

background is checked. The findings would emphasize the role of computational advancements in supporting and enhancing the efforts of music specialists and musicians.

The Emergence of Computational Methods

The use of computational technologies in the music industry has become more significant in recent years. The Electronic and Software Industry has contributed a lot to the growth of the music industry. The music available in the cassettes, gramophone recordings, and CDs are collected and processed to match the current music standards. Among the methods used to process music data are data mining, machine learning, and signal processing. They have opened up new lines of inquiry and education in the world of music.

Examining the research done in this area, three general categories may be identified—

1. **Analysis of Pre-recorded Music and Data:** This entails looking at already recorded music and data using specially created algorithms that use filters, to classify, and arrange them in the appropriate order.
2. **Composition of Music/Electronic Music:** This category encompasses the creation and composition of music within the genre.
3. **Notation Recognition:** This section focuses on identifying and interpreting notations.

Early Stages of Computational Music Analysis

The majority of musical research was conducted using analog technology before the 1970s. Vinyl records and magnetic tapes were two common analog media used for audio recordings. When working with audio data, researchers frequently had to manually transcribe and annotate them, which was a labor and time-intensive procedure.

In the 1960s, early researchers in computer science and musicology started to investigate the idea of music notation recognition. These endeavors aimed to create mechanisms capable of transforming scanned or photographed sheet music into digital representations. When the first image scanners became available for research institutes, the Massachusetts Institute of Technology began to apply optical music identification on printed sheet music in the late 1960s (Kassler, 250–254).

In the 1960s - 1970s, basic pitch detectors were developed. These systems could identify key sounds in a single-note audio recording. These early algorithms laid the foundation for advanced phonological analysis

techniques. Early composing tools, such as Max Matthews' Music IV, became available. These techniques enabled musicians to play in a methodical manner. However, because of its resilience, it has mostly been utilized in experimental and learning environments.

The early 1980s saw the birth of the musical instrument digital interface (MIDI)^[1] standard, which enabled digital control of instruments and components. MIDI technology allowed for the construction of digital repertoires as well as a standardized means of sharing musical information between computers and electrical devices.

The employment of computer technology in music increased between 1990 and 2000. It was also implemented in Carnatic music. During this time, significant developments in digital technology, music software, and computers for music analysis took place.

The digitization of audio recordings of Carnatic music concerts was a major development in this era. This required transferring analog tapes to digital media. Researchers now had more options to deal with big data^[2] thanks to digital audio, allowing for more sophisticated analysis and experimentation.

Computational Techniques in Carnatic Music Analysis

Data Collection and Preprocessing

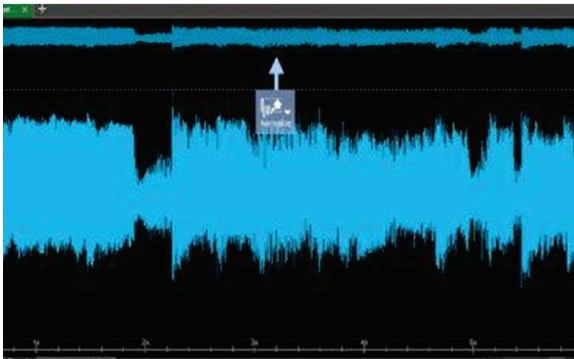
One of the main difficulties in pre-recorded data analysis is digitizing audio recordings using computational techniques and building analytical datasets.^[3] Numerous issues that need fresh research strategies arise from the computational analysis of Carnatic music (Koduri et al.^[4]) Techniques for preprocessing are those that improve the audio data's quality and eliminate noise. Techniques including filtering, normalizing, segmentation, feature extraction, and encoding are employed to eliminate noise, extract pertinent information, and enhance the precision of analysis and modeling.

For the purpose of collecting and classifying the data, metadata^[5] related to audio recordings and compositions—such as artist names, details on raga and tala, concert dates, and locations—is crucial. Data may comprise vocal and instrumental performances, depending on the objectives of the study, in order to examine the variations in interpretation and style between these two categories of performances. Occasionally, scholars gather other data modalities, such as written descriptions, video recordings, and lyrics, in order to enhance their study and contextual comprehension of the music.

