

THE USE OF VR TECHNOLOGY TO ENHANCE MUSEUM VISITS: A CASE
STUDY FOR TAXILA MUSEUM IN PAKISTAN



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PLAGIARISM

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ÖZET

Sanal gerçeklik, bir kişinin simüle edilmiş bir ortamla etkileşime girmesini sağlayan ve sanal dünyayla çevrili bir teknolojidir. Bu ortam, bilgisayar donanımı ve yazılımından oluşur. VR, bir kullanıcının gerçek ve simüle edilmiş bir dünyada var olduğunu düşündüğü ve keşfettiği üç boyutlu videolar ve görüntüler içerir. Sanal gerçeklik teknolojisi ezici bir şekilde gelişmiştir ve dünya genelinde popülaritesi giderek artmaktadır. Böylece sanal gerçeklik teknolojileri müze sektöründe de yerini almıştır. Dünya çapında miraslarını ve koleksiyonlarını sergilemek için VR teknolojisini kullanan birçok müze var. Artık bilgi ve sanata erişim çok kolay ve izleyiciler için erişilebilir hale geldi. Sanal Gerçeklik teknolojisi, müzelere alan eksikliğinin veya ziyaretçinin sergilerle etkileşiminin üstesinden gelmek gibi bir dizi avantaj sağlar. VR, kullanıcıların sanatsal simülasyonların sanal deneyiminde daha aktif olmalarını sağlar. Bu araştırma, Pakistan'daki Taxila müzesinin Budist kültürünün kimliğini ve mirasını Sanal Gerçeklik (VR) teknolojisi aracılığıyla keşfetmek amacıyla yapılmıştır. Taxila, çok zengin bir Hinduizm ve Budizm tarihine sahiptir. Kültür ve mirasını korumada da oldukça öne çıkıyor. Bu araştırma, özellikle gençlerin Taxila müzesini aktif olarak ziyaret etmeleri için VR teknolojisinin ziyaretçiler için ne kadar yararlı olabileceğini göstermektedir. Bu tez, Taxila Budizm Müzesi'nin gözlemlerini keşfetmeyi, gençlerin Taxila müzesine ziyaretlerini Sanal Gerçeklik (VR) teknolojisi aracılığıyla zenginleştirmeyi, mirasını korumayı ve bilgilerin içeriğini halka kolayca erişilebilir hale getirmeyi amaçlamaktadır. çekici yol. Bu araştırma tezi, verileri analiz eder ve kültür korumada VR kullanımına ilişkin mevcut örnekleri keşfeder. VR teknolojisinin benimsenmesi, insanlar tarafından daha iyi ezberlenen müzelere karşı ilgi çekici bir tutum da sağlıyor. Bu çalışma, duygusal ve yaratıcı bir deneyim yaşayan kişilerde güven duygusunun gelişmesine katkıda bulunmaktadır. Metodoloji kısmı ise 18-40 yaş aralığındaki turist ve ziyaretçilere sanal gerçeklik teknolojisi hakkında bilgi verilerek görüşmeler şeklinde gerçekleştirilmiştir. Mülakatların nihai amacı, sanal gerçeklik teknolojisinin müzelerde kullanımının değerlendirilmesi ve incelenmesi ve gelecekte ileri düzey sanal gerçeklik teknolojilerinin tasarlanması ve geliştirilmesi için öneriler ve fikirler sunmaktır. Katılımcılar, Taxila müzesinde VR teknolojisini kullanma fikri karşısında şaşkına döndüler ve olumlu geri bildirimde bulundular.

ABSTRACT

Virtual reality is a technology that enables a person to interact with a simulated environment and is surrounded by the virtual world. Such environment consists of the computer hardware and software. VR contains three dimensional videos and images that a user explores and considers itself as he or she is existing in a real and simulated world. Virtual reality technology is overwhelmingly advanced and becoming more frequent in its popularity throughout the world. Thus, the VR technologies have also taken place in the museum sector. There are many museums who are using VR technology to show their heritage and collections worldwide. Now the access to the knowledge and arts have become very easy and accessible to the viewers. Virtual Reality technology provides a number of advantages to the museums, like to overcome the lack of space or the visitor's interaction with the exhibits. VR allows the users to become more active in virtual experience of artistic simulations. This research is conducted in order to explore the identity and heritage of the Buddhist culture of the Taxila museum in Pakistan through Virtual Reality (VR) technology. Taxila has a very rich history of Hinduism and Buddhism. It is also very prominent in preserving its culture and heritage. This research demonstrates how much VR technology can be beneficial for visitors especially youth to actively visit the Taxila museum. This thesis aims to discover the observations of the Taxila Museum of Buddhism to enhance the visit of the youth to the Taxila museum through Virtual Reality (VR) technology to preserve its heritage and to make the content of the information easily accessible to the public in an attractive way. This research thesis analyzes the data and discovers the existing examples for the use of VR in culture preservation. The adoption of VR technology also provides an engaging attitude towards museums that is memorized by the people in a better way. This study contributes to developing the feeling of trust and confidence of people that have an emotional and imaginative experience. Whereas the methodology part outlined as interviews were conducted with tourists and visitors age group around 18-40 years, by giving them knowledge of virtual reality technology. The ultimate aim of having interviews is the evaluation and examination of using VR technology in the museums and to provide suggestions and ideas to design and develop advance VR technologies in the future. The participants were overwhelmed by the idea of using VR technology in the Taxila museum and gave positive feedback.

Keywords: Virtual Reality, Technology, Cultural Heritage, Museum, Virtual Museum, Buddhism



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1. INTRODUCTION:

With the rapid advancement in modern technologies, Virtual reality has emerged significantly in the recent years. The term virtual means imaginary or fictitious and VR refers to a simulated environment. Virtual reality technology is a fully computer-generated mechanism that provides a feeling of a real-world view. Importantly VR controls visual senses of the users and creates an immersive experience in a virtual environment that seems to be realistic. Virtual Reality is found in media technologies such as games and model building (Styliani et al. 2009).

