

Exploration and analysis of the use of modern electronic equipment in music laboratories to assist college course teaching

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Abstract: *In the music laboratory of colleges and universities, for students majoring in music, because the teaching techniques are different from those of general majors, and the particularity of students' creative learning, music courses are taught through practice, experiment and exploration. In today's society, with the continuous development of science and technology, the Internet and education have developed in parallel and become key factors that affect the destiny of the times. In the process of development, people organically combine the two, and educational informatization has gradually emerged and developed. The so-called educational informatization mainly refers to modern information technology based on modern electronic equipment (computer multimedia and network communications) in the context of information socialization. The development of educational informatization has broken the geographical limitations of education and has important practical significance for colleges and universities in course teaching. The number of people using modern electronic devices is increasing rapidly, not only for communication, information search and entertainment (viewing photos and video materials, communicating in social networks, as a platform for video games, etc.), but also for educational and creative purposes (painting, composing, etc.). Academic musicians, educators, and theorists gradually became involved in this process, hoping to use modern electronic equipment to achieve their goals. Especially during the three-year quarantine period, online teaching used modern electronic equipment to the extreme, and fundamentally adjusted our courses and work habits. Therefore, the use of modern electronic equipment (especially computer technology) in music laboratories has been used successfully by many composers and performers for tasks such as sound synthesis, gesture control and automatic or computer-assisted composition. Continuous advances in computer processing power and data analysis techniques have also created an environment that offers great potential for music theory research. It's now not only possible to apply the same type of pattern recognition algorithms to music that make tasks like automatic speech recognition and optical character recognition possible, but it can also be accomplished using a simple desktop or laptop computer.*

Keywords: *modern electronic equipment; Music laboratory; Auxiliary course teaching; Autonomous classification engine*

1. Introduction

In today's music experimentation scene, teachers' instruction is if limited to traditional methods (eg: simple grammar-based techniques or string matching and searching). It has been difficult to serve the learning of music majors in colleges and universities. Recent advances in information science have provided us with more sophisticated methods. In contrast, researchers in the music information research community have made significant progress in applying modern pattern recognition. The continuous development of the International Music Information Conference has proved the role of modern electronic equipment in assisting the teaching of college courses. We say that teaching courses colleges and universities is inseparable from the laboratory, the experimental venue for students to music technology knowledge, and the assistance of modern electronic equipment (especially computer technology) in the laboratory plays a particularly important role.

2. Modern electronic devices favored by musicians

In the initial basic music education, college teachers still used stylus pens in course teaching, and amount of knowledge input was limited by the speed of stylus pens. Due to the ubiquity of modern

electronic devices, there is also an increasing availability of digital source materials for music theory teaching. Students can automate extraction and machine learning at scale. They digitize musical scores and recordings and provide the results along with associated metadata. Educators can thoroughly teach students the teaching knowledge points in teaching, and use modern electronic equipment to transform from a "data-poor" field to another "data-rich" field. This also confirms to a certain extent the inevitable trend of today's society. For example: a full-time music teacher teaches basic music theory knowledge about a certain phrase or several sections in a musical work, and asks students to analyze the work. Students want and want more than music expertise and experience from teachers. Of course, there are such experts who can use more things to analyze one or several fragments, and their insight and understanding exceed that of computers. The number of such experts must be limited. They can analyze works within a reasonable amount of time and musical scope, which is within the scope of their expertise. In contrast, computers can process vast amounts of different music hundreds of times faster than humans, and with perfect consistency. This also highlights the important advantages of modern electronic devices. Bring great convenience to people.