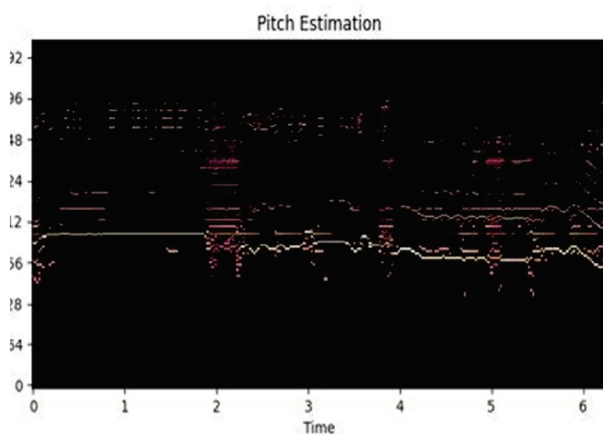
Raga Identification and Classification

Ragas, the melodic frameworks in Carnatic music, are central to its identity. Computational methods have been developed to automatically identify and classify ragas from audio recordings. These methods analyze pitch, tonal patterns, and other musical features to determine the raga being performed.

[The researcher has been able to try the AI tool ChatGPT for generating a code to analyze the pitch of a sample music file, which is a sample of her ongoing PhD research on Bangalore composers. The singer is Prof. Nagamani Srinath who has sung one of her compositions. ChatGPT generated a Python script,^[6] which when run on the sample music file gave the following pitch distribution.



Pic 1. Audio sample



Pic 2. Pitch Estimation

Music Information Retrieval

MIR-Music information Retrieval is one such field in which much research is done regarding Music classification, Music source separation and instrument recognition, and Automatic music transcription. Typically, a signal processing system is composed of many modules, such as segmentation, feature extraction, model creation, and decoding.

SVM-Based Raga Recognition

Machine learning has made machine support vectors (SVM)^[7] useful for raga recognition. By using the retrieved characteristics to train the SVM models, the researchers were able to discriminate between ragas with encouraging results (Patil & Kulmethe).

Deep Learning Applications

Deep learning approaches are used in raga recognition, specifically Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs). Improved recognition accuracy resulted from deep learning models' successful automated learning of hierarchical representations of audio input.^[8]

Composition Generation Using AI and Machine Learning

While Western music might have already progressed much into this domain, Indian music is still waiting to be explored. Although some ideas are already gaining attention like the "Automatic Music Generation of Indian Classical Music based on Raga"^[9] in which various machine learning techniques are being employed, including LSTM, RBM, GCA, FSM, and GAN producing new music that is stylistically and acoustically similar to the Indian classical music present in the training dataset.

Notation Software

Like other music traditions, Carnatic music also has developed its musicography, out of which, a notation system called Sargam is most commonly practiced. The Sargam notation scheme which enables easy music notation storage, publishing, and retrieval using computers is developed. iSargam^[10] (Mammen et al.) is the only music notation encoding system developed for Indian music notation. More research work has to happen in this field.

The integration of modern-day technology in music education and performance

From the time the semiconductor industry started, the electronic industry has also uplifted the music industry. The first tanpura from Radel Electronics came to light in 1979. Devices required for recording, storing, and propagation of music have developed to such an extent that everything is available at their fingertips. Many versions of the electronic instruments have come up. Also, the programming software required for music has grown multifold. Various apps are available to play tanpura, metronome, and table or a mridangam saath for the artist.

Due to the extensive research going on in this field, common music players like Amazon Music and Spotify are using Machine Learning and AI to come up with user-specific playlists. Technique analysis is one way AI is changing performance in Western music. AI systems may evaluate recordings or live performances using sophisticated algorithms to provide artists with comprehensive feedback on their dynamics, articulation, intonation, and rhythm. Research is also being done on using AI as an accompanist for a live music performance^[11] (Dannenberg).

Challenges and Limitations

When incorporating technical aspects into research on Carnatic music, there are challenges and limitations.

- Initially, there can be limitations on the quantity of high-quality audio data available for processing, particularly for rare historical recordings.
- Furthermore, the cultural and social nuances of Carnatic music may be challenging for computer algorithms to fully represent.
- And last, in the developing subject of human-computer interaction in music research, researchers need to strike a balance between automating music and preserving the human element.

