

Application of Big Data Technology in College Music Education

Jiang Bian, Hebei Institute of Communication, China

Tao Yang, Hebei Institute of Communication, China*

ABSTRACT

Based on information technology to promote the upgrading of various industries, the core of Industry 4.0, the current internet big data has gradually become a hot spot of social development, and a huge amount of data gushes out. Music is the education of beauty, and it is a key to inspire people to be true and good. China has been a land of culture and music since ancient times, and has a very high position in the history of world music. Combining advanced information technology with traditional music education to promote the development of national music education is of great significance to quality education. Based on the high-speed development of the era of big data, this article studies the specific application of big data technology in college music education, helps college students to cultivate open thinking and improve their independent music learning ability through online teaching platform, and formulates different teaching plans according to students' music learning data.

KEYWORDS

Big data technology, Colleges and universities, Music education, Teaching platform

INTRODUCTION

In the 21st century, human society has officially entered the information age. New internet technologies are continually emerging, followed by a massive amount of data. We need to collect and analyze these data, gain valuable information, and apply it to our daily lives and work (Zhang and Wan, 2020).

China attaches great importance to the development of big-data technology (Yu and Ding, 2020). In recent years, with the rapid development of internet technology, emerging technologies such as big data, artificial intelligence (AI), augmented reality (AR) have gradually matured to the point that they can be found in all walks of life, providing a strong boost to China's informatization and effectively improving residents' working and living standards (Green, 2006). Big-data technology is an important foundation for other scientific developments, and the emergence of big data marks the arrival of a profound revolution in the information age, that is, the "third wave" of information development, which has brought earth-shaking changes to national economic development and to people's productivity and lives (Gao, 2020).

DOI: 10.4018/IJWLTT.336838

*Corresponding Author

This article published as an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>) which permits unrestricted use, distribution, and production in any medium, provided the author of the original work and original publication source are properly credited.

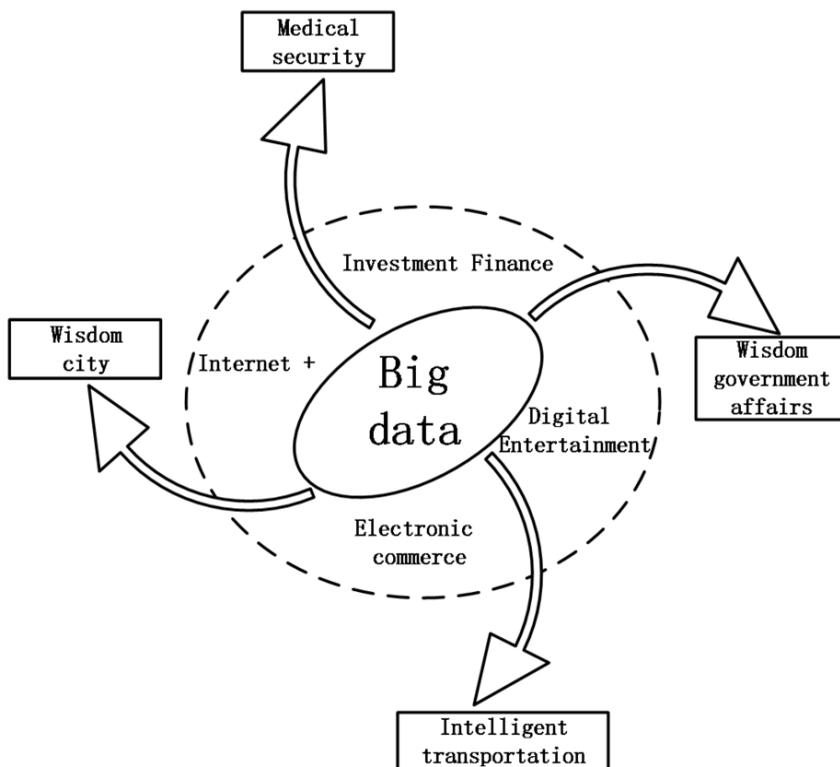
Compared with research on big-data mining in the United States since September 11, 2001, China's research started late, but it is developing rapidly (Cui, 2020). In recent years, projects such as smart cities, digital villages, and intelligent transportation are constantly emerging, which shows that the state attaches great importance to the development of big data and indicates that big data has become the trend of the times (Yuan, 2020).

