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ORIGINAL

3D Modeling from the Graphic Design of the FHP Headquarters of the Unified National Corporation of Higher Education. Perspectives for Virtual Tours and Visual Communication

Modelado en 3D desde el diseño gráfico de la Sede FHP de la Corporación Unificada Nacional de Educación Superior. Perspectivas para recorridos virtuales y la comunicación visual

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ABSTRACT

Higher education faces challenges in enhancing students' learning experiences and increasing their understanding and retention of information. Virtual tours with 3D modeling are presented as an innovative tool to address these challenges. The aim of this article is to examine the role of virtual tours with 3D modeling in higher education, highlighting their advantages, challenges, and key aspects for effective implementation. To implement virtual tours with 3D modeling effectively, several key aspects need to be considered. Firstly, navigation should be smooth and user-friendly to allow students to explore and learn effectively. Secondly, relevant information should be integrated effectively into the virtual tour so that students can access the information they need. Finally, interactivity is crucial for the success of a virtual tour as it enables students to interact with the environment and learn actively. Virtual tours with 3D modeling can be a valuable tool to enhance education and student learning in higher education. However, it is important to consider the challenges and key aspects for their effective implementation. By addressing these challenges and considering the key aspects, educational institutions can create virtual tours that improve education and student learning.

Keywords: 3D Animation; Interactivity; Polygonal Mesh; 3D Modeling; Rendering.

RESUMEN

La educación superior enfrenta desafíos para mejorar la experiencia de aprendizaje de los estudiantes y aumentar su comprensión y retención de información. Los recorridos virtuales con modelado en 3D se presentan como una herramienta innovadora para abordar estos desafíos. El objetivo de este artículo es examinar el papel de los recorridos virtuales con modelado en 3D en la educación superior, destacar sus ventajas, desafíos y aspectos clave para su implementación efectiva. Para implementar recorridos virtuales con modelado en 3D de manera efectiva, es importante considerar varios aspectos clave. En primer lugar, la navegación debe ser fluida y fácil de usar para que permita a los estudiantes explorar y aprender de manera efectiva. En segundo lugar, la información relevante debe ser integrada de manera efectiva en el recorrido virtual, para que los estudiantes puedan acceder a la información que necesitan. Finalmente, la interactividad es clave para el éxito de un recorrido virtual ya que permite a los estudiantes interactuar con el entorno y aprender de manera activa. Los recorridos virtuales con modelado en 3D pueden ser una herramienta valiosa para mejorar la educación y el aprendizaje de los estudiantes en la educación superior. Sin embargo, es importante considerar los desafíos y aspectos clave para su implementación efectiva. Al abordar estos desafíos y considerar los aspectos clave, las instituciones educativas pueden crear recorridos virtuales que mejoren la educación y el aprendizaje de los estudiantes.

Palabras clave: Animación 3D; Interactividad; Malla Poligonal; Modelado 3D; Renderizado.

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INTRODUCTION

3D modeling is a fundamental tool in graphic design as it opens up new perspectives and possibilities in creating virtual environments and visual communication.[1,2] In today's increasingly digital age, three-dimensional models have transformed how concepts are conceived and expressed. This new conception favors and encourages a new representation of objects and scenarios with unprecedented realism and detail.[3]

In this scenario, virtual tours emerge as an essential application of 3D modeling, offering the opportunity to explore environments in an immersive and dynamic way. These tours not only facilitate the visualization of architectural and urban spaces but also open up new frontiers in fields as diverse as education, entertainment, and the simulation of complex situations.[4]

Visual communication also benefits enormously from the capabilities of 3D modeling, enabling the creation of impactful and effective visual representations. In product design, advertising, and data visualization, the ability to generate accurate and engaging three-dimensional images plays a crucial role in effectively transmitting information and emotions.[5]

Virtual tours, in particular, play a significant role in higher education by allowing students and academics to explore educational environments. These virtual experiences enable students to immerse themselves in environments beyond physical limitations, facilitating understanding complex concepts and fostering interactive and meaningful learning.[6]