VR technology is an emerging technology that has growth potential in future to come. Due to its inherent qualities, it has great demand in its applications in the fields of education, medicine, entertainment, leisure, media, tourism, marketing, and many more.

This technology plays a significant role in the performing arts that provides a technological medium to discover the theatrical experience in the form of imaginary worlds and audience engagement (Dixon, 2014).

VR is about visions in the form of computer graphics that plays with the mind and shows as person is in reality. It is about technology that convinces a person that he/she has switched to another world. While using this technology, the computer disappears and becomes completely invisible, the person becomes a ghost in the machine. The computer becomes completely invisible and only treats behind the scenes (Pimentel and Teixeira 1995)

If a tourist is interested to visit a place physically, prior to his visit he can get maximum information / details virtually remaining at a distance while using VR technology (Accenture, 2018; Kim & Hall, 2019).

Due to its integral qualities VR is becoming more significant in the museum context. It can offer an authentic experience to visitors in providing detailed information, education and entertainment. VR also helps the visitors to perceive the virtual images and to obtain information about the assembling. The British Museum, Museo del Prado, and Vatican City have also launched VR technology for visitors (BBC, 2016; South China Morning Post, 2015).

It is estimated that about 35% of European museums are using VR technology and creating 3D artworks (Salgado et al, 2005). The Museum of Celtic Heritage, The Archaeological Park Carnuntum, and Salzburg Haus der Natur museum in Austria,

the Mauritshuis, and The Rijksmuseum in the Netherlands, and the Museum of London of them are good examples of using VR technology. Museums would not be prevailing only to protect, display and conserve the artifacts, rather they should provide a medium to educate and entertain their visitors and tourists.

There have been some examples of VR technology implemented in museums such as multi-touch screens, Leap motion controllers, Head Mounted Displays or 3D displays. Museums are implementing VR technology by using different methods like multi-touch screens, Leap motion controllers, Head Mounted Displays or 3D displays. These applications are most dynamic and interactive options to get into the integrated environment. The technology has created interest, especially for the young generation who find these places boring and uninformative. Moreover, the reason is not only the museums' old conditions but also the technology itself, as it plays a very important role in the daily lives of young people. According to Prensky (2001), this generation is the native digital generation introduced at an early age to technology, and they have viewed it as a critical part of their daily life (Prensky, 2001).

“Frederick Brooks in 1986”, developed a device that has a sense of touch in VR by using motorized handgrips and contains magnets that help in controlling robotic arms. Such haptic technologies help to deliver sensory stimuli by using human interface devices.

According to the idea given by Frederick Brooks regarding VR technology, this thesis deliberates on introducing VR technology for museums containing handgrips to help visitors in their virtual tour. It is well known that VR technology is being actively adopted in cultural tourism due to its importance and characteristics to achieve its value and goals of providing tourists with the best and most exclusive experience (Bruno, De Sensi & Luchi, 2010).

Accordingly, this thesis aims to provide the latest and advanced technology of VR to the Taxila Museum (Pakistan) to boost the tourism. VR technology is considered to be helpful to achieve a mass audience and eliminate the gap that exists between visitors and museums.

In the first part of this thesis, Virtual Reality technology and its history is discussed along with applications of VR Technology. Second part comprises importance of Virtual Reality in Museums and comparison between virtual and real museums with interactive 3D galleries. In the third part, the history of Taxila along

with the Buddhism culture in Pakistan is discussed. It also confers about different Buddhist and archeological sites in Taxila. The fourth part of the thesis is about the research methodology and the results of the research conducted in the Taxila Museum.

The research is firstly based on the data that is collected about Virtual Reality technology, history, and the effects of digital communication within the museum using VR technology along with the introduction of Taxila Museum and the Buddhism culture and its history whereas the methodology part focuses on the experimental research design.

To make it more realistic, experiment was performed within the Taxila Museum with tourists and visitors aged between 18-40 years. The experiment conducted forming two groups, treatment group and control group. Participants of both groups were asked to fill up a questionnaire having same set of questions just to judge their experience during their visit to the museum.

Data was collected, analyzed, and results have been compared to determine whether Virtual Reality technology is useful in gaining tourist / visitors attraction for museums especially for Taxila Museum.

2. VIRTUAL REALITY

2.1 Virtual Reality definition:

In virtual reality, the term “virtual” is defined as the quality of being essence or effect not in fact (*Hypertext Webster Gateway: Webster’s Revised Dictionary* 1913). The term virtual reality is derived from the medieval philosophical word “virtual”, which means strength and power.

Virtual reality expression was first used by Jaron Lanier in 1986. In the middle of it, many synonyms were formed, and the very concept of virtual reality evolved. Engineers use the term “virtual” more often when they efficiently substitute computers and peripheral devices in place of human senses. In this case, virtual reality can be called a computer-simulation of natural senses.

Virtual reality is an advanced technology that satisfies the participants that they are present in another place by substituting the primary sensory input with data received produced by a computer (Heim, 1998).

Virtual reality is an electronic simulation of environments that is being experienced via head-mounted eye goggles and wired clothing aiding the end user to intermingle in realistic three-dimensional situations (Steuer, 1995, p. 35).

Virtual reality is more like a cultural construct rather than a technological construct. Virtual reality is not seen as a technology but it is more like an experience. Moreover, it is an imaginative experience rather than a sensory experience. As a technological component, users accept it as a simulated world for social response (Reid, 1995).

Virtual reality resembles actual reality. It also induces the user's actions without interference with the existing reality. The experiences of virtual reality are different from the physical environment. It just provides sensory experiences.

2.2 Virtual Reality Technology:

Virtual reality technology includes the history of virtual reality and its applications in various fields of technology.