Future Directions

As technology advances, future methods of Computation in Carnatic music are promising. Researchers are investigating how to incorporate real-time analytics into performance, giving musicians instant feedback during rehearsals and live performances. Additionally, cross-disciplinary collaborations between computer scientists, musicians, and musicologists will foster innovation in this area. Notation Software exclusive for Indian Classical Music and availability of it across devices would be very helpful for musicians and students. Signal processing applications exclusively to cater to Indian music would add significantly in preserving the old music data and sharing it among the common platforms of social media would enrich the collection.

Conclusion

For scholars, performers, and lovers alike, the seamless fusion of tradition and technology in Carnatic music analysis offers an intriguing new frontier. Our knowledge of ragas, composition, and performance in this age-old tradition has been enhanced by computational approaches. The potential for more research and creativity at the nexus of tradition and technology is

limitless, despite ongoing obstacles. Computational techniques will surely be essential to maintaining and developing this treasured cultural legacy as we seek to solve the riddles of Carnatic music.

Footnotes

1. A broad range of electronic musical instruments, computers, and associated audio equipment can be connected to one another for the purpose of performing, editing, and recording music. MIDI (Musical Instrument Digital Interface) is a technological standard that specifies a communication protocol, digital interface, and electrical connections.
2. Big data refers to data sets that are too large or complex to be dealt with by traditional data-processing application software.
3. Dataset is a Collection of data
4. https://www.researchgate.net/publication/220723348_Computational_Approaches_for_the_Understanding_of_Melody_in_Carnatic_Music
5. Metadata is the information providing data and not the content itself.
6. https://drive.google.com/drive/folders/1H0wA5GNwkDZshz8WEmsj5M4zPXX80Wir?usp=drive_link
7. Support vector machines, which examine data for regression analysis and classification, are supervised max-margin models with corresponding learning algorithms in machine learning.
8. <https://www.linkedin.com/pulse/identifying-ragas-carnatic-music-machine-learning-sridhar-ravikoti>
9. <https://ieeexplore.ieee.org/document/10126388/authors#authors>
10. https://www.researchgate.net/publication/294728395_iSargam_music_notation_representation_for_Indian_Carnatic_music
11. <https://www.cs.cmu.edu/~rbd/papers/sbcm2000.pdf>

References

- Kassler, Michael. "Optical Character-Recognition of Printed Music: A Review of Two Dissertations." *Perspectives of New Music*, vol. 11, no. 1, 1972, pp. 250–54. JSTOR, <https://doi.org/10.2307/832471>.
- Koduri, Gopala Krishna, et al. "Computational Approaches for the Understanding of Melody in Carnatic Music." *Proceedings of the 12th International Society for Music Information Retrieval Conference, ISMIR 2011*. 263–268. www.researchgate.net/publication/220723348_Computational_Approaches_for_the_Understanding_of_Melody_in_Carnatic_Music
- Geetha, T., V. Exploiting Carnatic Music Characteristics for Music Content Identification. 2 Jan. 2012, hdl.handle.net/10603/25329.

- R, Vijayakumar. Automatic Recognition and Classification of Carnatic Ragas. 13 Oct. 2016, hdl.handle.net/10603/111461.
- Patil, Mangal, and Maheshwari Kulmethe. "RAGA IDENTIFICATION BY USING SVM CLASSIFIER." ResearchGate, Nov. 2022, www.researchgate.net/publication/371540407_RAGA_IDENTIFICATION_BY_USING_SVM_CLASSIFIER.
- Ravikoti, Sridhar. Identifying Ragas in Carnatic Music With Machine Learning. 7 Feb. 2021, www.linkedin.com/pulse/identifying-ragas-carnatic-music-machine-learning-sridhar-ravikoti.
- S. Adhikary, M. S. M, S. S. K, S. Bhat and K. P. L, "Automatic Music Generation of Indian Classical Music based on Raga," 2023 IEEE 8th International Conference for Convergence in Technology (I2CT), Lonavla, India, 2023, pp. 1-7, doi: 10.1109/I2CT57861.2023.10126388.
- Mammen, Stanly, et al. "iSargam: Music Notation Representation for Indian Carnatic Music." EURASIP Journal on Audio, Speech, and Music Processing, vol. 2016, no. 1, 16 Feb. 2016, doi:10.1186/s13636-016-0083-z.
- Dannenberg, Roger B., "Artificial Intelligence, Machine Learning, and Music Understanding," in Proceedings of the Brazilian Symposium on Computer Music (SBCM2000), Curitiba, Brazil, 2000.





