised to venture into uncharted musical territories. We find ourselves on the brink of a new era in both musical exploration and pedagogy, with technology opening doors to innovative teaching and learning experiences.

Upon interviewing students and parents from different parts of the world who largely hail from Indian ethnicity, it is quite apparent that the Indian community outside the country seems to be experiencing a deep sense of nostalgia for their motherland along with its rich culture and traditions that includes Indian classical music, dance, etc which they deeply value. They want to dedicate themselves to safeguarding these traditional art forms, which serve as a cornerstone of their identity as Indians. Living abroad among different lifestyles and cultures can make it challenging to stay connected to these aspects that signify their 'Indianness'. Therefore, when faced with the inability to attend in-person formal classes, they enthusiastically embrace the informal online platforms to ensure ongoing learning. And get access to quality music education transcending geographical bounds, allowing students from around the world to access quality music education. Pratibha opines that the geographical gap should not hinder the desire to learn or suppress talents. (*P. Parthasarthy, personal communication, August 2024)* The avid learners within and outside India can now learn music at their own pace, fitting their studies around their personal schedules. This flexibility is particularly beneficial for working professionals or students who cannot commit to regular class timings.

III. CURRENT GAPS IN DIGITAL PEDAGOGY FOR HINDUSTANI CLASSICAL TRAINING

1. Lack of Physical Presence: Hindustani music has a deeply experiential tradition, where the guru's physical presence is crucial. The immersive environment of traditional learning, where students observe, absorb, and internalize nuances, is difficult to replicate online. The mere soundscape of a live class enables us to absorb so much of the musical reverberations of the room which creates an unparalleled ambience where the personal energy gets transferred from teacher to student. In an online class, the essence and the soul of the music is deteriorated and makes it less impacting.

2. Audio Quality & Latency: "Latency has implications for two fundamental teacher-student modes of interaction [in music]: playing together, and conversation." (*Dealing With Latency in Your Online Teaching*, n.d.). While the aspect of the precision of the swara can be preserved to some extent, factors

like internet lag and poor audio transmission primarily affect the precision of *laya* (rhythm). Online teaching of several rhythmic components like compositions, or melodic playfulness with the rhythm (*bol-baant*, *taan*, etc) is challenging due to latency, which affects *laya* (rhythm) precision. For instance, in a physical class, the tutor can correct mistakes instantly as the taal plays in real-time. However, in an online class, the tutor must ask the student to pause, demonstrate the correction, and wait for them to retry. If the student is quick to grasp corrections, the process moves fairly smoothly. But if they struggle, a lot of time is required in correcting and making back-and-forth adjustments when compared to an offline class, where the student can internalise rhythm more effectively.

3. Training vocal techniques: In traditional learning, a guru corrects the voice throw, resonance, and projection in real-time. Online, students tend to sing softer due to mic sensitivity, affecting their ability to develop a full and powerful vocal tone.

4. Irreplaceable role of Guru: Although compositions can be archived and reproduced exactly as they were composed, adopting the *gayaki* (singing style) through technology remains a challenge. If technology were to enable this, it could potentially diminish the Guru's role. However, the music community firmly believes that no technology can replace a Guru, as it is the Guru who breathes life into a disciple's music, guiding them until they eventually evolve and shape their art through their own creative capabilities.

IV. SOLUTIONS AND FUTURE

A purely online format in Hindustani music education still faces significant challenges due to the highly nuanced nature of the art form. Technology can aid the learning process, but as of today, it cannot completely replace the holistic and interactive nature of traditional in-person teaching yet. Hybrid models, which integrate periodic in-person sessions with online learning, offer a balanced approach to Hindustani music education facilitating better mentorship. While online classes provide accessibility and flexibility, in-person interactions ensure nuanced guidance. This blended approach can help bridge the gap between traditional *guru-shishya* parampara and modern digital pedagogy. Latency remains a most difficult issue as of today. "Music is not based on serial interactions like sending and receiving data packets – it's played by generating sound at specified intervals of time in perfect synchrony…When timing is off in music, even by milliseconds, it's best described as a feeling…and an unsettling one. Practiced musicians begin to feel discrepancies in time starting at latencies as low as 10ms." (*Dealing With Latency in Your Online Teaching*, n.d.) Caleb opines that the closest that it could be improved is up to 10 milliseconds to make it more of a real-time experience implying that it is an unavoidable situation.

"Techniques like 'Fourier Transform' and 'Hilbert-Huang Transform' are already being used to analyze the frequency and temporal characteristics of ragas." *(Varma, 2024)* These techniques help understand the frequency and time-based characteristics of ragas, revealing patterns that may not be immediately apparent to human ears. In the future, interactive software could allow students to visually analyze the microtonal variations of each swara in different ragas, helping them develop a keener sense of intonation. Such tools could also simulate how the same raga sounds in vocal styles, making learning more immersive. Machine learning models, such as Support Vector Machines (SVMs) and Hidden Markov Models (HMMs), have already been used to classify ragas based on their unique melodic structures. "They [SVM and HMM] help predict the next part of the [melodic] sequence by looking at the probabilities of different transitions between states." *(Varma, 2024)* Chordia and Rae conducted a study as mentioned by Samarth Varma that showcased the effectiveness of SVMs in raga recognition by training the model on diverse pitch-class profiles, resulting in high accuracy in differentiating various ragas. *(Varma, 2024)* Hidden Markov Models (HMMs) can analyze the probability of note transitions, making them useful for identifying characteristic melodic phrases (*pakads*). "HMMs are advantageous in this application because they consider the temporal dependencies between notes, which is crucial for accurately capturing the essence of ragas." *(Varma, 2024)* Future applications could integrate these models into real-time feedback systems that analyze a student's singing or instrumental performance and provide immediate corrections on *swara* precision, *laya* (rhythm), and *gamaka* (ornamentation). Advanced tools such as MATLAB and LibROSA (Python) allow for pitch detection, beat tracking, and spectral analysis, helping researchers study rhythm, tempo, and timbre in detail. With advancements in automatic pitch detection and melody transcription, AI-driven tools could transcribe live performances

into notations, making it easier for students to analyze recitals of great musicians and their *gayaki*.

When a student struggles to create an impactful and meaningful melodic phrasing, even though AI and technological tools may fall short in fully replicating human creativity, they can still provide valuable sample audios from renowned musicians. These samples can demonstrate the creative ideas and an impact of a well-executed melodic phrase, serving as a useful reference for the student.

The fusion of Hindustani music and technology represents a crucial step in its evolution, balancing tradition with innovation. While digital tools enhance accessibility, pedagogy, and preservation, they cannot entirely replace the depth of direct mentorship inherent in the guru-shishya tradition. Instead, they serve as valuable extensions, ensuring that Hindustani music remains vibrant and adaptable in a rapidly changing world. By embracing technology thoughtfully, this ancient art form can continue to thrive while staying true to its cultural and aesthetic roots.

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