3. The trend of modern college course teaching highlights the importance of modern electronic equipment (computer technology application)

University laboratories can be divided into chemical laboratories, physical laboratories, and biological laboratories according to their disciplines. According to laboratory characteristics, it can be divided into dry laboratory and wet laboratory, main laboratory and auxiliary laboratory, conventional laboratory and special laboratory, and hazardous laboratory. For comprehensive teacher-training art laboratories in colleges and universities, unlike the above-mentioned laboratories, the experimental venues provide more electronic equipment for course teaching. For example, laboratories for music majors are divided into two categories: one is for practical teaching and research, the laboratory provides students with enough space to accommodate various musical instruments, and provides students with professional music skills. The second category is music theoretical research. The laboratory needs to use the provided electronic equipment to verify existing music theory models and analyze different characteristics of music. How to distribute and relate to different types of music. Modern electronic equipment refers to the tools used to store and transmit educational information by means of modern science and technology. It generally consists of two parts: one is hardware, that is, various electronic equipment, such as slide projectors, projectors, projection screens, laptops, digital cameras, computers, tablets, mobile phones, etc.; the other is software, that is, various electronic teaching materials, such as slides, music information retrieval systems, digital source materials, audio tapes, video tapes, CDs, computer software, etc. Traditional teaching can no longer satisfy modern teaching, and further exploratory research is bound to be carried out, and the use of computer technology is even more important. The following is a study of the extremely important role of computer technology in terms of musicology and music performance.

For students in the music department, according to the talent training plan to cultivate music teacher talents suitable for the new era, the courses "Musicology Writing" and "Piano Performance and Teaching Methods" and multi-voice analysis and writing combined with computer applications are very good Complete lesson plan. For example: musicology writing, multi-voice analysis and writing courses, traditional manual music creation, can only take notes in notes, our current teaching uses digital touch screen equipment to meet the specific requirements of teaching. In teaching, teachers and Students are able to see large enough fonts for text about music, with strong coverage of wide lines (important for reading music fluently from scores)^[1], that is, the presence of a large screen; and quick page turning without the involvement of hands. Music performance students use computer applications, when performers perform on stage, the screen is matte, not reflective, "Musicology Writing" special field, to facilitate distance (synchronous and asynchronous) learning with students, using special programs Easily "draw" musical texts, add notes and fingerings to them, theoretical music studies, and write music conveniently both manually and in the music editor when preparing for online or hybrid courses and during course implementation. Students have the ability to quickly and ergonomically record notes (e.g. musical dictation) and lectures. The contact between the stylus and the touchscreen is soft and crisp. Conforms to good ergonomics. Digital software - The digital pen can write freely on the surface of the screen, just like writing with a pencil or pen on paper. The digital pen is fast and convenient. Such speed depends on the functions and control capabilities of the screen and stylus. And your scores and books are easily accessible with simple annotations and underlining in "Open Devices" format. And the device is also specially equipped with electronic "page turners", and according to your needs, necessary and useful applications, additional external devices can be installed on the device.

4. Advantages of modern electronics

Mobile devices (such as tablets or smartphones), tablets, have been on the rise in recent years^[2], and the screen size of tablets (10 inches and above), which makes students learn more effectively, among foreign students in 2022 Writing notes on tablets has become especially popular. It is also very popular for foreign students to use tablet dictation in solfeggio and ear training classes. Smartphones tend to increase screen size (average to 6-6.5 inches), but it is still not very comfortable for reading and writing notes. But it has the advantage of being able to sing or write short musical outlines from sight. Next, let's talk about the positive features of the stylus. Many brands today include a stylus in their most advanced models. ^[3]Above the screen surface is a multi-touch capacitive sensor, thanks to the capacitive layer you can move, your finger is sensitive to touch, in the application thanks to the capacitive layer you can move your finger to touch; ^[4]you can finger turn pages and zoom documents, write, mark and Draw (Draw with very high precision, the stylus lies quietly on the surface of the reader screen, leaving no graphic traces. For added convenience, the capacitive layer allows the creation of an unlimited number of notes and edits when using the stylus, and synchronize files with other devices. For example, when teachers in colleges and universities teach courses, (1) conduct synchronous and asynchronous online classes. The teacher then makes notes on the program's public screen without connecting to an additional drawing app, the teacher sends the notes, and the students play or record in real time as they listen to the students. In the teaching of the "Musicology Analysis" course, only checking tasks and dictation are required on the screen, and students' mistakes are marked with a stylus. (2) When conducting conditional mixed teaching, especially when teaching in the classroom, all content can use elements of online technology, which allows students to use hybrid courses in this case to increase student participation in the course process. ^[5]For example, this course "Piano Performance and Teaching Methods" Check the homework, observe each student's discussion of the task through the playback on the screen (the task is sent to the chat room in the form of a photo), analyze the mistakes they made and make corrections to the music text.