2.2.1 History of virtual reality

The notion of virtual reality has been around for years, but the term virtual reality was first introduced by Jaron Lanier in the late 1980s. Due to VR technology, images worlds, and stories became reality in the form of literature, art, and mainly digital media. Nowadays it is impossible to imagine the profession of interior designer, architect, or plan to work without a graphics workstation. Each medium has its limitations and constraints to how the vision of reality can be contemplated, and it has appeared that humans are in a continuous struggle to search for a medium more realistic and more immersive than before. Virtual reality is a name for absorbing and interacting with a computer-generated environment. Some people also see one another through this synthetic environment. If we talk about art, the first person was Myron Krueger to talk about VR. In early 1970, Krueger build a gallery of two-dimensional computer-engendered atmosphere. Virtual Reality is a term for computing that has the main objective of generating a virtual world. Also, by interacting with the virtual world using specific devices to stimulate the environment by making it feel real as possible (Barfield, 1995).

The idea of VR has come from the inner motivation to get the Ultimate Display, as said by Ivan Sutherland (Biocca, et al, 1995). Such an invention stimulates in a way that looks like everything is real.

The efforts of Michael Noll of Bell Labs and the Dean of the Annenberg School for Communication in LA (Los Angeles) are also very significant. Branded as technical, he also created many influences on computer art, some of which should be included in any virtual reality story. He also invented various devices for stereo viewing, telepresence viewing, 3D drawing, and tangible communication, which strongly encouraged to use of technology to redefine the arts. He also created a 3D graphics system to visualize the dance. Today Virtual Reality is more than technology as it is a culture that defines technology.

The use of this technology is decided solely based on artistic and technical criteria, whether it can be used for artistic expression or practical application. Virtual reality has changed the way of thinking.

“It is a fact that the relationship between humans and machines has ceased to be purely technical and had entered into the ancient realm of theatre” (Laure, 1991).

Jonathan Steuer, the founder of Cyborganic media stated in 1992 in his article in “Journal of Communication” that technology was not used as much in the VR experience. According to Steuer, the definition of VR is a stimulated and real environment in which a perceiver experiences telepresence. He defined telepresence as an arbitrated environment. To go further with Steuer’s definition of VR, it has some essential qualities like interaction, immersion, and simulation. The word simulation is used for computer technology to create a visual, auditory, and artificial tactile world. Immersion according to Steuer means vividness which includes the senses with the integrated and artificial world. Lastly, interaction consents the users to operate in the auditory world. Interaction is expedited with the help of computer programming that helps to navigate into the virtual space and it also provides a medium of communication with the other person who is sharing the same virtual space.

In the age of post-modernization, the concept of reality and have philosophical and concrete implications for those who are involved in the virtual and artificial

illustration of reality. Virtual reality is insufficiently stimulating throughout the world. According to Brenda Laurel, “Reality has been always too trivial for the human imagination. We are always trying to transcend (McCarthy, 1993)”.

People, in the beginning, have transcended time and space with their imaginations. Human imaginations have completely relied on artificial experiences. Michael Heim in 1991, has written the book “The Metaphysics of Cyberspace”, which depicts about Virtual Reality is changing the way people think and see themselves. It shows a beautiful concept and an opportunity to bring cultures together through a new super-medium of scientific analysis and aesthetic expression that propelled artists to push their ideas and technology to put forward to create virtual reality.

Modern VR devices have been helpful to people to capture their feeling in an alternate world. The sense of presence has become more reliable with technology advancements.

Figure 1 Stereoscope



Image source: <https://collection.sciencemuseum.org.uk/objects/co3642/reflecting-wheatstone-type-stereoscope-small-fold>

Charles Wheatstone in 1838, in his paper “Royal Society of London”, explained that the brain processes two-dimensional images from both eyes and converts them into a single object or three-dimensional object. With the help of this information, he used to create a mirror stereoscopic viewer that is shown in Figure 1. David Brewster in 1849, later developed Lenticular Stereoscope.

Figure 2 Flight Simulator

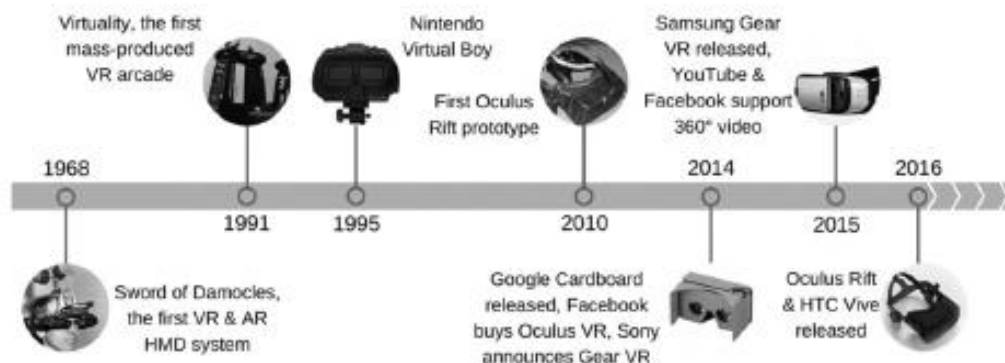


Image Source: <https://www.nasflmuseum.com/link-trainer.html>

In figure 2, it is perceived that it is a flight simulator. In 1929, Edwin Link developed a fuselage for plane movement, cockpit inclusion, and realistic dangers during air travel. These mentioned simulators became the subject of pilot training during World War 2 and were used by all armed forces and fighting nations. It was estimated that more than 500,000 US pilots got the training from this simulator (J.M. Moshell, 1993).

This is an example of VR technology in a flight simulator that can also be used for the Museum visit virtual tour.