Research on emerging internet technologies in colleges and universities is at the forefront of the times. Big-data technology is the basis of knowledge in key research fields such as AI and AR, so the importance attached by colleges and universities is natural. Universities use big-data technology to collect student data, analyze and process it, and improve the efficiency of school management. Collecting students' family information, reward and punishment records, achievements in various subjects, and other data can help colleges analyze and understand students' living habits, study status, and other specific situations and formulate better teaching-management systems.

As one of the important components of higher education, music education in colleges and universities involves a large amount of data. It is particularly important to analyze and process these data and use this information as the theoretical basis for adjusting teaching methods. For example, the school's music course offerings are adjusted according to the proportion of students who have chosen the courses in the past. People who are interested in a particular subject account for a relatively large proportion, so there are more courses the following semester.

Big-data technology is, of course, conducive to teaching students in accordance with their aptitude, but when collecting and analyzing students' data, we must protect their privacy. Some data should be accessed only by specific people, and there are certain errors in massive data that need to be identified with discretion. Special attention should be paid to data protection to avoid data leakage.

Figure 1. The impact of big data on other industries



Based on the rapid development of the big-data era, this article studies the application of big-data technology specifically to university music education. The research aims to help college students cultivate independent thinking and improve their ability to learn music independently through online teaching platforms and to help colleges develop different teaching plans based on students' music learning data.

BIG-DATA TECHNOLOGY

Big data is the collection of massive amounts of information from various users. The role of big-data technology is not just to collect information blindly, but to analyze and process these data to uncover valuable information (Li, 2021a). At the beginning, big data was used only in the IT research field, but now it has been used everywhere for decades. Nowadays, whether it is in regard to a wide variety of product recommendations, college course offerings, or facial recognition for online payments, massive data information is required (Kang, 2016).

Features of Big Data

Big-data technology usually has four characteristics: volume (quantification), variety (diversification), velocity (timeliness), and value (value density), which are commonly referred to as the four V's.

- 1) **Volume:** the data volume is huge, and it has jumped from the terabyte level to the petabyte (1PB = 1,024TB) level. Baidu maps alone can generate 1.5 TB of data every day, while human society has produced 200PB of printed materials so far.
- 2) **Variety:** data sources are wide and diverse. Data generated by common images, videos, blogs, social media, etc. are all data sources.
- 3) **Velocity:** the processing speed is extremely fast, following the "one-second law," and the data can be processed from generation to consumption in seconds (Yuan, 2020). Even if the data volume is huge, the consumed time is still very small, so that valuable information can be quickly obtained from a huge amount of different types of data.
- 4) **Value:** as the volume of data increases, the value density decreases, resulting in a smaller proportion of truly valuable information in massive data. It is necessary to make rational use of big-data technology to mine and analyze high-value information and apply it to finance, transportation, travel, communication, and other industries to improve their efficiency (Rui, 2021).

Application Status of Big Data

In recent years, with the continuous improvement and development of big-data technology, it has gradually become applicable to all areas of people's work and lives, especially in the fields of finance, e-commerce, medical security, and traffic management (Sun, 2020). Big data was first applied in the financial industry (Wei et al., 2022). The financial industry collects massive user data through big-data technology and analyzes them according to credit scores, historical records, and other dimensions so as to formulate targeted services for customers and make themselves more beneficial.

E-commerce platforms mostly analyze users' needs through their historical consumption data, predict their future consumption intentions, and provide a theoretical basis for enterprises to formulate marketing policies to improve their competitiveness (Zhou, 2020). The application of big data to the medical field is manifested mainly in medicine research and development and market operations (He, 2022). New drugs often have side effects. With the development of big-data technology, more experimental sample data can be collected, which can effectively shorten the time of drug side effect research and improve efficiency. Medical enterprises analyze demand trends for various drugs and medical devices through big data and make relatively scientific production plans according to actual needs (Chen, 2021).

The rapid development of big-data technology has injected new vitality into China's higher education, effectively promoting the reform of traditional education and improving students' learning efficiency by optimizing teaching methods and strengthening student management. Nowadays, applications of big data can be seen everywhere in human society, providing help for people's work and lives and laying a solid foundation for the future development of science and technology (Xu, 2020).