In today's society, where mobile devices such as tablets or smartphones can be connected to a dongle to project onto a TV without the teacher having to be near the big screen, it is worth mentioning that a new Librera app feature for teachers is Extremely convenient, when it is turned on,^[6] text loaded into an application (such as a sheet music) begins to move from the desired position. Its speed eliminates the need to turn pages manually (for example, without a special pedal), making it convenient for teachers teaching courses.

5. Computer-assisted course instruction has important advantages

Traditional course teaching and theoretical research, relatively limited access to music literature, and time constraints imposed by manual analysis. ^[7]Computers and digitized music collections have now removed these limitations, and computer-assisted course instruction has the important advantage that different computers can contain thousands of recordings. With these thousands, big data can study the hidden musical insights hidden in a few pieces of music. People use experience to verify the effectiveness of existing theoretical frameworks, improve and revise existing important theories, and inspire new ones. Theoretical methods and perspectives. Computer applications in higher music education have played a major role in the spread of music technology, enabling automated extraction and machine learning at scale, enabling academic faculty to automate the types of tasks they have traditionally performed manually when teaching courses. Recently, the use of modern pattern recognition and data mining techniques for music analysis has become very popular. Teaching college courses, compared to traditional course teaching, is by no means meant to reduce the value of traditional tools and methods, because they really have proven value and provide many benefits that pattern recognition cannot provide. Computer technology cannot do this, just as pattern recognition techniques offer advantages over traditional analysis techniques. Computer software has a use of pattern recognition techniques combined with modern computer learning algorithms to help provide new musical perspectives that can be applied to classical music, jazz and various popular and traditional music, including interdisciplinary research across different types of music. ^[8] The software can be used to adapt different types of music without any manual adjustments. Potentially misleading entrenched assumptions and biases that inevitably arise when teachers do their best to teach a course can be avoided. Computer technology is able to consider many more features (i.e., musical features) than humans can at one time, and more complex interrelationships between them. Of course, it is admitted here that computers can only assist course teaching and cannot replace humans. Because no matter how advanced computer technology is, it is unlikely that it will independently evolve any

perfect musical model. Computer pattern recognition techniques can reveal what might otherwise be covered up, but can distract teachers from teaching and research. Let's talk about one of the computer software-Symbolic, which is divided into seven categories:

- Instruments: What types of instruments exist, and which ones are given relative to other instruments, but also taking into account the differences and importance of voiced and unvoiced instruments.
- Structure: How many individual sounds are there and how do they interact (e.g., chords, intervals, etc.)?
- Rhythm: Consider the time intervals between different notes and the duration of each note.
- Dynamics: How loud are the notes and what are the changes in velocity?
- Statistics of audio frequencies: How often do different notes occur?
- Melody: What types of intervals exist? How many melodic changes are there? What types of phrases are used and how often are they repeated?
- Chords: What harmonic intervals exist? What type of chords do they represent? How much harmonic motion is there and how fast? Once a computer has extracted features from music, it can process them using pattern recognition algorithms. No need to manually build the model automatically. This means that computers are useful not only in learning the mapping of the model, but also in the insights that the model itself can provide.

6. Electronic Device Applications - Autonomous Classification Engine (ACE) Will Go Mainstream

Computer technology and pattern recognition are subtle and complex fields, and autonomous classification engines can also play a significant role in improving college course teaching. The fresh perspective it provides also provides teachers with valuable ideas for teaching and validates existing theoretical models and insights into how different features are distributed and related to different types of music.