From Tanpura to tablets: Technology's influence on Hindustani Music



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Abstract

Over the course of many centuries, Indian classical music has developed into a rich and intricate art form that is firmly based on tradition and cultural history. The 'guru shishya parampara', in which music was taught verbally, i.e., sitting in front of the mentor and then accepting the lessons orally, was the traditional method of acquiring these traditions. In India, it is regarded as the best method of instruction, particularly when it comes to practical topics like music. But as time went on, a number of innovations, including the phonograph, the gramophone, the microphone, and other tools, transformed how people thought about discovering, making, and performing music. These technological developments have significantly impacted many facets of music production, performance, learning, and teaching in recent years, and they have both benefits and drawbacks. For instance, one benefit is that we have tools and software that can help us preserve music, but a drawback is that Indian music has lost some of its acoustics as a result of people using electronic tanpura more frequently than manual ones, which also has an impact on the industry that produces these instruments. The purpose of this research paper is to examine the creation, development, effects, and positive and negative aspects of technical advances achieved in the field of music.

Keywords: Indian Music, Technological advancement, Education, Performing, Opportunities

Research Paper

Introduction

Music and technology have had a profound and mutually influential relationship throughout history. The rich cultural legacy of Indian classical music, which spans thousands of years, has changed over time and has been impacted by contemporary technological developments. The music industry has undergone a significant transformation as a result of technological improvements. The aforementioned innovations have exerted a substantial influence on the realm of Indian music, encompassing diverse facets like music production, distribution, marketing, and the very conception of music within the Indian setting. The traditional music industry in India has experienced a significant transformation with the emergence of digital music platforms and streaming services. The digitization of the entire music ecosystem has emerged as a very influential consequence of technology growth in the realm of Indian music. The progression of electronic music instruments has also exerted an influence on the overall efficacy of music education, practice, and performance.

During the nascent stages, significant developments such as the creation of the gramophone and tape recorders brought about a transformative impact on the preservation and dissemination of Indian music. The advent of this technology facilitated the capturing and reproduction of musical performances, expanding the reach of musicians to broader audiences and ensuring the preservation of their musical legacy for subsequent generations. The emergence of new genres and styles of Indian music was facilitated by technical improvements, which allowed performers to access diverse regional and international musical influences through recorded media.

The advent of electronic versions of traditional instruments marked the onset of a significant transformation in Indian classical music. Some of the popular instruments are shruti box, taalmaala, electronic tanpura etc. The inaugural presentation of the electronic Shruti Box took place at the Karnataka Gana Kala Parishat in Bengaluru in 1971. This pioneering device, developed by Radel Electronics Pvt Ltd, marked the beginning of a new age in electronic musical instruments.

The advent of the electronic Tanpura in 1979 brought about significant changes in the realm of performing music. Raj Narayan attributes the instrument's widespread acclaim to the esteemed vocalists, Dr. Balamurali Krishna and Prof. TR Subramaniam. Notably, Dr. Balamurali Krishna holds the distinction of being the first musician to incorporate the electronic Tanpura into a live concert, while Prof. TR Subramaniam utilized it during his performances in the United States. According to the speaker, these musicians who were considered revolutionary and radical came to the realization that embracing technology was necessary.

The electronic tabla known as Taalmala, which was introduced in 1987, was a significant advancement in the field of tabla technology. This innovative instrument incorporated software and microprocessors, leading to what Narayan described as a substantial leap forward in its capabilities. The electronic lehra machine, Sunadamala, also included microprocessors in its design. With the ability to perform 200 ragas across 20 distinct taals, this device facilitates independent practice for tabla players. The initiative was inaugurated in 1993 by the renowned musician, Pandit Ravi Shankar. (Radel)

Following the advent of the initial electric Veena in 1971, a subsequent iteration known as the electronic Veena was introduced in 2002. This updated version featured adjustable frets and integrated amplifiers designed to enhance the auditory experience. Notably, Radel's DigiVeena synthesizer, patented in 2002, represents the inaugural Indian electronic musical instrument to receive such legal protection. Moreover, it stands as the first synthesizer within the realm of Indian music capable of generating sounds resembling those produced by instruments such as the Tanjore veena, mandolin, saxophone, and flute.