COLLEGE MUSIC EDUCATION IN THE BIG-DATA ENVIRONMENT

Current Situation of Music Education in Colleges and Universities

At present, domestic colleges and universities are vigorously promoting the development of music education, practicing the educational concept of "taking aesthetics as the core" (Hu, 2021). Generally speaking, compared with other disciplines, music education is in a relatively weak position in the education system of colleges and universities, and the importance attached to it by schools needs to be raised (Liu, 2022). Currently, all kinds of music courses in colleges and universities are offered for non-music majors, and the main teaching form is campus cultural activities (Han, 2022).

Music education in colleges and universities in China started late. Except for art colleges and some key comprehensive universities that can effectively promote it, music education in most colleges and universities failed to achieve the expected goal, the concept of music education was not deeply rooted in people's hearts, and the teaching foundation was weak. Many non-music-major students are not interested in music learning, their enthusiasm for participating in various music elective courses is not high, and they even think that music learning is of little significance to their self-cultivation. They don't have enough music literacy to choose appropriate courses, so they just choose a music course that is easy to pass. In addition, colleges and universities do not pay enough attention to it, and music-theory teaching is not perfect. In elective music classes, students are usually lax, the teaching quality can't be guaranteed, and it's difficult for non-music majors to obtain various musical instruments. All these issues limit the development of music education and make it difficult to realize the aesthetic function of music education.

Features of Big-Data Music Education

Based on the rapid development of the internet and the rise of big-data technology, the music-education system in colleges and universities has undergone major changes, including the following:

- 1) **Data:** students can learn all kinds of music theory and obtain related resources on the internet, and teachers can make teaching plans for students more reasonably. With big-data technology, the data on music-learning activities of students of various majors are collected, integrated, analyzed, and processed and a database is established to understand students' learning situations.
- 2) **Cross-regional connection:** due to the imbalance of music-education resources, some colleges and universities are short of music-education teachers. Based on the internet and big-data technology, cross-regional online teaching has been adopted to provide quality online music education for college students so as to realize the sharing of music-teaching resources and form cross-regional connections.
- 3) **Reasonable push:** use big data to collect information about students' ages, ethnicities, family situations, etc. and build a music learning platform on this basis so as to provide music courses that are most suitable for students and to help students choose the courses they are most interested in.

Big-Data Music-Curriculum Mode

The purpose of music education based on big-data technology is to improve college students' music self-cultivation. To achieve a high level of music education, it is necessary to improve teachers'

knowledge reserves and ensure students' learning enthusiasm. With the help of big-data technology, we can realize the integration and optimization of music-education resources, adopt new teaching methods, and improve students' enthusiasm for music learning (Ma, 2019). Generally speaking, there are the following music-teaching modes in the big-data environment:

- 1) **Micro-class:** a micro-class is very different from the traditional teaching methods of the past. It has the characteristics of highly condensed content and short time span. It often teaches only one knowledge point or demonstrates one small skill. It is more suitable for students with scattered time to learn and can also stimulate some students' interest in learning and improve their independent-learning abilities (Wang et al., 2021).
- 2) **Digital teaching materials:** big data can be used to develop rich resources of music intelligence education and digital music-teaching materials, for example, to compile original teaching content into vivid and interesting graphic teaching materials or to record micro-videos. This actively mobilizes students' emotions about the course teaching, guiding them to change from a bored state to a positive and optimistic state, and enhances students' enthusiasm and learning efficiency.
- 3) **Flipping the classroom:** a brand-new teaching mode, in which teachers upload the completed music-teaching videos to a QQ or WeChat group chat. Students can preview the teaching content before the formal class starts, and if they have any questions, they can record them. During class time, teachers should give students the correct answers, arrange appropriate music training, and engage in teacher–student interaction so that students can have a deeper understanding of music and cultivate their abilities to learn independently.

APPLICATION OF BIG DATA IN COLLEGE MUSIC EDUCATION

Music-Teaching Resource Library

With the rapid development of many internet technologies, colleges and universities have begun to make use of network resources gradually, collecting a large number of extremely high-level and characteristic music-education resources and setting up internet music-teaching resource banks, which can be used to supplement classroom teaching, and students can choose their favorite teaching content to study independently through the resource bank (Thibeault, 2018).