ACE can be used directly as a classifier. Once a suitable classifier has been selected, either through automatic ACE optimization or using pre-existing knowledge, the user only needs to provide feature vectors and model classification to ACE. ACE is designed to provide flexibility to teachers with more experience in pattern recognition. The advantage of ACE is that it only has a simple interface, so teachers with the most limited technical background can easily use it without having to understand the working principle of the underlying algorithm, making complex computer technology simple. Graphical interface for the ACE classification framework. An important advantage of ACE is the freedom to modify and customize it as you see fit. This also means easy installation. ACE has a total of ten dimensionality reduction algorithms. With so many algorithms it can read defined files. In terms of performance verification, its performance is better than existing systems. It is also applicable to percussion instruments that enter ACE. It makes complex computer technology simpler.

For the theoretical research of polyphonic analysis and creation, computer technology provides countless conveniences, making teaching easier, such as it can convert audio performances into symbolic formats. In daily traditional teaching, only a few specific pieces of music can be obtained, while computers capturing performance characteristics not otherwise specified in the score, these additional pieces broaden our horizons and inspire our students' creative work.

With the continuous development of modern technology, there will be a broader space for the research and development of computer technology. In course teaching, computers will use fingerprints to identify teachers, allowing teachers to automatically identify specific music fragments. Teachers can automatically identify anonymous recordings and scores, and database retrieval functions in computer systems can be queried by humming, and databases can be searched using voice input rather than symbolic input. Computer technology will be able to correctly mark fragments and automatically identify similar music based on the mood, style, and historical periods of various music genres. There are also some practical uses, such as music playlist generation, recommendation, and prediction. All bring convenience to teachers in teaching courses. Students can better complete the course learning through convenient methods, and teachers use computer technology to improve teaching, especially to help teachers who study music theory. Expand the deeper realms of music.

The music application program of modern electronic equipment will also become a common

program for college course teaching, such as: musical instrument simulator and music editor, the two are used together, and the combination of electronic equipment is used in teaching. operation of the equipment, the musical skills are acquired as a fundamental part of music theory and ear training (modal scales, chords, rhythmic patterns), and the main forms of classroom work are developed during the course (musical reading and writing, musical dictation), etc.

It is emphasized that the frequency of exploring and analyzing modern electronic equipment is on the rise in recent years. It is widely used in the teaching of college courses, easy for teachers to teach, and handy to use, and has become the darling of music laboratories. , such as: laptop transformer with touch screen. It can be folded in half and placed on a piano music stand or a console performer for strings or brass, free programs for handwritten notes, and more. Tablet computers have become particularly popular among students of major conservatories, and are also commonly used for dictation in audition and ear training classes of major conservatories, as well as smartphones that appear frequently now, and now almost everyone owns them. Often used for singing from sight or writing short musical outlines. If we look back at past teaching, for example, in 2011, we used educational readers. At that time, there was no Android system. Traditional teaching could not study and work efficiently. It was also inconvenient for students to take notes in class. Nowadays, application programs that replace traditional teaching frequently appear in college classes. Write notes on preloaded music scores in the format of PDF settings, including PDF applications. For convenience, you can load multiple music scores at one time. Paper. According to the teacher's teaching plan, effectively complete the teaching tasks and open up a broader teaching space. For the teachers and students who use it, these functions provide the greatest convenience.

7. Conclusions

The future of modern electronic devices is exciting. The amount of digital information in our lives will continue to increase dramatically in the future, and the quality will also be greatly improved. Modern electronic equipment is rapidly and unexpectedly entering many aspects of college course teaching. The general trend is that all aspects will develop in the direction of integrating today's new technologies. Teachers must effectively apply modern electronic equipment in music laboratories. To use equipment teaching tools to assist teaching, you must have good educational and teaching skills and superb information technology literacy. Only in this way can information technology and classroom teaching be organically combined. As college music laboratories use new technical means of electronic equipment in the classroom With continuous application in teaching, educators can only be successful in future classroom teaching practice if they keep pace with the times, have the courage to explore, and continue to innovate.

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