In addition to the aforementioned firms, Sound Labs and Svaram have also engaged in the production of musical instruments. Sound Labs specializes in the manufacturing of electronic versions, while Svaram focuses on the production of modified or customized versions of acoustic instruments. Furthermore, notable advancements have been made in the realm of applications, such as iTabla Pro, that provide substantial practicality within the context of our modern, rapidly evolving society.

Given the temporal progression of these advances, it is evident that they have had significant implications for contemporary music education, pedagogy, recording, performance, and manufacturing.

Research question: What is the influence of technological advancement on Indian music and how it has affected the music community?

Objective: To investigate the impact of technological advancements on Indian music.

Hypothesis: the following study hypothesis that the advancement in musical technology has eased for the teachers, artists and students in context of doing riyaz and performance but in totality but in totality with special reference to makers of the traditional instruments and with the artists whose performing is not getting adequate overtones which are always required for the essence and the aesthetics of music.

Methodology: In light of the research inquiry at hand, I have investigated this work utilizing an investigating methodology that relies primarily on primary resources. The primary method employed for data collecting in this study was using primary materials, supplemented by secondary resources. This approach was undertaken to examine the concise historical progression of technological advancements within the realm of Indian music. Interviews with teachers, artists and instrument manufacturers were taken to examine the research question.

Findings :

As per the interviews, survey and other sources that were taken in use to study about the topic the appropriate findings with explanations have been given below.

Positive impact

Technological innovations have exerted a multitude of good influences on the realm of Indian music, hence facilitating its expansion, enhancing its availability, and augmenting its global outreach. The following are several significant favorable effects:

The utilization of electronic renditions of conventional instruments: Electronic reproductions of traditional musical instruments, such as the electronic tanpura and digital tabla machines, offer performers a simple and dependable means of accompaniment. This development has enhanced the accessibility of practice and performance.

Acoustic instruments may encounter challenges in terms of audibility while performing for larger crowds or in environments where electric instruments, such as an electric sitar, violin, or tanpura, might excel due to their ability to be easily amplified. Electric instruments often provide a wider range of tonal options in comparison to



their acoustic counterparts. This phenomenon provides opportunities for the blending of genres and the exploration of innovative approaches. (Sharma)

Electric instruments are considered highly suitable for traveling and performances in diverse contexts due to their enhanced portability and simplicity of transporting. Electric equipment are impervious to the influence of seasonal or meteorological fluctuations. The utilization of sophisticated materials and production methodologies has resulted in notable enhancements in the overall quality and longevity of instruments. This practice guarantees enhanced consistency and precision in the production of traditional instruments, hence yielding advantages for both artists and instrument manufacturers.

The assurance of instrument calibration is achieved by the utilization of advanced tuning mechanisms. Accurate intonation and tuning techniques play a key role in Indian classical music. The advent of tuners has shown to be immensely advantageous for students engaged in the process of acquiring knowledge in their respective fields.

The Advancements in Live Performances: The quality and experience of live Indian music performances have been enhanced by advancements in amplification, sound processing, and stage technology. This enables musicians to provide performances of exceptional quality across a diverse range of locations. In the past, vocalists utilized a high pitch when performing without the aid of microphones. However, a contemporary inclination has emerged towards using a gentle and calming vocal style, made feasible by the utilization of microphones. This technological advancement enables the music to reach a wider audience. During the pre-independence era, a prevalent practice known as *baithaks* emerged, characterized by gatherings that took place either within the premises of a monarch's court or at the abode of esteemed artists. Nevertheless, the advent of sophisticated audio technology has facilitated the organization of music conferences, enabling large audiences of thousands to witness live performances. (Verma)

The sound system has assisted not only to vocalists, but it has proven to be very beneficial for instrumentalists. The book titled "Bharatiya sangeet me vaigyanik upkarnon ka prayog" authored by Dr. Anita Gautam includes a reference to Pandit Shivkumar Sharma, who states that in the past, such programs were organized. In the scenario when a festival spanning five days is

taking place in Maharashtra, it is customary for either four or five vocalists to perform, with no inclusion of instrumentalists. The lack of a sound system resulted in a limited reach, hence explaining the rationale behind this circumstance. With the exception of a limited number of instruments such as the *Shehnai*, it possesses a remarkably robust auditory quality. To a certain degree, the flute may also be audible, however, string instruments such as the *Sitar*, *Sarangi*, *Sarod*, *Santoor*, *Surbahar*, and *Jaltarang* are considered to be mellower in nature. It may be argued that these instruments have greatly benefited from the introduction of sound amplification systems.