The essence of a music-teaching resource database is the scientific and accurate content. It is necessary to carefully examine all teaching content to avoid teaching mistakes and to keep the database stable and updated in the long term to maintain its vitality so as to achieve the goal of teachers' convenience and students' willingness to learn (Cui, 2021).

Cultivate Students' Learning Awareness

The data sharing advantages of the Internet can be utilized to enhance communication between students and high-level music experts through various music exchange communities, thereby enhancing their music cultivation. For example, in a piano-focused group, they can learn the relevant playing skills and musical score knowledge, discuss each step of playing with their companions on the internet, and listen to each other play so as to deepen their understanding of piano music (Li, 2021b). Students can learn about different types of music-appreciation content on the internet, experience musical works with different melodies, timbres, and atmospheres, and improve their music-appreciation abilities and their own music self-cultivation. At present, college students' autonomous music-learning abilities are generally not strong, and few students can persist in daily learning. In the era of big data, music education and teaching in colleges and universities require students to complete online platforms, so learners must practice active learning and a certain degree of self-control; otherwise it will be difficult to complete related courses.

Table 1. Investigation of autonomous music-learning ability of college students

Autonomous Music Learning	Percentage
Study every day	3%
Study frequently	25%
Study occasionally	37%
Never study	35%

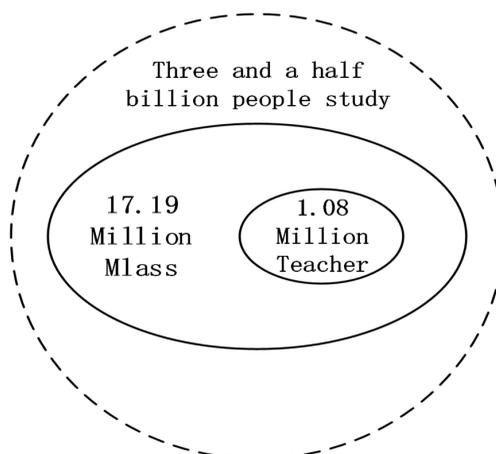
The emergence of big-data technology has changed teachers' teaching philosophies and students' developmental direction in college-level music education. In colleges and universities, we should face up to the shortcomings of the current music-education system, break through the shackles of traditional music-teaching modes, re-examine the current music-teaching content, and enhance college students' aesthetic abilities. Classroom teaching should focus on expanding students' thinking, providing them with more opportunities to know and understand music, and on paying attention to the cultivation of their music aesthetics.

Online Music-Teaching Platforms

To combine college music education with the development of big-data technology, an online music-teaching platform is constructed and the data on students' daily musical activities are collected. The data are deeply excavated and analyzed so that students' activity times, hobbies, habits, and other information can be revealed, which is convenient to help teachers make targeted teaching arrangements for students (Qi and Jiang, 2007). At present, new music-teaching platforms frequently emerge and the platforms and equipment are constantly updated, which makes the visual-presentation ability of online music teaching more mature. Teachers can solve common problems such as audio and accompaniment by using MIDI, which is a powerful information-technology support to promote the development of music education (Ludovico, 2017).

In 2020, driven by the epidemic and other reasons, China's colleges and universities generally launched online teaching. Nearly 1.08 million college teachers opened more than 10 million courses on various online-teaching platforms, meeting the learning needs of hundreds of millions of college students.

Figure 2. Online learning of chinese universities during the epidemic period in 2020



Through the online music-teaching platform, you can collect the teaching videos of world-famous music schools such as the Curtis Institute of Music, the Royal Academy of Music, and the Berklee College of Music. Students can receive lectures from world-famous music festivals at the greatest music institutions without leaving home, which can achieve twice the result with half the effort for any college student's music study. Teachers in colleges and universities can also study together, face up to the gap between China's music-education level and the international top level, learn from their teaching ideas and methods, and adjust their teaching plans according to the actual situation of schools.

College students can understand the teacher's lecture content in advance, take relevant notes, and communicate with the teacher after the class starts. In their spare time, they can watch teaching videos from prestigious schools such as the Berklee College of Music, learn relevant knowledge, and improve their music cultivation.

