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A sample of virtual reality applications in music education

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Abstract

Virtual reality technology provides an opportunity for students to engage in a lasting, active, interactive, and enjoyable learning experience, particularly by embodying abstract concepts and utilizing multiple sensory organs. These applications can be utilized to create individual and unique educational environments for each student's specific interests, needs, and learning styles. In this context, it is believed that technological applications used in educational environments can also be useful within the scope of music education. This study aimed to determine the effect of these activities on the music performance anxiety levels and performance development of undergraduate students of the music department. A 10-week series of lessons has been designed utilizing virtual reality technology, the 'virtual stage' application, to reduce performance anxiety and enhance the performances of students in the field of vocational music education. The study group is determined by homogeneous sampling. A total of 26 students participated in the study. The quantitative data of the study were obtained with the Kenny Music Performance Anxiety Inventory and the performance observation form developed by the researcher; the qualitative data were obtained with the semi-structured interview form.

Keywords: Music Education, Virtual Reality, Instrument Training, Instructional Technologies**.**

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1. Introduction

Virtual reality applications, in which digital content elements such as sound, animation, images, and holograms are created by computers, are the perception environments of real-life time, space, and objects placed in real-time in 2D with virtual reality glasses. Virtual reality technology, which can technically be used to impact the 5 senses, is now applied to be more effective on audio-visual emotions (Erol et al., 2021; Oyelere et al., 2020; Tehli, 2020; Yaman, 2019).

It is clear that the concept of virtual reality was initially used by Jaron Lenier in 1979; however, T. Gaddis was the first to define virtual reality (Şekerci, 2017). This concept was utilized in the historical process as three-dimensional works of the 19th, 20th, and 21st centuries with the advancement of computer technology (Şekerci, 2017; Tepe et al., 2016; Bayraktar and Kaleli, 2007; Emre et al., 2019; Kurbanoğlu, 1996). We also see that virtual reality technologies have begun to be used in every field of technology, with the constant change and development of computer software and hardware (Türk et al., 2017; Aydın, 2020; Hüsmen, 2022; Kanschik et al., 2023).

When we review the relevant literature, it is observed that there are some studies conducted on the contributions of the use of virtual reality applications in education, which can simultaneously combine virtual and real environments to educational practices. In their study, Moussa et al., (2022) aimed to establish whether virtual technologies had positive effects on dental education achievements and to identify the attitudes of dental students and educators towards these technologies. They concluded that the virtual reality technologies improved dental education achievements of dental students and that the attitudes of students and educators towards the virtual reality technologies also turned out to be positive.

In their study, Jiang et al. (2022) aimed to establish the current research and future research areas on the use of VR in undergraduate medical education. As a result of their study, they found that there were a limited number of studies on the use of VR in non-surgical areas where psychomotor skill training was not required, where VR simulators were used for surgery, 3D models, and virtual worlds for anatomy. In their study, Kavanagh et al., (2017) aimed to investigate the achievements that educators wished to achieve by using virtual reality technology, the applications they provided to educational practices, and the problems they faced. They concluded that educators preferred virtual reality applications in special situations that required realistic simulation and that these applications positively impacted students' intrinsic motivation.

As is widely acknowledged, virtual reality technology provides permanent learning to students, especially by concretizing abstract concepts, and offers them the opportunity to learn by doing and experiencing through active, interactive, entertaining, and multiple emotional organs (Zheng et al., 2020; Nisha, 2019; Balcerak Jackson & Balcerak Jackson 2024). With virtual reality applications, it is possible to create individual and unique educational environments for every student's special interest, needs, and learning styles (Çetintav and Yılmaz, 2022; Marougkas et al., 2024). Digital innovations and developments are used in different disciplines with the integration of information technologies into education contexts (van der Meer et al., 2023).

Previous studies support the general belief that technology is commonly preferred in these educational contexts (Çavaş et al., 2004; Orhan and Karaman, 2011). In this sense, it is believed that the inclusion of virtual reality applications in the vocational music education process, which includes the applied courses in its programs, will positively impact the teaching process and contribute to the creation of effective and permanent learning contexts (Yang, 2024). Considering this, it was aimed to identify the effect of virtual reality applications on the music performance anxiety levels of undergraduate music education students.