The advent of technology has facilitated the ability of musicians to sustain their performances by means of virtual concerts and live streaming, particularly in response to notable global occurrences such as the COVID-19 pandemic. As a result, they were able to maintain engagement with their audience despite the prohibition of public gatherings.

Wider audience reach: One of the key advantages of this approach is the ability to reach a larger audience. The advent of digital platforms and streaming services has facilitated the global dissemination of Indian music. Contemporary artists are currently able to disseminate their artistic creations to a global audience, so broadening their support base and augmenting their visibility. The emergence of diverse applications, such as *Soundcloud* and numerous social media platforms, serves as notable illustrations of this phenomenon.

Accessibility of learning: The topic of discussion pertains to the concept of accessibility in the context of learning. Online platforms provide a plethora of resources for acquiring knowledge in the field of Indian music, encompassing instructional materials, educational sessions, and interactive aids for honing one's skills. The advent of this technology has facilitated greater accessibility to music education, enabling students to receive instruction from proficient educators, irrespective of geographical constraints.

The teaching of music has been significantly transformed by technology through the integration of interactive learning platforms, virtual courses, and online tutorials. Consequently, there has been a simplification in the process for aspiring musicians to obtain trustworthy training and access to educational resources. The field of music education has been significantly impacted by technological advancements, which have facilitated the integration of online tutorials, interactive learning

platforms, and virtual lessons. The advent of this development has facilitated enhanced accessibility to high-quality teaching and materials for individuals desiring to pursue a career in music. (Goswami)

Advancements in Music Arrangement and Facilitation of Music Production: Digital audio workstations (DAWs) and music software have facilitated the exploration of novel sounds, arrangements, and production techniques. Consequently, a plethora of distinctive and diverse musical compositions have been generated. (Saurabh)

Artistic individuals possess the capability to produce recordings of superior quality within recording facilities that are outfitted with state-of-the-art technologies. As a result, individual musicians and small studios are now capable of producing music of professional quality without requiring substantial resources.

Opportunities for Fusion and Collaboration: The advent of technology has significantly contributed to the facilitation of collaborations between Indian musicians and artists hailing from many cultural backgrounds and genres. Consequently, the amalgamation of conventional Indian components with modern aesthetics has given rise to captivating fusion genres.

The investigation of sound through experimental methods: The advent of technology has equipped artists with a diverse array of tools for the purpose of sound modification and experimentation. Consequently, the emergence of distinctive and unparalleled auditory landscapes has been observed in the realm of Indian music. The phenomenon of global collaboration and cross-cultural exchange has become increasingly prevalent in contemporary society. This trend is characterized by the growing interconnectedness and interdependence of individuals, organizations, and nations across different geographical locations and cultural backgrounds. (Goswami)

The advent of the internet and the proliferation of social media platforms have significantly contributed to the facilitation of relationships between Indian musicians and artists hailing from diverse geographical locations. Consequently, this phenomenon has facilitated the interchange of musical concepts, genres, and methodologies, thereby enhancing the overall diversity and richness of the international music sphere.

In the broader context, the integration of technological innovations has assumed a pivotal role in facilitating the progression of Indian music within the contemporary epoch, enabling its transformative growth while

preserving its intrinsic traditional elements. The aforementioned favorable effects persistently influence the domain of Indian music, guaranteeing its liveliness and significance in the contemporary globalized society.

Negative impact:

Loss of Authenticity and Natural Sound: Traditional Indian classical music relies heavily on the natural timbre and tonal qualities of acoustic instruments. The introduction of electronic instruments and amplification can sometimes alter the organic sound, leading to a loss of the authentic, unadulterated experience. The 'harmonics' which are the basis of Indian classical music are so far found to be missing in the electric versions of the instruments like tanpura. Observing a YouTube video showcasing Ustad H. Sayeeduddin Dagar is an excellent way to gain insight into the harmonics and overtones generated by a manual tanpura. In the video, Ustad H. Sayeeduddin Dagar personally does the Jawari process on the paired tanpuras, followed by tuning them to the Madhyam note.