Figure 3 A milestone in the history of Virtual Reality



As it is explained above about the history of VR technology, it is seen in Figure 3 demonstrates various stages of Virtual Reality technology development in different years. It is seen that it starts from HMD (Head Mounted Display) systems that were made in 1968 to Oculus and VR goggles in 2016 (Geron, 2011).

2.2.2 Application of Virtual Reality Technology

Virtual Reality technology is used in various fields of computers. Although the entertainment industry remains interested in its applications in gaming and theatrical experiences. Even people can grasp the information that VR is a model made by some architects of their building plans so that people can walk through it to understand it before the foundation is laid. Clients can also have a look around to see the interior and can also suggest the design.

Several car companies are using VR technologies in the form of virtual prototypes that are used for testing before making the actual part. In this way, the development process becomes very easy and less expensive.

Below it discusses extensively the applications in which VR technology is being used (S.N. Trika, 1996).

2.2.3 Head-Mounted Display:

Head-mounted display or HMD was invented by Ivan Sutherland in 1968. They are considered to be the most famous and instantaneously recognizable objects that are associated with Virtual Reality. It is also known as ‘Virtual Reality Headsets’. HMDs are attached to the head, covered the eyes, and show visual images. 3D visions can be seen and the virtual camera is moved according to the movement of the head.

The purpose of HMD is that they have been used in military and medical training (D. J. Sturman. et al,1994). The HMD can be seen in figure 4 below.

Figure 4 Head-Mounted Display(HMD)



Now it is seen that like HMD, VR glasses are used for Museum visits that are seen virtually to enhance the visit of tourists.

2.2.4 The Power Glove:

In 1982, Thomas G. Zimmerman manufactured gloves used as a flexible optical sensor and innovative technology for ultrasonic and magnetic hand positioning. It is also used for finger-tracking movements (D. J. Sturman. et al, 1994).

Figure 5 Power Glove



Image source: <https://www.microsoft.com/buxtoncollection/detail.aspx?id=20>

The technology of Power Glove can be seen used in museums as well with the help of VR glasses. These gloves can sense the movement of fingers where the user will move.

2.2.5 CAVE:

CAVE stands for CAVE Computerized Automatic Virtual Environment. It was first developed in the Electronic Visualization Laboratory at the University of Chicago. It can say that CAVE is mainly a virtual reality room that has a projector that covers all the walls of the room with stereoscopic visuals which can be seen with the help of glasses. Speakers are also placed inside the room sounds (C. Cruz-Neira et al, 1992). The image for CAVE in figure 6 can be seen below.

Figure 6 CAVE



The idea of CAVE can also be used for the museum's virtual visit. The stereoscopic visuals of the Museum's artifacts can be seen within a CAVE.

2.2.6 Education:

Virtual reality has a great impact on education. The way of learning has completely shifted from printed symbols in textbooks to augmented simulations. Texts have been changed to fictionally based symbols. It is the potential of Virtual reality technology to modify education and learning experimentation. People grasp images and symbols more quickly than numbers or lines. Larry Smarr, at the University of Illinois, described that “The brain system is very advanced because when we look at the world we can absorb a lot of information per second, like the text

of thousands of copies of a magazine. But in the mental condition of computer text, we can read only a hundred bites of information per second” (Dede, C. et al, 1996).

With the help of VR technology, it is easier to interpret symbols, images, colors, sounds, etc. in a society of cyberspace. There have been interesting phenomena linked with Virtual Reality Technology in a learning system for students. We can talk about the use of VR (Virtual Reality) in the classroom inspired by students to work independently from teachers. Students found it very easy to learn with virtual worlds and work together to explore the capabilities of the system and to build worlds. Virtual reality technology helps to affluence the use of the equipment and the imagination of students and also improve their skills that are involved in the task of world-building. The second advantage is that; the students not only enjoy using this knowledge but also build their virtual worlds (Dede, et al, 1996).

2.2.7 Entertainment:

For the last few years, VR has been more advanced in the computer industry. The devices like data gloves and HMD are a part of this technology. Today, we can see that VR technology is being used for gaming and entertainment purposes as well. It consists of computer-generated images. It has an extreme impact on the entertainment area in the form of TV and films. Leading organizations such as Google and Facebook are investing billions in Virtual Reality technology (Zyda, 2005).

Figure 7 SPARKED



Figure 7 shows the largest live performance of Cirque de Soleil, in collaboration with Zurich. It was known as a live drone show which is called ‘SPARKED: It is a live interaction between Humans and Quadcopters’ in the year

2014. This figure shows an entertainer standing in the middle of flying drones that are designed in the form of lamps (Tim Spears, 2014).

2.3 Virtual reality's importance in museums

The main purpose of Virtual Museums and exhibitions is to overawed the restrictions of physical space and to deliver a unique experience to visitors remotely. Virtual museum technology is a key to providing teaching and learning of rich history, culture, and architectural value and to enhancing the actual visit to the museum.

Due to several types of research, it is considered that the value of museums should be protected by authenticity, which is considered to be the heart of a museum's worth and its value that is illustrious from the others (Count, 2009). On the contrary, some researchers have claimed the importance of Authenticity with inauthenticity, because fake practice is also part of the knowledge in museums today (Halls, 2007; Hede & Thyne, 2010). Authenticity can be obtained through the advancement in information technology and due to this technology, visitors can explore, discover and appreciate the museum visit, overcoming the barriers of time, space, and language (Chung, et al, 2018).

The book 'new museology' by Peter Vergo, published in 1989, is considered to be a prototype of museums from exhibiting in simplicity to a precious collection to grab visitors' attention. The term 'museology' means the study of museums. In this book, the author has discussed the museums of Scotland, Wales, and England, their activities, and what role they play in order to display their things merely in history. New Museology mainly focuses on enhancing the visitor's visit to the museums (Vergo, 1989).

