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The Impact of VR Technology on Music Education in the Context of "Internet Plus" Teaching

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Abstract. With the advancement of modern science and technology, virtual reality (VR) technology—one of the products of high-tech modernization—has brought great convenience to people's daily lives. Taking VR technology as the medium and domestic music education in China as the foundation, this paper explores the characteristics, application value, and impact of VR technology in music teaching. Through theoretical research, it aims to promote the integration of VR technology into China's music education, fostering new possibilities for classroom teaching and the development of innovative educational models.

Keywords: VR technology, music education, teaching models, instructional scenarios

1. Introduction

In the profoundly intricate realm of computer science, a nascent technology emerges, which goes by the appellation Virtual Reality (VR), constructed upon an amalgamation of disparate scientific domains: graphical computing, sensor integration methodologies, nuanced human-computer dialogues, multimedia interfacing subtleties, three-dimensional perceptual displays, and synthetic mimetic application frameworks [1].

An assessment of the peculiar traits inherent in Virtual Reality (VR), reveals noteworthy merits arising from its use. A construct, it becomes, a domain whereupon students' immersion in virtual experiences is made possible; not merely through auditory participation in melodies but fortified by an orchestration of multi-sensory stimuli synthesizing optic, acoustic, and haptic perceptions, thereby allowing for musical concepts to manifest tangibly before them. The depth in apprehending these musicological abstractions gains by perceiving thusly. Within this immersive sanctuary, participants gain liberty unprecedented, akin to exploring an infinite celestial realm resonating with harmonious experience spanning beyond conventional borders. Through employment within pedagogical methods brought forth into classroom territories, educators witness enhancements profound, which VR implementations furnish—caters fully to pedagogic demands aligned with learners' ever-evolving aspirational sequences. From the vantage point provided here, realization occurs that educational paradigms undergo marked metamorphosis upon integrating VR, a transformation harmonized intimately with aims defined as scholastically transformative.

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2. Literature review

2.1. Research background

Since the beginning of the 21st century, China's economy has become increasingly prosperous due to the deepening of reform and opening-up. The Internet has gradually spread nationwide since the early 2000s, and classroom teaching has evolved with the introduction of digital tools such as computers, electronic whiteboards, and projectors. In this era of the Internet, rapid technological innovations—such as Artificial Intelligence (AI), 5G communication, 3D printing, and VR technology—have emerged. These technologies not only drive innovation in science and technology but also make people's lives more diverse, convenient, and efficient.

2.2. Current status of domestic research

As illustrated in Figure 1 (Annual Trend Chart of Publications):

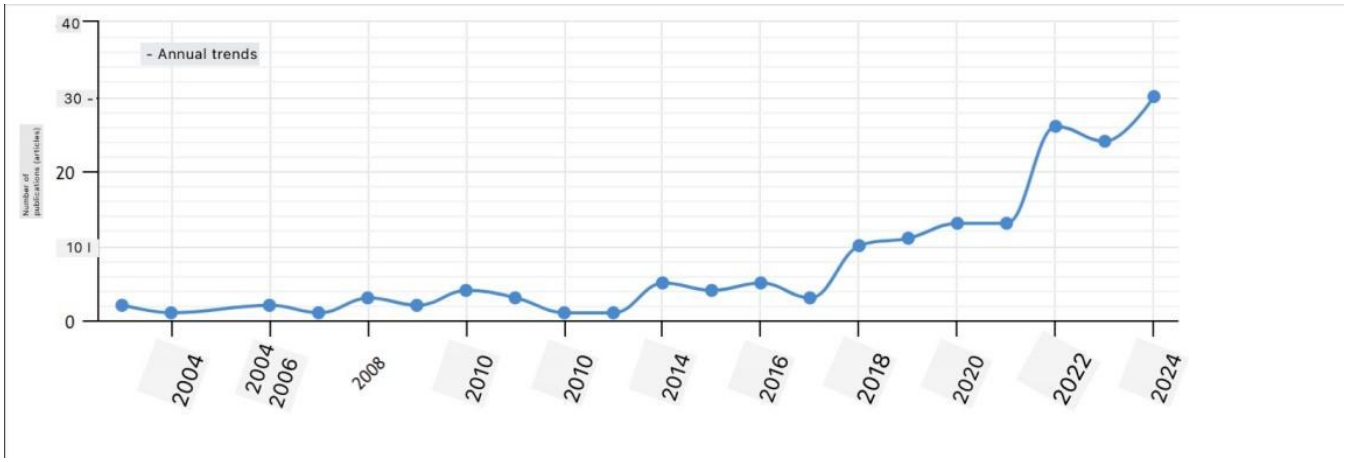


Figure 1. Annual trend chart of publications

Research on VR technology in China began around 2003. Prior to 2018, fewer than ten papers were published annually. From 2018 to 2024, however, the number of publications has shown a steady upward trend. This suggests that as technological innovation progresses, VR technology continues to attract increasing attention from scholars. A small research peak occurred in 2022, and by 2024, the number of publications reached a historical high. This upward trend indicates that as VR technology matures, more researchers from different disciplines are engaging with it, offering diverse perspectives and insights. According to the current trajectory, more academic contributions on VR technology can be expected in the coming years.