He proceeds to elucidate the disparity to his student, Martin Spaink, regarding the initial resonances of Raaga Abhogi and their subsequent transformation into the resonances of Raaga Bageshri after some meticulous adjustments. Attaining such exceptional auditory acuity and proficiency is only possible via diligent practice with the manual Tanpura.

Digital Piracy and Copyright Issues: The ease of sharing and disseminating digital content increases the danger of unlawful recorded replication and distribution, which may have an adverse effect on artists' ability to make a living.

Pressure to Adopt Commercial Trends: As commercialization increases, there may be pressure on musicians to appeal to popular tastes, thereby muddying the purity of classical music in the process.

Loss of Originality in Performances: The spontaneity and originality that are essential components of Indian classical music may be diminished by the use of technological assistance like auto-tune and digital editing, which can result in highly polished performances.

Loss of Traditional Teaching Methods: Online tutorials and virtual classes are challenging the traditional Guru-Shishya parampara (teacher-student lineage). In classical music 'talim' the bond between the guru and shishya is the most important which is built by staying with guru at their residence as much as possible



but in online systems of learning such things are not possible. This can diminish the teacher's comprehension and personal connection with the pupil.

Dependence on Electronic Devices: Electronic tanpuras and other accompanying devices are now widely used. While they are useful, they can sometimes replace the skill of supporting performers, thereby impacting the live performance experience.

Financial loss instrument manufacturers: With the increasing popularity of electronic instruments, the manufacturers of acoustic or manual instruments like sitar and tanpura have faced significant negative consequences. The creators have encountered a significant financial issue, particularly during the COVID-19 period. There were unfortunate deaths among the family members of the creators as a result of these crises. They are now compelled to offer their instruments at an elevated price to customers. Additionally, some families engaged in this manufacturing art have transitioned their business to contemporary instrument shops. (Bashir)

Lack of awareness in the students and teachers: The survey results indicate a noticeable deficiency in awareness and excitement among both students and teachers toward musical instruments. This is primarily attributed to the prevalence of electronic devices utilized in educational establishments. Undoubtedly, the use of automated tools has facilitated tasks. However, disregarding the significance of manual instruments poses a potential long-term harm to the music fraternity. (Survey)

Conclusion

Through this study, it can be concluded that the advancement of technology has led to many changes in the forms of music and has also impacted the whole music fraternity which is inclusive of instrument makers, sound engineers, etc. The hypothesis has proven to be right that the progress in musical technology has made it easier to practice and perform music. However, this progress has not fully benefited traditional instrument makers and artists who are unable to achieve the

necessary overtones for the essence and aesthetics of music.

Additional findings from the study indicate that technological progress has created numerous vocational opportunities in the field of music. However, it has also resulted in a decline in awareness and utilization of traditional instruments within academic institutions. This long-term trend may pose a threat to the authenticity of this art form. Individuals without the financial means or resources to learn from a guru often turn to educational institutions to study music. If the traditional elements of music education are disregarded at these institutions, there is concern about whether future generations will possess the ability to safeguard the most authentic expression of this art form.

An optimal combination of tradition and technology is essential to propel the music community forward.

References

- “About Us - Radel India - Digital Indian Musical Instruments.”
Radel India - Digital Indian Musical Instruments, 1 Jan. 1971, www.radel.in/about-us.
- Sharma, Mrityunjay, Assistant Professor, Dept. of Music, HP University Shimla, Interview by Nakul Malhotra, 10/09/2023
- Verma, Baldev Raj, Vocalist Indore Gharana, Top Grade Artist of A.I.R and Doordarshan, Interview by Nakul Malhotra, 28/07/2023
- Dagar, Sayeeduddin, Tweaking Tanpuras, video uploded on 24/08/2017
<https://youtu.be/phvUUBn2TN8?si=2cQ4YdlovPRD>
- Bashir Sitarmaker, instrument manufacturer, Shaniwar Peth, Miraj, Maharashtra, Interview by Nakul Malhotra, 14/08/23
- Kartar Chand, instrument manufacturer, Dashrathpuri, New Delhi.
- Goswami, Vineet Mohan, Assistant Professor, Faculty of Music and Fine Arts, University of Delhi, Interview by Nakul Malhotra 10/09/2023
- Saurabh Kumar, Faculty member, RK Films and Media Academy, New Delhi Interview by Nakul Malhotra, 2/9/2023