In recent years, several studies have recognized the importance of virtual reality technology as a tool that complements museum visits and cultural heritage experiences. Southalle et al. (2019) found that virtual reality offers an opportunity for modified and couture heritage skills. In addition, Han et al. (2019) found that virtual reality is also a source of insightful learning experiences from a cultural heritage perspective. Given the importance of learning and education in the context of museum visits, virtual reality is accepted as a valuable tool for museum experiences.

2.3.1 Experience design for virtual museums

"Experience" is defined as gaining direct knowledge of events or concepts through the perception of consciousness and feelings. This type of knowledge can be gained through interaction and observation. It is said that experience does not have the same value for all people because each person gathers their data through observations in an environment. The experience can be demonstrated to learn and gain knowledge and skills. The development of digital technology has opened up some areas of life and social encounters, "increasing" the experience of the contemporary world, but also encompassing knowledge and interaction with dimensions in space and time on the Internet using social networks, playing a game, performing actions in a 3D virtual environment, participate in a site-specific multimedia installation, etc. People nowadays are intensely involved in the digital world in a modern way. The influence on our culture, inclinations, and behaviors is massive (Harte R, Glynn L, 2010).

Talking about the experience in virtual museums is as like navigating through the website. It includes interaction and visualization through web pages. The 3D virtual reality technology makes it much easier to perceive and understand by the users. VR technology is user-friendly and the interface is well-known. Navigation of a virtual museum is very simple as the user can switch between different pages of the web by clicking on the webpages links Input devices are also used for controlling the navigation process through the virtual tour (Harte R, Glynn L, 2010).

2.3.2 Hybridization between virtual and real museums

According to ICOM (International Council of Museums) 2007, it is defined as "a museum is a non-profit and enduring organization in a culture and development open to the public, which conquers, preserves, studies, unites and affirms the perceptible and imperceptible heritage of mankind and its surroundings for education, study, and entertainment". The virtual elaboration of cultural heritage has as its ultimate goal the multiplication of its communicative possibilities and the ability of the user public to better understand the cultural heritage that it transmits. Virtual information through virtual reality technology, therefore, recapitalizes and its physical consistency spreads and propagates the message they convey through digital technology. Digital technology thus facilitates the visitor's mental perception and imagination process, making it legible and recognizable, and things can be easily identified (ICOM Italia, September 2019).

Digital technologies in virtual reality also offer many new opportunities for caregivers and the public, through the formation and experimentation of fusion assortments, the assimilation of physical objects with digital ones, and also the use of virtual and mixed reality strategies and storytelling for communication purposes.

In a hybrid museum, it is digital knowledge that has different constraints and challenges. The digital installations are harmonized with physical one that includes the space of the museum. There is a screen and a projection in multimedia. For the public, interaction with these devices is a great experience.

Figure 8 Virtual Museum of Rome



Figure 8 illustrates a Virtual Museum in Tiber Valley, Rome in 2014, in the museum of Villa Giulia. It shows interaction in digital installation with only one user who is operating this system of virtual reality. This digital setup is made on a large scale to share it with other visitors also. A wide space is seen in the image around the system that is created for the visitors to stand and participate actively. Such kind of digital interaction arises the social and cultural values of visitors (Pietroni, 2019, p. 6).

2.3.3 Media Hybridization:

Media communication and creative arts are said to be affected by media hybridization. It is considered to be a vehicle for revolution and development. Also, Virtual reality, is not only used in games but also it's part of cinemas and augmented reality as well.

The purpose of media hybridization is to devise new methods of representation in museums. In the research findings, it is considered to be a very interesting field aiming at a deeper cultural mediation for the public, especially for the

young generation, which is usually rather unwilling to visit museums. At the end of the 1990s, due to the advancement of computer technology with better graphics capabilities, the development of virtual reality (VR) technological environments dedicated to cultural heritage has become a predominant challenge for researchers and a new major opportunity for cultural organizations. In these innovation phases, the purposes focused on the visualization, which includes 3D graphics of collected quality, and secondly, on the interaction with the virtual space, the possibility of consulting 3D models, and open content. Virtual reality has been called a digital environment that can involve the visitor in enriching the learning experience, categorically this three-dimensional space that follows personal curiosity and builds a modified path of inspiration and knowledge (Hassenzahl, M., Tractinsky, 2006, Volume 25, pp. 91–97).

Figure 9 Virtual Museum of Ancient Flaminia



In Figure 9, the Virtual Museum of Ancient Flaminia Italy can be seen using VR technology that was built in 2007-2008. In this, we can see that instead of a single user experience in a virtual reality environment, there are multiple users where players can interact with each other in a 3D virtual environment. Virtual multiplayer environments show the importance of communicating cultural heritage. Interaction within museums is considered to be very effective. Sometimes interacting with digital content becomes a barrier to the public or difficult to manage.

The museum environment is a major problem that designers of digital applications cannot ignore. Unlike games, which are highly stimulating and purposeful, museum audiences are heterogeneous and diverse, often middle-aged to older and unfamiliar with technology. Despite innovative features in form, language,

and interaction methods, creating a digital connection that everyone likes is not easy (Pietroni, et al, 2007).

2.3.4 Interactive 3D galleries

Interactive 3D galleries play an important role to attract visitors to museums. These galleries have been very productive to support the image of the museums. 3D galleries are also very helpful in web pages and users can browse these pages by clicking on the hyperlinks provided on the web pages.

Figure 10 Web-Based Interactive 3D Gallery



Source: P. Petridis, M. White, N. Mourkoussis, F.Liarokapis, M. Sifniotis, A. Basu and C. Gatzidis / *Exploring and Interacting with Virtual Museums*

Figure 10 shows the interactive 3D gallery in which the user interacts by dragging and dropping into this virtual gallery. This figure shows different textures and movies that are displayed on the sides of this web page. These objects can be dragged into the scene by the user in the virtual environment. This 3D gallery explains a virtual exhibition of museum artifacts present in a real gallery. This is a very easy way to interact with the virtual environment in which users simply have to walk into the room and interact with the virtual objects and retrieve information (Martin White, 2007).