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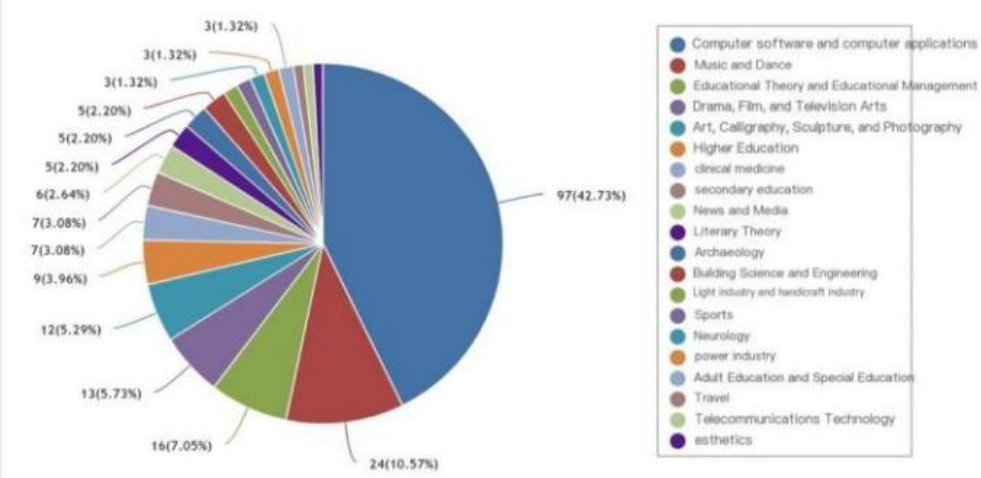


Figure 2. Chart of the portion of each factor

Figure 2 (Chart of the Portion of Each Factor) presents the distribution of research fields retrieved from the China National Knowledge Infrastructure (CNKI) database. Among 144 relevant papers, 24 focused on music and dance, accounting for 10.75% of the total. Within this broad field, topics include dance performance, choreography, dance education, music performance, music therapy, music theory, and music education. Specifically, only five papers in CNKI directly address the impact of VR technology on music education. This scarcity highlights the novelty and research potential of this topic, demonstrating that VR-assisted music education remains an underexplored but promising direction.

2.3. Research signification

2.3.1. Practical implication

With notable immersion and interactivity as its defining attributes, the infusion of virtual reality technology within music education underscores an acute transformation quintessential to addressing a primary dilemma pervasive in musical pedagogy: the metamorphosis of abstracted musical notions into corporeal experiences conducive to tangible learning engagement. It appears that pedagogical innovation burgeons conspicuously herein, with profound augmentation observable in the expeditious assimilation by which students apprehend and internalize such intricate musical types of knowledge.

It is visible from the array of diverse ethnic backgrounds subsisting under China's multicultural tapestry—encompassing 56 distinct ethnological groups each harboring unique and disparate musical legacies—that virtual reality confers an unparalleled conduit for scholars therein. Such technological incursion permits intellectual passageway onto virtual platforms through which once geographically or temporally unattainable native performances may now be virtually witnessed and culturally absorbed. Thus, students find themselves engaging not merely at the surface level but penetrating deeply into emotional nuances and cultural substrata resonant within musical interpretations; consequently, their comprehension expansively amplified becomes noticeable. Multisensory representations extend further utility wherein perception of melodic cycles, rhythmics, and disciplined harmonies derive enhanced educational elucidation via immersive delineations rendered all the more perspicuous for both educator demarcation and learner perception cudgeling complexities.

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2.3.2. Theoretical significance

This research contributes to the enrichment of music theory. Currently, studies in music theory have become increasingly diversified and multilayered. However, research on the integration of VR technology with music education remains limited in China, with relatively few exemplary cases or references available. Therefore, this paper attempts to review and synthesize existing viewpoints to form a coherent theoretical understanding, offering a modest contribution for future scholars interested in this emerging field. As a student specializing in music, the author considers it both a responsibility and a mission to advance the development of music education through such interdisciplinary exploration.

3. Development characteristics of VR technology in music education

VR technology in music education is characterized by immersion, imagination, and interaction.

3.1. Immersion

According to scholar Lü Jiyong, immersion refers to the ability of VR technology to engage learners' sensory functions through its advantages in sound effects, animation, and other technical means, enabling them to be fully absorbed in the simulated environment [2]. This immersive setting blurs the boundary between virtuality and reality, making participants feel as though they have entered another world. In such environments, learners can experience vivid visual, auditory, and even tactile sensations.