Therefore, this article delves into the various applications and perspectives of 3D modeling from graphic design by analyzing how this technology influences the perception and sharing of the surrounding visual environment. From technical advances to artistic and communicative implications, this research aims to examine the impact of this tool on the creation of virtual tours and contemporary visual communication. In addition, a virtual tour program of the FHP Headquarters of the National Unified Corporation for Higher Education (CUN) is presented, which illustrates practically the possibilities and relevance of these technologies in the educational and communicative fields.

METHOD

The present study was developed using a mixed approach consisting of two consecutive stages to comprehensively cover the Impact of virtual tours with 3D modeling in higher education. This methodological structure allowed for a systematic and detailed approach to the research and guaranteed an in-depth understanding of the advantages and challenges associated with implementing virtual tours in educational environments. The division into stages made it possible to separate the theoretical review from the practical application, which facilitated identifying the opportunities and limitations of this technology in higher education.

Stage 1: Documentary Review

The first stage consisted of an exhaustive documentary review aimed at exploring and analyzing the main advantages and implications of virtual tours with 3D modeling in the context of higher education.[7,8] Previous research, scientific articles, technical reports, and other relevant sources were examined to identify the trends, benefits, and challenges associated with integrating this technology into educational environments.

Search for Sources

Extensive searches were conducted in academic and scientific databases, such as Scopus, Web of Science, and Google Scholar, using relevant keywords such as "virtual tours," "3D modeling," "higher education," "online learning," and "educational innovation." Scientific articles, technical reports, doctoral theses, and other relevant documents published in the last 10 years were included.

Selection Criteria

Strict selection criteria were established to ensure that only high-quality and relevant documents were included. The following criteria were considered:

- Relevance of the topic: documents were selected that directly addressed the topic of virtual tours with 3D modeling in higher education.
- Research quality: priority was given to documents presenting original research with clear and well-founded methods and results.
- Impact and relevance: we selected documents that significantly impacted the field and were relevant to current research.

Analysis of the Evidence

The evidence was analyzed to identify patterns, trends, and conclusions about 3D-modeling virtual tours in higher education. The following aspects were examined:

- Advantages and challenges: the advantages and challenges associated with implementing 3D-modeling virtual tours in higher education were identified.
- Impact on learning: studies examining the Impact of virtual tours on student learning, such as understanding complex concepts and retaining information, were analyzed.
- Design and development: we examined approaches and strategies for designing and developing effective virtual tours, such as navigation, interactivity, and integration of relevant information.

This review allowed us to identify the key aspects that influence the effectiveness of virtual tours in higher education. In addition,

we analyzed previous studies that have addressed the implementation of virtual tours in different educational contexts. This allowed us to identify best practices and common mistakes to avoid when designing and developing this tool.

Stage 2: Development of the Virtual Tour

In the second stage, we proceeded with the practical development of the virtual tour for the FHP Headquarters of the National Unified Corporation for Higher Education (CUN).

Tools and Techniques

3D modeling tools and specialized software were used to create a detailed and realistic virtual environment that would allow users to explore the educational center in an immersive way. This made it possible to recreate the architecture and Design of the center accurately with details such as the texture of the materials, the lighting, and the ambient sounds.

Design and User Experience

Aspects such as fluid navigation, integrating relevant information, and user experience were considered to guarantee an educational and enriching virtual tour. An intuitive and accessible user interface was designed, allowing users to easily navigate the virtual environment and access additional information about the venue and its facilities.

Objectives and Achievements

The objective of this stage was to create a virtual tour that was attractive, entertaining, educational, and enriching. A virtual environment was created that allows users to explore and learn interactively, which is expected to impact the students' learning experience positively.