1.1. Purpose of study

The goal of the current study was to assess the project writing and execution procedures from the researcher's point of view.

2. Methods and materials

2.1. Participants

The study group is determined by homogeneous sampling which is one of the purposeful sampling methods. A total of 26 students participated in the study, with 13 in the experimental group and 13 in the control group.

2.2. Data collection tools

A 10-week series of lessons has been designed utilizing virtual reality technology, the 'virtual stage' application, to reduce performance anxiety and enhance the performances of students in the field of vocational music education. These activities will be used to evaluate the effect of music department undergraduate students on music performance anxiety levels and performance development. The quantitative data of the study were obtained with the Kenny Music Performance Anxiety Inventory and the performance observation form developed by the researcher; the qualitative data were obtained with the semi-structured interview form.

2.3. The writing process of the project

Interviews were conducted with 5 software companies to decide on the essential software and hardware for the project. After these interviews, information about unit prices and value-added tax (VAT) rates of technical equipment needed was obtained. Moreover, extra information was also obtained about which applications could be included in the software-related content and which applications could be replaced by these applications in case of exceeding the budget. A final budget was created based on the information obtained.

It was decided that in the software that would be prepared under the name of "virtual scene", the application content would be developed with the "Unity" program, the image quality would be high-poly and the modeling would be animated. Within the scope of the project, the Meta Quest 2 glasses, which were stated as a technological product and contained the necessary hardware required during the implementation process, were requested. Moreover, the development of the software for PC, VR, and mobile versions was another issue that was consulted with the relevant companies.

After the contents to be included in the software were decided, the project draft started to be prepared. During the preparation phase of the project, the research method was also determined. A statistics expert was incorporated into the project process to ensure the validity and reliability of the analyses to be made and to compare the data to be obtained. The preparation of the project draft was finalized based on the views received from field experts and presented to the BAP unit, and this project was deemed suitable to be financially supported by the BAP council. Following the completion of the project tenders, the necessary equipment was purchased.

The application's design draft is now being built in collaboration with the software preparation business. By the previous research and expert opinions received, the instruments to be included in the application were selected by paying heed to the fact that they could be played while using VR glasses. The draft design of the aforementioned virtual scene is illustrated in Figure 1 and Figure 2.

Figure 1

Image 1 of Draft design

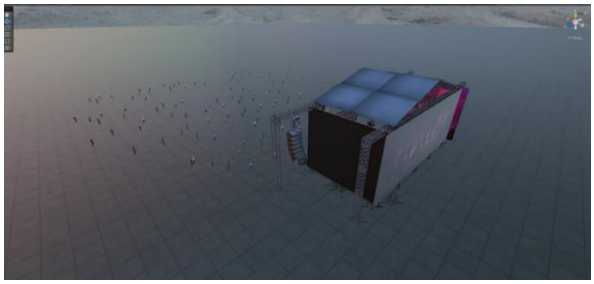
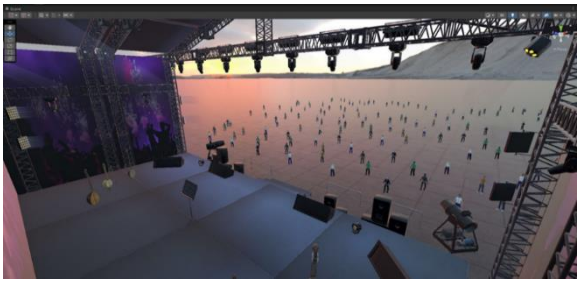


Figure 2

Image 2 of Draft design



During the development phase of the virtual stage shown in Figures 1 and 2, rectifications were made to improve the nature and human sounds because the audience appeared together as a group and the stage was prepared outdoors in practice. Moreover, the lighting of the stage was improved and the applause feature was added for the audience when the stage was opened. The Unity engine program was used to prepare the virtual scene and the Blender program for modeling. The image quality was changed from High-poly to low-poly (Realistic Texture) to improve the flow feature.

To optimize the application with the preferred VR glasses, a low polygon was worked on, and realistic coatings were applied to it. “Hands-Free (Hans Tracing)” mode was preferred in the application. The reason why the "Hands-Free" feature is preferred is that with this feature, users can interact with the application with their real hands.