Establish a New Teaching Concept

Music teaching in the big data environment should not only focus on grades themselves, but should encourage students to develop in a personalized and open direction. At the same time, higher requirements are put forward for music teachers in colleges and universities, including not only the ability to teach music but also technological abilities such as making teaching micro-videos, opening online open classes, etc. In the process of teaching, if some students express personal needs, teachers should carry out differentiated teaching according to those students' interests and should not force them to study their own set content.

In the classroom, music teachers show all kinds of music-teaching videos to students through the music-teaching platform and the data-mining ability of big-data technology, breaking the shackles of traditional ideas, making efforts to create an open classroom teaching space, and promoting students' music cultivation with the help of numerous network resources. At the same time, they can show students how to use musical social-networking sites to communicate with and help others, breaking the time and space constraints of music-teaching classes and cultivating students' independent thinking.

To further promote the reform of teaching models in the future, teachers can integrate 5G high-speed networks with traditional teaching models, strengthen innovative teaching, establish and improve the construction of hybrid teaching models, and promote the smooth progress of music-education reform in universities.

CONCLUSION

With the continuous development of science and technology, integrating advanced information and data technologies into traditional music education is of great importance to promote the development of quality music education. This article takes the rapidly developing era of big data as the research background, takes the application of big-data technology in music education in universities as the research object, combines the current situation of music education, the characteristics of music education in the big-data environment, and new music-teaching models, and focuses on the specific application of big-data technology in music education. However, we are still in the early stages of big-data technology development. While universities utilize relevant technologies to mine, analyze, and process data, they also face security risks such as data leakage. Therefore, universities need to pay special attention to the data security of all teachers and students. How to organically combine traditional education with modern advanced technology and make it a new paradigm requires continuous exploration by university educators.

AUTHORS NOTE

The authors declare that they have no conflicts of interest. This work was not supported by any funds. The authors sincerely thank those who have contributed to this research.

REFERENCES

- Chen, X. (2021). Development and innovation of music course teaching mode based on big data. *Journal of Physics: Conference Series*, 1744(3), 032018. doi:10.1088/1742-6596/1744/3/032018
- Cui, Y. (2020). The influence of music appreciation courses on the formation of college students' ideological quality under the environment of big data. *Journal of Physics: Conference Series*, 1533(4), 042074. doi:10.1088/1742-6596/1533/4/042074
- Cui, Y. (2021). The promotion of music education based on big data to the ideological and moral education of college students. In *2021 2nd International Conference on Computers, Information Processing and Advanced Education* (pp. 888–891). ACM. doi:10.1145/3456887.3457096
- Gao, W. (2020). Research on the coordinated development and innovative application between national music and contemporary multicultural music education based on big data. *Journal of Physics: Conference Series*, 1648(3), 032063. doi:10.1088/1742-6596/1648/3/032063
- Green, L. (2006). Popular music education in and for itself, and for 'other' music: Current research in the classroom. *International Journal of Music Education*, 24(2), 101–118. doi:10.1177/0255761406065471
- Han, J. (2022). The dilemma and countermeasures of music education under the background of big data. *Wireless Communications and Mobile Computing*, 2022(8), 1–12. doi:10.1155/2022/8341966
- He, H. (2022). Design and implementation of data mining technology in music education platform. In J. C. Hung, J. W. Chang, Y. Pei, & W. C. Wu (Eds.), *Innovative computing* (pp. 1493–1498). Springer. doi:10.1007/978-981-16-4258-6_184
- Hu, Y. (2021). Application value of artificial intelligence system in music education. In *2021 4th International Conference on Information Systems and Computer Aided Education* (pp. 1459–1462). ACM. doi:10.1145/3482632.3483173
- Kang, S. (2016). The history of multicultural music education and its prospects: The controversy of music universalism and its application. *Update - University of South Carolina. Dept. of Music*, 34(2), 21–28. doi:10.1177/8755123314548044
- Li, J. (2021a). Research on the construction of university music teaching cloud platform based on data mining technology. *CONVERTER*, 2021(6), 615–621.
- Li, T. (2021b). Selection of audio materials in college music education courses based on hybrid recommendation algorithm and big data. *Journal of Physics: Conference Series*, 1774(1), 012019. doi:10.1088/1742-6596/1774/1/012019
- Liu, Y. (2022). Research on the design of a traditional music push system for big data. In V. Sugumaran, A. G. Sreedevi, & Z. Xu (Eds.), *Application of intelligent systems in multi-modal information analytics. ICMMA 2022. Lecture Notes on Data Engineering and Communications Technologies* (Vol. 138, pp. 665–672). Springer. doi:10.1007/978-3-031-05484-6_84
- Ludovico, L. A. (2017). The web MIDI API in on-line applications for music education. In L. A. Ludovico & A. M. F. Yousef (Eds.), *eLmL 2017: Proceedings of the Ninth International Conference on Mobile, Hybrid, and On-line Learning* (pp. 72–77). IARIA.
- Ma, L. (2019). Traditional music protection system from the ecological perspective based on big data analysis. *Ekoloji*, 28(107), 3667–3676.
- Qi, F., & Jiang, T. (2007). Structure of a remote oral music education application. In *2007 First IEEE International Symposium on Information Technologies and Applications in Education* (pp. 257–259). IEEE. doi:10.1109/ISITAE.2007.4409282
- Rui, Y. (2021). Strategy of diversified music education in our country based on the analysis of big data. *Journal of Physics: Conference Series*, 1744(4), 042130. doi:10.1088/1742-6596/1744/4/042130
- Sun, Z. (2020). Analysis of the inheritance of traditional music culture based on big data auxiliary technology. *Journal of Physics: Conference Series*, 1648(4), 042029. doi:10.1088/1742-6596/1648/4/042029