RESULTS

Stage 1: Document Review

Higher education is facing increasingly complex challenges, such as the need to improve the learning experience for students and increase their understanding and retention of information. In this sense, virtual tours with 3D modeling are presented as an innovative tool to address these challenges. The literature suggests that virtual tours with 3D modeling can improve students' learning experience, increasing their motivation and commitment to learning.[9,10]

Furthermore, virtual tours with 3D modeling can help students understand complex concepts more effectively, allowing for detailed exploration and visualization.[11] These virtual tours also offer accessibility and flexibility for students to access educational environments that might otherwise be inaccessible and offer flexibility in terms of time and place of learning.[12]

Improved Accessibility

Virtual tours allow people from all over the world to visit the university regardless of their geographical location. This is especially useful for international students, people with reduced mobility, and those who cannot physically see the campus for various reasons. Virtual tours democratize access to information and the university experience while allowing more people to consider and experience the educational offer of an institution without geographical barriers.[13,14]

Promotion and Marketing

A well-designed virtual tour can be a powerful promotional tool for the university and attract potential students, professors, and researchers. It provides an attractive preview of the facilities and resources available, which can be decisive in the decision-making of future students. Universities can use these tours in digital marketing campaigns to increase their reach and visibility.[15,16]

Detailed Exploration

Virtual tours can offer a detailed and comprehensive campus experience, allowing visitors to explore buildings, classrooms, laboratories, libraries, and other essential facilities in great detail. This thorough exploration is helpful for prospective students and their families, researchers, and collaborators who want to learn about the university's capabilities.[17,18]

Time and Cost Savings

It eliminates the need to physically travel to campus, saving time and money for both visitors and the university. This can be especially beneficial for those considering various university options and wishing to explore different campuses. It also allows potential students to efficiently evaluate multiple institutions by directly comparing facilities and resources from the comfort of their homes.[19,20]

Incorporation of New Technologies

Implementing virtual tours is a testament to a university's commitment to innovation and the adoption of new techniques. This integration not only improves the experience of current users but also demonstrates to future students that the institution is at the forefront of educational technology. Augmented reality (AR) and virtual reality (VR) can be incorporated, providing an even more immersive and advanced experience.[21,22]

Stage 2: Development of the Virtual Tour at the FHP Headquarters of the CUN

Virtual Reality (VR) and Augmented Reality (AR) Technology

Exploring the basic concepts of VR and AR technology, including how they work and how they are applied in creating 3D virtual tours, allows for creating immersive virtual environments that enhance the user experience. VR and AR can highlight specific aspects of the campus, such as advanced research laboratories or sports facilities, offering a deeper and more specific insight into what the university has to offer.[23,24]

User Experience (UX)

Examining the UX design principles in creating virtual 3D tours guarantees users an immersive and satisfying experience. Good UX design is crucial to keeping users engaged and providing intuitive navigation. The interface should be user-friendly and accessible so users can explore the campus efficiently and enjoyably.[25,26]

Digital Marketing and Educational Promotion

Virtual tours have become an effective digital marketing tool for promoting educational institutions, attracting potential students, and highlighting their facilities and academic programs. This tool can be integrated into websites, social networks, and email campaigns.[27,28]

Accessibility and Democratization of Education

Examining how these tours can contribute to the accessibility and democratization of education allows people from different parts of the world and with diverse physical limitations to explore the campus virtually. This is particularly important for promoting inclusion and equity in access to higher education.[29,30]

Technical and Methodological Process

The development of virtual tours has become an essential tool for presenting architectural, educational, and recreational spaces. This process involves a meticulous combination of 3D modeling, texturing, lighting, and rendering techniques to create immersive and compelling experiences. In this context, precision in modeling and attention to detail is imperative to guarantee the authenticity and credibility of the virtual environment.

Virtual tour production process

Modeling in 3ds Max

3ds Max is the leading software used for modeling the facilities and structures of the university campus (figure 1). This software allows for accurate and detailed representation of the buildings, classrooms, laboratories, and other relevant areas. The precision in the modeling ensures that users have a reliable representation of the campus, which is crucial for the credibility of the virtual tour.