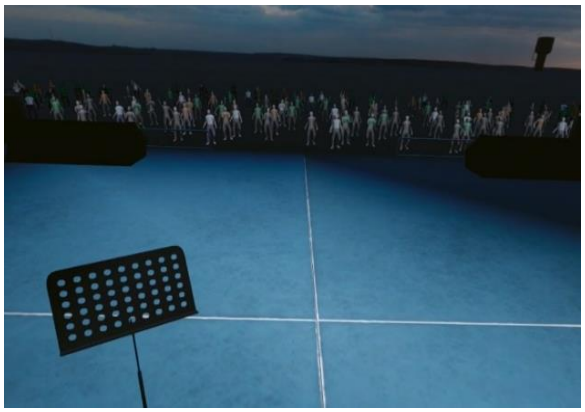
The final version of the "Virtual Scene" prepared with the virtual reality application to be used with the experimental group is illustrated in Figures 3 and 4.

Figure 3

Image 1 the final version of the Virtual Scene

Figure 4

Image 2 of the final version of the Virtual Scene



The application was implemented by taking into account the environment of the VR glasses (Meta Quest 2) where the virtual stage application would be used, and by making the environment/place/classroom in which it was used secure. This security feature, included in the VR glasses' software, is the reason why these glasses have been preferred in the first place. Moreover, when leaving the designated security area, the VR glasses increase the security level even further by showing the whole environment thanks to their internal camera.

The application, whose design process was finalized, was installed on the VR glasses via the SideQuest and Oculus programs. The installation was implemented interactively with the company that prepared the application. The installed application was tested by the researcher, final rectifications were made in line with the consultations with the company and it was made ready for the application period.

An activity plan was created for the implementation of the project. The plan of the activities is presented in Table 1.

Table 1

Activity Plan

Week	Subject and Content	Purpose	Duration/min
1st Week	Information about the use of virtual reality and VR glasses	Informing about what virtual reality applications are like and what kind of work can be done with VR glasses.	
2nd Week	Experiencing the use of VR glasses	Ensuring that students prepare for the VR glasses experience before the application and starting the adaptation process to the virtual environment.	
3rd Week	Onset of live performance preparations	Practicing instrument holding/stance/sitting positions using the VR glasses.	
4th Week	Live performance preparation procedure	Offering the experience of playing instruments/singing with the VR glasses and implementing the adaptation process to the virtual environment.	
5th Week	Live performance preparation procedure	Enabling the students to make concert preparations individually in a virtual environment.	
6th Week	Live performance preparation procedure	Enabling the students to make concert preparations individually in a virtual environment.	
7th Week	Live performance preparation procedure	Enabling the students to make concert preparations individually in a virtual environment.	
8th Week	Live performance preparation procedure	Enabling the students to make concert preparations individually in a virtual environment.	
9th Week	Live performance preparation procedure	Performing the final rehearsal with the application prepared with the virtual reality technology; completing the concert preparation procedure,	
10th Week	Staging the live performance	Presenting the rehearsals performed throughout the procedure as live performances.	Live performance duration varies depending on the work that students will perform.

2.4. Ethical consideration

The research endeavor conforms to the most elevated criteria of ethical methodology in scientific inquiry. To reduce participant risks, safety precautions were included in the research design. After careful examination, it was determined that there was no substantial danger of bodily or psychological harm associated with the experimental methods. Participants had the necessary support throughout the trial, and any possible discomfort was kept to a minimum.

3. Results

To establish the experimental and control groups for the application, 2 violins, 2 violas, 2 cellos, 2 drums, 2 tambur, 2 baglamas (three double-stringed instruments), 2 Kabak kemanes (rebab), 2

percussion instruments, 2 reed flutes, 2 pianos, 2 qanun, and 4 singing students were selected. The project application started within the time specified in the project work schedule.