2.3.5 Virtual Reality Touch Museum

Yuchen Zhao, in his experiment, made a Virtual Reality touch museum to show how traditional museums display their items and help to facilitate learning methods. This museum not only benefits from to display of the building but also invades the virtual space with its original environment. The experience of virtual and real worlds had a great impact on the user's minds to gain historical knowledge and to feel the shapes and textures of the objects (Y.-L. Chang, 166–178, 2015.)

Figure 11 VR touch museum



VR Touch Museum is a virtual museum that creates a sense of touch, as this can be seen in Figure 11. In this museum, a person can experience a sense of touch through the hands and feet by touching the floor materials and props. In this figure, it can also be seen that half of the space is sheltered with grass and half with the surface carpet. Two desks are also placed in front of the user. Desks contain copper sheets which when the user will touch them can feel the real props while looking at virtual props. Two different surfaces show that the grass area feels to be the outer area of the museum whereas the carpet area gives the feel of the exclusiveness of the museum. Users can touch the props that are present on the desks by seeing them in the virtual world.

2.3.6 Types of Virtual Museums:

Andre Malraux in 1947, gave the idea of a virtual museum. He put the idea of an imaginary museum, that has no walls and three-dimensional boundaries like a virtual museum. A virtual museum is the assembling of recorded images, text documents, and sound files or the cultural interest that is retrieved through electronic media (A. Malraux, et al, 1996).

The definition of virtual museum is also defined as a collection of digital images gathered in a variety of media, to provide easiness in its accessibility and connection. It brings exceeding traditional methods to communicate and interact with the visitors being resilient towards the needs and interests of the visitors. There is no existing place for the objects and the information that can be publicized all over the world (W. Schweibenz, et al, 1991, pp. 185–200).

Another definition of a virtual museum states that the Web can show digital images to an intranet by computer or to a CD-ROM as an extension of a museum. It can also be completely imaginative. It is a completely 3D remodeling of a physical museum. It can be a completely mythical and fictional environment in which different artifacts have been allocated (3D Van Gogh, Museum Virtual Tour).

According to the ICOM (International Council of Museums) organization, there are three types of virtual museums: the content museum, the brochure museum, and the learning museum. The brochure museum is used as a marketing tool for future visitors to provide basic information such as the calendar of events, location, and opening hours to create willingness and enthusiasm among the visitors (D. Bearman, J.,1998).

The content museum consists of a website, that provides all the information about the collections of the museum. The database consists of detailed information with the content presented about the museum and it is used in an object-oriented way. Whereas, in the learning museum, there is a website containing different access points for the visitors depending on their age, background, and knowledge. The information is provided in a context-oriented way. The website is also educationally upgraded and is linked to advance information in order to inspire and motivate the virtual visitors to understand and gain more knowledge and visit the site again. The main aim of the learning museum is to attract virtual visitors and to make a strong bond with the online collection of data (D. Bearman, J., 1998).

2.4 The rebellious power of AR and VR in the Museum

The divisive capacity of modern fact points to unexplored events in the afterlife and produces visionary events. AR and VR are considered in a traditional museum exhibition, which plays an important role in decorating the share of heritage and tradition, and contains components that sustain and create inventive experiences (Bekele et al., 2018; Fenu & Pittarello, 2018; Guttentag, 2010; Han et al., 2018; Hudson et al., 2019; Little et al., 2019; Schaper et al., 2018).

AR and VR regulate the interaction of site visitors in museums with the help of the use of growing artistic experiences, that is considered to be different technologically (Bae et al., 2020; Bekele et al., 2018; Buhalis et al., 2019; Guttentag, 2010; Lorenzo et al., 2020; Trunfio et al., 2020; Tussyadiah et al., 2018; Yung & Khoo-Lattimore, 2019).

Virtual reality is known for creating digital imagery with a 3D computer-generated environment that creates virtual worlds and museum content that helps immerse oneself in the cultural heritage of museum exhibits. Visitors interact with the virtual reality environment where they can experience a full 360-degree view. This leads to the provision of interactive information and various socialization illusions (Bekele et al., 2018; Kim et al., 2020; Lee et al., 2019; Trunfio et al., 2020). By using VR technology, they felt like they were present in the real world and sense the feeling of reality.

2.5 Experiencing virtual reality in the art museum of London:

In recent years, virtual reality reemergence has led this technology to be incorporated into art museums in the form of VR-based exhibits. A lot of studies are examining the impact of virtual reality technology on the social experience of art museums.

Eryn Parker and Michael Saker have written an article and searched “Art Museums and Incorporation of Virtual Reality: Examining the impact of VR on spatial and social norms”. They conducted research at Anise Gallery in London, UK, between June-July in 2018, and focused on VR technology. Their research shows how people alter their way of watching. Also, it explores the users' approach from the physical setting of the art museum to the digital space of VR. The art museum is a space that is dependent on social norms and can adapt and modify the essence of a

phenomenon. The norms of these spaces make social behavior anticipated and understandable (Barker and Wright, 1955; Falk and Dierking, 2016).

Eryn and Michael concluded in their research article about using VR technology in the art museum, that people became more active in watching. Participants were also experiencing as they were present in the physical environment. This practice for the participants was very thoughtful and they were thinking about how they might react to this digital space and also trying to visualize the digital environment overlapping the physical space of the museum.

Through VR technology, participants adopt a sense of 'being there' (Bailenson, 2018) that is felt very private. VR is considered to be a more satisfying experience for the participants. Also, VR has the potential to create a social relationship with art museums. However, visitors felt very comfortable using the VR technology and it is possible that social norms might develop in the physical space.