In the pedagogical practice of music, augmented by VR-based instructional frameworks, discretion falls upon educators to meticulously observe when learners interact with simulated scenarios. Tangible indicia—eye trajectories, gesticulations of the hands, or corporeal stance—become the medium through which comprehension of musical material is tangibly manifested. Such empirical manifestations render observable that which is often considered abstract and subjective within musical academe: understanding. Real-time scrutiny of these phenomena avails tutors a clear vista into students' learning trajectories. From such surveillance, one may discern underperformance against delineated educational aspirations; thereby, immediate identification of deficiencies allows for superior amendment of teaching stratagems embedded in the VR milieu. This recalibration promotes an optimized didactic mission whilst concurrently attending to the bespoke academic pathways intrinsic to individualized learner engagement.

3.2. Imagination

Imagination, in its essence coalescing within the domain of virtual reality (VR), manifests as an intermediary that conjoins sensory perception with rational cognition. Learners plunged into VR environments—distinctive from their corporeal contexts—initially encounter phenomena through emotional and sensorial lenses; however, these scenes are architecturally objective and organized underpinned by reasoned structuration. Cognitive harmonization arises therefrom, nurturing imaginative faculties amongst learners.

Consider a child hailing from the verdant expanses of northern China yet pursuing education in southern terrains. A sentiment akin to homesickness might well up within such a learner. It can be seen from instances wherein VR technology meticulously reconstructs hometown vistas paired with ethnic melodies familiar thereto, thereby engendering an evocative reconnection with one's abode of origin. In another vein, students aspiring towards an understanding of music nexus to grassland cultures find themselves transported vividly via VR—a conduit whereby they materialize

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imaginatively in those cultural tapestries. An enhanced comprehension vis-à-vis distinctive musical styles endemic to said region is thus expedited, intuitive at root but experiential in reach.

3.3. Interaction

Interaction refers to the learner's ability to engage directly with the virtual music environment without relying on traditional computer tools. In this context, the hardware derived from VR technology—such as virtual headsets and motion controllers—acts as the instruments of interaction [3].

Among the three characteristics, interaction is the most observable and yields the most direct feedback for instructors. By observing students' physical reactions, teachers can gauge their engagement and comprehension, then adjust and refine subsequent lessons accordingly. This immediate feedback mechanism significantly enhances the adaptability and responsiveness of teaching.

4. Application and value of VR technology in music education

4.1. Application in music appreciation classes

In analyzing the current landscape of music education in China, it is evident that the curriculum remains heavily focused on specialized vocal and instrumental training. Students with family support may even access advanced music production courses during secondary education, whereas music appreciation is often undervalued. Former Chinese Vice Premier Li Lanqing once emphasized that "art education is not merely technical training—it should not only teach students to play instruments or sing, but more importantly, cultivate their aesthetic sensibilities and ability to appreciate art." In recent years, the Ministry of Education has implemented policies to strengthen aesthetic education, and many universities have responded by restructuring curricula to include music appreciation and related activities. For instance, China University of Geosciences (Wuhan) has diversified its general education curriculum, emphasizing aesthetic education through public music appreciation courses and events aimed at promoting holistic student development.

The infusion of VR technology into the curriculum designed for appreciation studies serves to augment experiential learning by introducing immersive dimensions. Environments reconstructed digitally provide engagement with historical concert scenarios wherein comprehension of Western composers—Beethoven, Mozart, and Haydn being exemplary figures—is profoundly facilitated. Interaction within these reconstructions employs imaginative faculties alongside sensorial perceptions, offering insights into both the contextual spaces of creativity pertinent to the composers and their emotive articulations conveyed through composition. It can be observed that traditional pedagogical settings reliant on lectures accompanied by PowerPoint presentations lack the dynamic interaction inherent in VR-assisted instruction; here lies an avenue that amplifies interactive participation, elevates learner inquisitiveness, and fulfills an intrinsic yearning for discovery unique to such methodologies. Through three-dimensional engagings suffused with depth, students may internalize artistic understandings: achieving aesthetic objectives herein defined by the notion that feeling is absorbed inwardly while form finds external expression—a principle central to education oriented toward appreciation.

4.2. Utilization within instrumental learning contexts

A plethora of opportunities for engagement with virtual instruments is presented to learners via VR headsets coupled with controllers, enabling interaction with digital manifestations such as pianofortes, violins, or percussion sets, observable from current technological adaptations. Those scholars whose familial fiscal resources render tangible instrumentation unattainable find in VR an egalitarian

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conduit toward musicianship practice and exposure. In this manner can be discerned a diminution of both pecuniary impositions and logistical impediments concomitant with heightened availability of eminent pedagogical experiences through digitally orchestrated exhibitions by virtuosos of distinction.