In the 1st and 2nd weeks of the activity plan, an information meeting about virtual reality applications was conducted and the VR glasses were introduced. For the students to experience what was likely to happen and how they might feel when they wore the VR glasses, each student was allowed to wear the VR glasses for 15 minutes at the end of the meeting. The students stated that they feared that they would not be able to see anything before wearing the glasses and that they experienced dizziness when they put them on. Students were allowed to experience what the 360-degree virtual world was like before moving on to the "virtual stage" application. Students stated that the virtual world made them very happy, that even the idea that such an environment could exist before did not seem real to them, and that they enjoyed being in that environment and did not want to leave the virtual environment. When they moved on to the virtual stage, they stated that the stage was very big, and being able to see their own hands felt "very realistic" to them. At the end of the second week of the activity, it was observed that the students adapted to the glasses and the application, loved the application, and had fun during the project.

In the 3rd week of the application, the process of practicing with the instruments started. It turned out that there were students who expressed their concern about how they would play their instruments after the instruments were incorporated into the application period. In the 3rd week, instrument holding/stance/sitting positions were practiced with the students, especially after they put on glasses. It was observed that the students playing stringed instruments initially had problems playing their instruments with glasses, they brought their strings closer to the bridge of the instrument, the singing students were the ones who practiced most comfortably with the glasses, and the students thoroughly got used to the virtual reality glasses in the 4th week.

Rehearsals continued for the concert to be held in the following weeks of the event. During the rehearsals, students stated that they experienced dizziness, fever, and lost their perception of reality if they stayed in the virtual world for 30 minutes or more. However, some students also stated that they were affected by the sounds coming from the real world while performing with the glasses.

During the application period, the students stated that they were nervous about how to play their instruments with the glasses in the first week, but in the last 2 weeks of the application, they started to perceive the virtual world as natural as the real world. It was observed that the lack of control experienced in playing the instruments with the VR glasses, which was observed in the first weeks of the application, declined in the last week of the application.

4. Discussion

At the end of the virtual reality application activities, a concert titled "From Virtual Stage to Real Stage" was organized. All students who took part in the implementation process participated in this concert. During the 10-week activity period, it was observed that the students participated in the study ambitiously and voluntarily in the activities implemented with the virtual glasses. In the last week of the event, students demanded that they wanted the virtual glasses to be included in their daily routines and that they wanted to continue to use the glasses in their courses later in their education lives as well.

Moreover, during the application period, the students were asked the question "How many minutes have you been in the virtual world?" at the 15th and 20th minutes of their presence in the virtual world. Students answered "for 35-40 minutes". It is believed that their answer to this question and their answer to it supported their assertion that they lost their perception of reality during the VR implementation process.

Instruments such as violin, viola, cello, tambur, qanun, reed flute (ney), kabak kemane, baglama, piano, and some singing instruments were included in the application. It was observed that the students practicing the string instruments with the virtual reality glasses initially had problems holding their instruments correctly, but this problem disappeared in the third week of the application. The

string instrument students did not experience any problems regarding intonation. We think that this was simply because the instruments in question were fretless and provided aural intonation.

It was observed that students had problems holding the tambur and baglama instruments at the beginning and experienced anxiety because they wanted to see the frets of their instruments. However, in these students, unlike the string instrument students, this problem disappeared in the second week. No negative situation was observed in the piano, flute, and singing students. However, because the qanun student's instrument had a peg, the student experienced a lot of difficulties during its application. Throughout the practice period, the student constantly checked whether he had placed the pegs correctly. However, this student practiced quite comfortably in the last two weeks of the application. He clearly stated that he moved the pegs automatically and instinctively.

5. Conclusion

During the application period, especially in the design phase of the application, the high software cost caused some add-ons to be removed in the development of the application. During the development of the application, it was requested that the students add the notes of the works they would perform in the concert, that they can choose their notes within the application, that they can see their instruments in the virtual environment, that the number of spectators is increased and that they are designed in a more realistic human form; however, these requests were canceled out because they exceeded the budget of the project. Therefore, this application was rearranged to develop it based on hands-free mode, remove the dispersed and free movements of the audience, and see them as an ensemble together.

It is vitally significant and essential to carry out studies that will ensure that the virtual reality technology that is contemporary, up-to-date, keeps pace with the current era, and is available in the education systems of advanced countries, is included in every field of the education system of our country as well. It is believed that this technology can be used in all types of music education, including general, vocational, and amateur.

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