So it is concluded from the research of Eryn and Michael that VR technology plays an important role in attracting tourists and it had a great impact on the people's engagement towards the museum. Thus this is the power of VR to create a physical relationship with the museums. People also enjoyed using this technology in the museum.

2.6 VR theatre in Japan for Mayan Exhibition:

The exhibition of "Mayan Civilization" was held in Japan Ueno at the Science Museum. This VR theatre was held on a large scale between 18 March to 18 May in the year of 2003. The research was held by the French Association of computer graphics and the France Asia workshop in Virtual Reality.

In the exhibition held in Japan in 2003, VR images were displayed that were viewed by 120,000 visitors. This was the first time in Japan where VR technology was used in the exhibition to display the Copan ruins. The theatre consisted of large screens in which the VR images were displayed. There was a lot of graphic representation in the images. The significance of VR technology in a museum is its interactivity which makes a difference between VR and other technologies like television. In the VR theatre, there is a direct interaction between the audience and the VR images that are displayed on the screen. This technology proves that it is totally different from the regular game content. By using the PC controller, visitors freely move around the space in the VR environment and experience the tour of the ruins

interactively (Michitaka Hirose, Research Center for Advanced Science and Technology, 2005). Visitors enjoyed experiencing VR technology as in reality it is not possible for the visitors to see the buried shrines. It is not easy to define civilization and history and it can be only complete when there will be a spark in the culture of ancient people. So it is important to have VR technology for this purpose and people can move around everything and gain more information. This idea made visitors more attracted to the museum and appreciated the idea.

2.7 Virtual Museum of Sculpture (VMS) in Italy:

M. Carrozzino and M. Bergamasco are the researchers who made research using Virtual reality technology in the museum of sculpture and also states in the 'Journal of Cultural Heritage 11' (2010), about the Virtual Museum of Sculpture (VMS). It is considered to be an immersive VR system technology where the visitors can interact with the annals of the artworks that are placed in the virtual environment of 'Cathedral Square of Pietrasanta' is the capital of Versilia in Italy and is known for the 'city of marble and artists' as it has a lot of artwork in its territory. VMS consists of virtual sculptures showing on the panoramic stereo screen that is 7.5 meters wide to impart a good view. It contains a cylindrical screen. The visitors can interact by using a handheld trackball, that allows the user to select any sculpture and view it from any perspective and distance. It also contains a lot of images and texts along with oral recitation to provide information about the artistry. The setup of VMS is user-friendly and easy to use even by the non- trained operators (M. Bergamasco, et al,1999).

Figure 12 Virtual Museum of Sculpture



3. BUDDHISM CULTURE IN PAKISTAN

3.1 History of Taxila

Talking about Ancient history, Pakistan contains its treasures of which one most important is Taxila. It is known as a city of Gandharan civilization. Taxila is considered to be the hub of Buddhism, an epicenter of learning, and a meeting point for various cultures like Huns, Kushans, Mauryans, Greeks, Achaemenids, and eventually Muslims. It is also the most important archeological site in the world (Britannica, The Editors of Encyclopaedia. "Gandhara". *Encyclopedia Britannica*, 7 Nov. 2019).

In the 1800s CE, treasures of Taxila came to light by Alexander Cunningham who was leading a British throne under John Marshall. John Marshall was the director of the Archeological Survey of India in the area of 1900s CE. Along with this, Marshall also contributed his work in Taxila which played a significant role in enhancing the ancient culture.

Taxila in ancient history is also known as Takshashila, which is situated in the Northwestern part of Pakistan. It is 30 km north of the capital Islamabad. Taxila is also home to one of the oldest and most renowned universities in the world. This university was born in the Gandhara period. At the same time, it accommodates 10,500 students, including those from the countries of Babylon, Greece, Syria, and China (Puri, Baij Nath, 2022).

There were many experienced and professional teachers of philosophy, medicine, politics, accounting, commerce, music, dance, and other performing arts. Taxila is also known for its handicrafts, which reveal not only the city's culture but also the history of the place. Besides handicrafts, the town's stone carving is also very famous and a small cottage industry of stone carving has developed in the town. Taxila Museum is a well-known museum in Pakistan. The artifacts on display in the museum showcase the ancient culture and history of the region, showcasing the many artifacts of the Gandhara Civilization.

The main jewels and statues come from the stupas surrounding the museum and are not present in the museum.

3.1.1 Buddhist Archeological sites in Taxila

Uncovering the archaeological sites at Taxila have developed urban establishment on the sites from 1000 BC with some Buddhist stupas and monastic developments. Despite Marshall's significance to the Greeks, there was no evidence of a Greek temple, palace, or any other specifically Greek building was found. In contrast with the urban plan that consists of blocks and structures, each rectangular group of buildings contained houses planned in the eastern style interposed with Buddhist stupas and shrines (Dani, 1986: 92).

Different places in the Taxila region include areas like Mohra Muradu, temples of Jandial and Pippala, Sirkap, and the monasteries of Julian. Unique stonework has been used in the different monuments of that period. Bhir Mound is considered to be the earliest remains. Traces have been found on the old buildings in the area of Taxila that contains exceptional stonework.

Figure 13 Taxila remains of Buddha



The above segment of remains depicts the earliest forms of the Buddha in Taxila. This represents the only impression of the statue remains. For this purpose, Taxila is well known for its numerous Buddha statues and its Buddhist monasteries and temples.

Figure 14 Protected Buddhist Pillar in Taxila



Figure 14 shows a series of seated Buddhas adorning this pillar in the Mohra Muradu area of the Taxila region. Located in the main monastery of the Mohra Muradu region, the Buddha Pillar lives today behind a protected wall within the remains. Numerous artifacts have been stolen from Taxila over the centuries by some merchants, so most of the country's vast treasures have been kept under wraps in the Taxila Museum. This particular stupa (a Buddhist place of worship) is also protected and one of the best preserved. Manifestations of the Buddhas are still in their original location around Taxila.