Thibeault, M. D. (2018). Music education in the postperformance world. In G. W. McPherson & G. F. Welch (Eds.), *Creativities, technologies, and media in music learning and teaching: An Oxford handbook of music education* (Vol. 5, pp. 203–216). Oxford University Press.

Wang, C., Jiang, B., & Zhong, S. (2021). Research on the application of big data in the evaluation system of music teaching in Chinese colleges and universities. In *Proceedings of the 13th International Conference on Education Technology and Computers* (pp. 252–257). ACM. doi:10.1145/3498765.3498846

Wei, J., Karuppiah, M., & Prathik, A. (2022). College music education and teaching based on AI techniques. *Computers & Electrical Engineering*, 100, 107851. doi:10.1016/j.compeleceng.2022.107851

Xu, J. (2020). Application research of big data analysis in higher vocational music education. In *2020 2nd International Conference on Applied Machine Learning (ICAML)* (pp. 172–175). IEEE. doi:10.1109/ICAML51583.2020.00042

Yu, L., & Ding, J. (2020). Application of music artificial intelligence in preschool music education. *IOP Conference Series. Materials Science and Engineering*, 750(1), 012101. doi:10.1088/1757-899X/750/1/012101

Yuan, S. (2020). Application and study of musical artificial intelligence in music education field. *Journal of Physics: Conference Series*, 1533(3), 032033. doi:10.1088/1742-6596/1533/3/032033

Zhang, J., & Wan, J. (2020). A summary of the application of artificial intelligence in music education. In *Proceedings of the International Conference on Education, Economics and Information Management (ICEEIM 2019)* (pp. 42–44). Atlantis Press. doi:10.2991/assehr.k.200401.012

Zhou, Y. (2020). Research on music education model by using computer music technology in colleges. *Journal of Physics: Conference Series*, 1624(2), 022053. doi:10.1088/1742-6596/1624/2/022053

Jiang Bian was born in Hebei, China, in 1979. From 1998 to 2002, he studied at Hebei Normal University and received his bachelor's degree in 2002. From 2002 to 2008, he worked at the Film and Television Art College of Hebei University. Currently, he works at the Hebei Institute of Communication. He has published four papers and published one book as an associate editor. His research interests include vocal music education and music performance.

Tao Yang was born in Hebei, China, in 1982. From 2001 to 2005, he studied at Yanshan University and received his bachelor's degree in 2005. From 2005 to 2008, he worked at the Film and Television Art College of Hebei University. Currently, he works at the Hebei Institute of Communication. He has published seven papers. His research interests include music education and music theory.