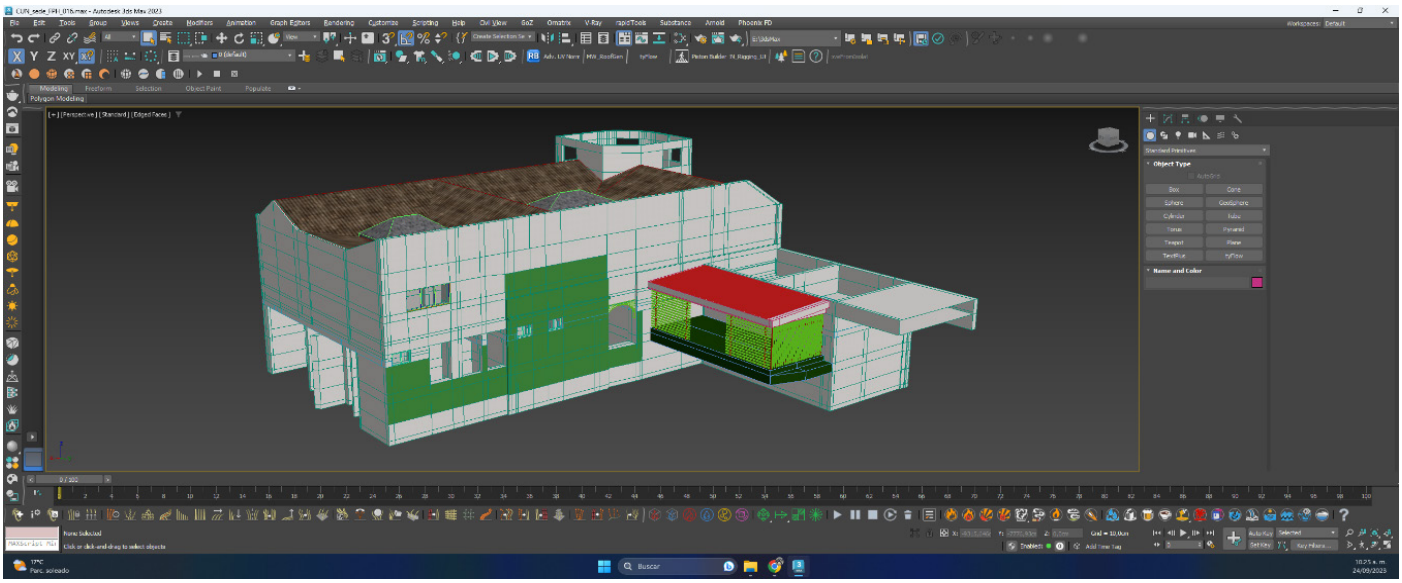


Figure 1. First initial 3D model of the basic block, made in 3ds Max

Mapping and Texturing

UV mapping and texturing techniques in 3ds Max apply realistic textures to 3D models (figure 2). Programs such as Photoshop, Quixel, and Substance Painter create and edit the necessary textures, ensuring a high level of detail and visual quality. This process guarantees that the materials and finishes of the buildings look authentic, which contributes to a better immersive experience for the user.