When considering practitioners engaged with the exploration of traditional Chinese musical apparatuses, equally relevant are the attributes offered by VR advancements. Instances include historically ethnic instruments—exemplified by morin khuur (horsehead fiddle) and muqam—that persistently elude broad geographic acquisition possibilities. Through procedural ostensibly attained VR controller usage, aspirants simulate the praxis of playing such rarities, thereby achieving potential economization of procurement expenses and diminishment of associated obstacles linked to geography.

Moreover, it emerges evident under exceptional circumstances where proximity to physical instruments remains unfeasible that VR-enabled continuance of habitual rehearsals preserves proficient technical command and tactile cognizance amidst real-world hindrances.

4.3. The utilization of VR in vocal instructional settings

The introduction of Virtual Reality (VR) technology into the domain of vocal instruction emerges as a profound juxtaposition to conventional practices, introducing both immediacy and scientific rigor. As posited by Jiyong L, traditional methodologies within vocal pedagogy predominantly lean upon the scaffolding provided by psychological imagination married with guided visualization—a pedagogy deficient in comprehensive explication rooted in physiological understanding. Within these classes, instructors frequently resort to utilizing abstract metaphorical language epitomized by exhortations such as "elevate your soft palate" or "maintain your larynx flat," terms depicting internal processes obscured from learner's direct observation or physical manipulation, thus engendering a disconnect regarding their substantive meaning. Educators incline towards deploying suggestive images for stimulating correlated corporeal adjustments within students, aiming toward modulation of vocal conditions requisite for optimal tonal management.

Students persistently encountering difficulties grasping which muscular components are employed during phonation invariably arise from reliance on verbal instructions alone. Consequentially, the risk remains pronounced for evolution toward inaccurate techniques potentially precipitating vocally harmful effects, overtime leading to conditions illustrative of vocal nodules or tears of the vocal fold. Observations note VR technology as offering solutions through provision of lucid and dynamic elucidations of the underpinning singing's physiological mechanisms.

Immersed in virtual environs facilitated by VR headsets, learners engage tactilely via hand controllers, experiencing interactive capabilities furnished by three-dimensional anatomical representations pertinent to primary organs involved in voice production—these include lungs, oral cavity structures, as well as pharyngeal and laryngeal configurations. Such elements manifest spectrally through dynamic visuals permitting scholars insight into operational kinesis and functionality achieved whilst singing extends itself as an art form deeply embedded in abstraction, however; the transformation delivered by VR converts this abstraction into perceptible forms.

Of import is the capacity elided by VR to translate theoretically convoluted physiological enactments into interfaces accessible via visual modality for pedagogical objectives medically contextualized systematically aiding examination of instrumental apparatuses engaged amid performance in real-time scenarios. Resultantly, VR encompasses advantages applicable across demographies inclusive of burgeoning novices in one's vocal journey and individuals valorizing learning patterns described by intuitional bias, efficacious assimilation, alongside robust evidence-based absorptive alignments stemming from varied cognitive preferences inherent in diverse learners.

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5. Conclusion

A significant paradigm potential exists for transformation within music pedagogy, having undergone evolvement through virtual reality's emergence, supplying educators with frameworks practical in nature and students access to efficient learning paths. The enrichment of instructional content concomitant with engagement levels elevated among students indicates a decrease in their predisposition toward disengagement, notwithstanding conceptual abstractness.

Virtual reality technology provides conveniences substantial and precision remarkable, offering considerable advantages observable by educators. Instructors are facilitated instantaneously to appraise real-time performances of students upon learning objectives' fulfilment observance. This dynamic adjustability presented by virtual systems exemplifies resolutions addressing inefficiencies typically ascribed to conventional classrooms' deferred feedback mechanisms [4]. From such observations emanates communication fostering mutual progression—a reciprocal reinforcement setting ideal where teaching experiences enhance learning substantially and vice versa. Within contemporary fast-paced society appears manifest the indispensability inherent in efficacious interactions—interpersonal and interfacing prominently human-machine alike. Contexts of communicative positivity fortify trajectories developmental while hindrances therein give rise to obstructive manifestations.

Persist does unequal technological resource distribution geographically disparate across China's varied landscapes. Underdeveloped regions languish deprived infrastructural elements essential for integrating VR educationally. Further, challenges materialize in costs prohibitive regarding VR hardware alongside ancillary device requirements. Additionally discernible resistance emerges notably from senior pedagogues entrenched habitually in methodologies customary—their hesitancy towards tech-adoption inferred further impeding dissemination thereof [5].

Observably challenging however these variables might await redress; prospectively augurs auspicious for VR incorporation in sphere educational musical understanding. Anticipated cost reductions aligned concomitantly with digital literacy advancements herald transformations situating fundamentally VR technology within modern student-centered music education paradigms characteristic ultimately.

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