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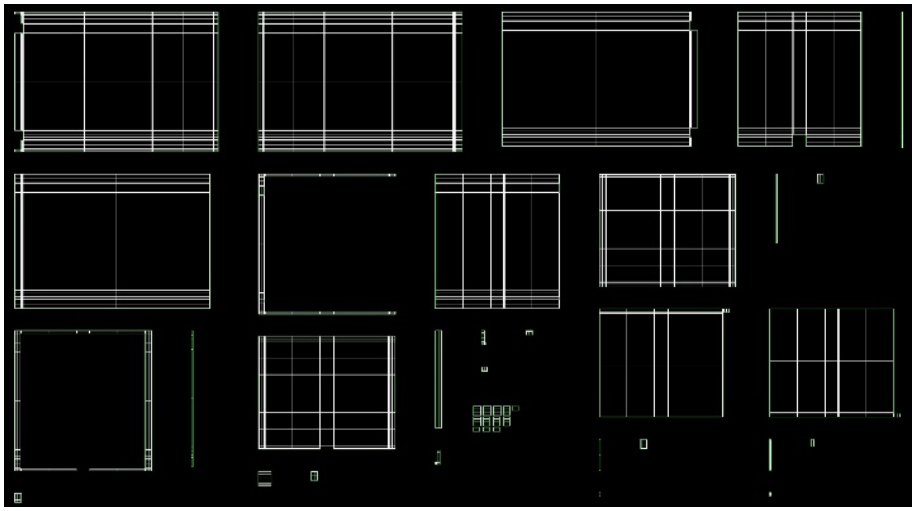


Figure 2. Mapping process in Unwrap to prepare textures in Substance

Lighting and Rendering

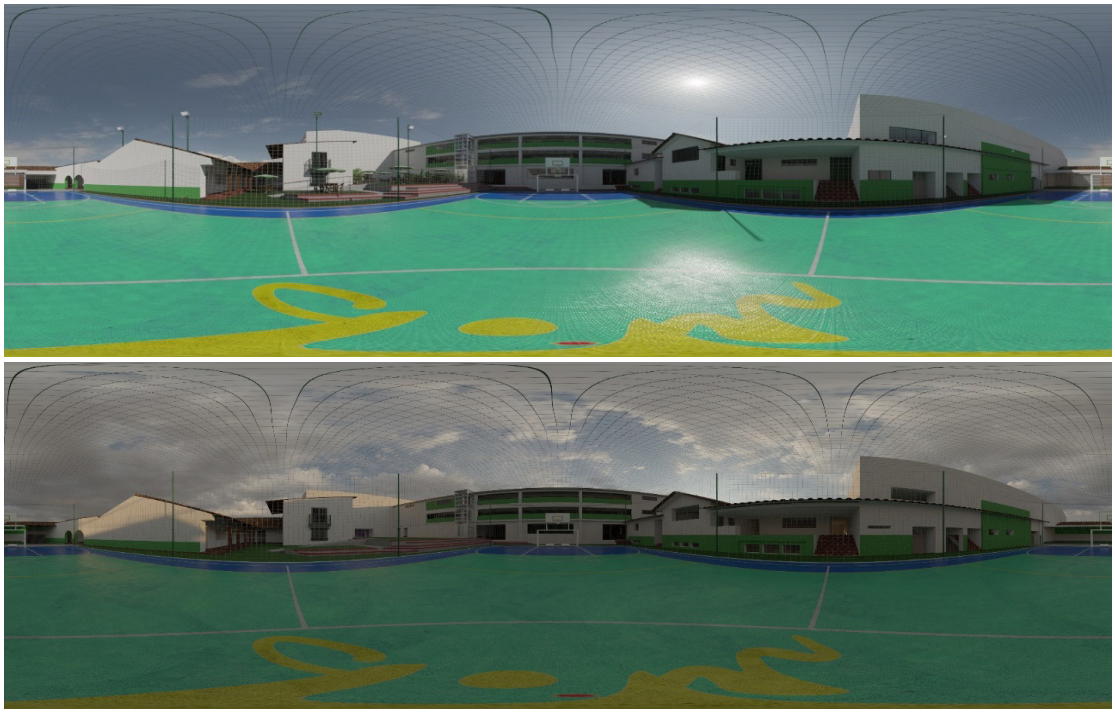


Figure 3. Lighting process using HDRI images to speed up the lighting processes

Lighting plays a fundamental role in creating a realistic atmosphere in the virtual tour. Global illumination (GI) techniques and natural and artificial lights simulate natural light conditions and highlight important features of the campus, such as study areas, recreation areas, or points of architectural interest (figure 3). High-quality rendering ensures that details and textures are accurately represented, creating visually striking images that attract and captivate users.

Interactivity and User Experience

Interactivity is key to an immersive and satisfying user experience on a virtual tour. Intuitive navigation controls are implemented to allow users to explore the campus at their own pace and direction. In addition, interactive elements such as embedded videos, pop-up information, and links to additional resources can be included to enrich the user experience and provide further details on the university's facilities and programs.

Integration of Emerging Technologies

Explore how emerging technologies, such as augmented reality (AR) and virtual reality (VR), can enhance and expand the capabilities of 3D tours. AR can overlay contextual information about the campus in real-time. At the same time, VR offers an entirely immersive experience that transports users to a realistic virtual environment, provides new ways of interacting with the campus, and offers innovative opportunities for promotion and education.

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Topology Analysis with Google Earth

Google Earth is used to study the topology of the area where the FHP headquarters of CUN University is located (figure 4). This allows for a better understanding of the terrain's characteristics, including inclination and elevation variations, which favors an accurate representation of the surrounding environment. This analysis is vital to coherently integrate the university campus with its urban environment.

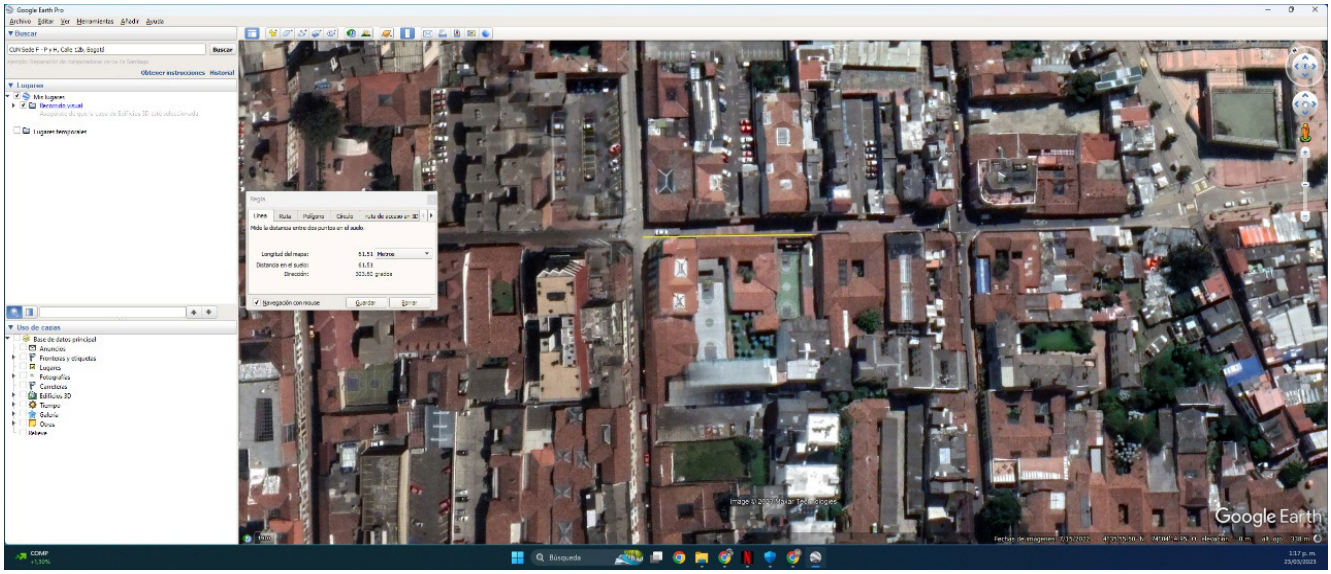


Figure 4. Use of Google Earth for geolocation and measurement of the slope of the land

Compatibility with Virtual Reality Glasses

To provide an immersive virtual reality experience, Steam software was used in conjunction with HTC Vive glasses (figure 5). In addition, an HTML file was created using Panotour that allows access to the virtual tour both locally and via the internet, allowing users to explore the campus from anywhere, anytime.



Figure 5. Panoramic image of headquarters H, edited for use in the virtual reality program

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Hosting Service and Responsive Website

The online presentation is hosted on a service to ensure its accessibility and availability. In addition, a responsive website was designed to adapt to any device and make the virtual tour accessible to a broad audience.

Evaluation and Feedback

Finally, it is essential to evaluate and gather feedback on the virtual tour once it is complete. Usability tests can be carried out with real users to identify improvement areas and ensure optimal user experience. User feedback can also help identify virtual tour highlights and areas requiring more attention or development. This continuous evaluation ensures that the virtual tour meets the established objectives and satisfies the needs of the end users.[31,32]

DISCUSSION

This study offers a detailed look at how VR can influence potential students' perceptions and decisions when exploring a university campus virtually. By examining the experiences of participants who used VR as part of their tour, the article reveals the possibilities and practical implications of this emerging technology in the educational field.

Implementing virtual tours with 3D modeling in higher education can significantly impact the way students learn and interact with academic material.[33,34] However, it is important to consider the challenges and limitations associated with this technology, as well as the key aspects of designing and developing effective virtual tours.

Integrating advanced technologies such as 3D modeling and virtual tours into the educational environment not only improves accessibility and university promotion but also redefines the user experience and facilitates a deeper understanding of real spaces.[35,36] The FHP headquarters project of the CUN Corporation demonstrates how these tools can be used effectively to create an immersive and detailed experience that will benefit both the institution and its potential students.

Advantages and disadvantages

One of the most significant advantages of virtual tours with 3D modeling is their ability to enhance the learning experience for students. Virtual tours can increase students' understanding and retention of information by allowing for detailed exploration and visualization of concepts.[37,38] In addition, the accessibility and flexibility of virtual tours can be beneficial for students with disabilities or those who do not have access to traditional educational environments.[39,40]

However, there are also disadvantages associated with implementing virtual tours with 3D modeling. For example, creating these tours may require specialized technical skills and resources, which can be an obstacle for educational institutions with limited resources.[41,42] Furthermore, creating virtual tours can be expensive and impedes educational institutions with limited budgets.[43,44]

Key aspects for design and development

To design and develop effective virtual tours, it is essential to consider several key aspects. First, navigation must be intuitive and easy to use.[45,46] Second, relevant information must be effectively integrated into the virtual tour so students can access the necessary information.[47,48] Finally, interactivity is key to the success of a virtual tour; students must be able to interact with the environment and learn actively.[49,50]

Implications for higher education

Implementing virtual tours with 3D modeling can have significant implications for higher education. For example, it can allow for greater flexibility and accessibility in education, which can benefit students who do not have access to traditional educational environments. In addition, virtual tours can allow for greater personalization of learning, which can help students with individual needs.

Limitations

During the design and modeling process, a virus infected the project's base file, causing the loss of textures and the generation of ghost models. This resulted in an increase in file size and poor computer performance. To address this problem, several solutions were implemented, such as backup systems and the search for specific technical solutions provided by Autodesk.

CONCLUSIONS

Virtual tours with 3D modeling can be a valuable tool for enhancing students' learning experience in higher education. However, it is essential to consider the challenges and limitations associated with implementing this technology and the key aspects of designing and developing effective virtual tours. Educational institutions can create virtual tours that improve education and student learning by addressing these challenges and thinking about the key elements. Integrating advanced technologies such as 3D modeling and virtual tours into the academic environment not only improves accessibility and university promotion but also redefines the user experience and facilitates a deeper understanding of real spaces.

FINANCING

None.

CONFLICT OF INTEREST

None.

AUTHORSHIP CONTRIBUTION

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Validation: Miguel Angel Ordoñez Guar.
Visualization: Miguel Angel Ordoñez Guar.
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