Figure 15 Feet of Stucco Buddha in Taxila remains



In the period of 303 BCE, Ashoka served as a Viceroy of the Mauryan Empire in Taxila. At that time Buddhism was spread in this region. After the death of Ashoka in 232 BCE, the Mauryan Empire started to break and Taxila has its independence. So in figure-13, we can see the feet of the largest Buddha of Taxila which was Ashoka (Aditi Shah, 2020).

3.1.2 The Myth and Reality of Taxila

Taxila's origins are legendary. Myth has it that Taxila is considered the land of Taksha, the name of a great king. Taxila also has a story accompanied by the sacrifice of a snake. by King Janamejaya, mentioned in the story of the great Indian epic Mahabharata. (Raychaudhuri, Hem Chandra, 1923 John Marshall, 2013) Mahabharata is said to have lived here for the first time.

Considering the establishment, Taxila has been a supreme cultural center. It is a great center of learning and gaining knowledge. This ancient city is also appreciated for having one of the first universities in the world (John R. McRae and Jan Nattier, 2012). This University thrive during the 5th to 1st centuries BC and

represented its importance in the great civilization. Although it was not a regular center for learning and attaining knowledge rather it is a combination of religious and secular studies related to the temples and monasteries.

3.1.3 Buddhist Art in Taxila museum

It is claimed that Pakistan is considered to be a Homeland for the Indian Muslim minority when British rule ended in 1947. Due to this, the guardians of Pakistan Museums and archeologists revealed the pre-Islamic ancient history to the new Muslim ancient. During the time of 1950 and 1960, Ancient Buddhist sculptures and other artifacts became very significant for nation-building in Pakistan. The Taxila museum became a symbol of Buddhist art and is known as a "sacred region" and "truly sacred land of Buddhism" (Naqvi 1970, 19).

Figure 16 Buddhism artifacts in Taxila Museum



Image source: <https://blogs.lse.ac.uk/southasia/2019/07/22/long-read-a-pakistani-homeland-for-buddhism-buddhist-art-muslim-nationalism-and-global-public-history/>

As Figure 16, there is a huge range of artifacts that are present in Pakistan. Also, many Museums in Pakistan officially highlight the Buddhism culture in the 1950 and 1960 period.

4. CASE STUDY- TAXILA MUSEUM

4.1 Scope of the Research

Virtual reality is a technology that creates a stimulating environment in which the users interact with the virtual environment. VR technology in the world has enhanced its engagement with the visitors in the museums where this technology is used and also has enriched the experience of the visitors. The scope of this research is all about attracting visitors and youth to historical places like museums after getting experience with VR through 3D videos and images. The representation of the virtual museum and the virtual reality museum experience form the units of analysis in the study. The research focuses on learning cultural heritage in the form of visual education. This research is held in the Taxila museum of Pakistan. Interviews are conducted to assess the opinion of the people who visited the museum regarding visual technology.

4.2 Aim of the Research

This thesis aims to attract tourists and visitors to museums through VR technology that captivates their attention toward history and preserving heritage and enhances the young generation's visits to museums and artifacts. This thesis also explores the perceptions and experiences of museum professionals by using VR to see their visions of future technologies in museums and see the advantages and limitations of these technologies. These multimedia techniques like VR technology provide new means to communicate their content and information consequently. The research thesis mentioned how to attract people of different age groups to museums and make their visit memorable by using a Virtual Reality platform. This insightful experience will stay on their minds forever and inspire them to visit the museums regularly. This thesis aims to take a qualitative approach to analyze the data by interviewing the visitors. One of the key features of this approach is data collection. A practical sampling process and statistical sampling are followed, in which the sample is empirically significant and is chosen according to the level of knowledge that each individual can expect.

4.3 Research Methodology

The method that is chosen for the research is dependent on the nature of the research problem. It is also observed that which method is more appropriate for the

research is determined by the nature of its social phenomena. (Morgan, G and L Smircich, 1980).

This thesis aims to define the sort of research that is preferred for the study. In this research, the data is collected to obtain sufficient information to demonstrate its hypothesis.

In this thesis the research hypothesis is:

“Visitors experiencing 3D tours of museums will have a more positive attitude and develop intentions of visiting historical places in reality”.

The qualitative method is chosen to find the results for this research.

To explain Qualitative research, Denzin and Lincoln state that the qualitative method not only entails measurements but also the examination of the results and process in terms of frequency quantity, and amount. Thus in social sciences, it is the analysis of insight and discovery (Merriam, S. 1988).

The qualitative method that is used for the data collection in this research is by conducting interviews with tourists and visitors by giving them the experience of a virtual tour through 360 degrees videos both inside and outside of the museum. The interviews include the experiment results between two groups that are the treatment and control groups. The interviews comprise semi-structured questions that are asked from the treatment group as well as asking about the VR experience of videos that were shown to the visitors.

There are 5 participants in the control group whose interviews are conducted through social media (Facebook) by sending them Google forms. These people were approached on the Taxila museum group on Facebook and were selected randomly. Their responses were collected within the time of two weeks. It includes 3 females and 2 males and they don't have any information or experience with VR technology. Females aged 27 to 30 years whereas males aged 25 and 36 years old. In the control group, 7 questions were asked of the participants and they were all my acquaintances. Whereas, in the treatment group random people were selected for the interview while they were visiting the museum. This includes 10 participants, 6 males, and 4 females and their age ranges from 20-40 years. There is one female participant whose age is 14. These participants were asked 10 questions each. This research is based on open-ended questions in which participants are free to answer the questions based on their understanding and knowledge. Through which valuable information is received from the participants. In the interview, the questions were asked in the native language of

Pakistan i.e. Urdu and all the responses were recorded as a video with the permission of the participants and then they were interpreted in English as can be seen in Appendix A.

4.3.1 Sampling Selected for the Study

The sampling that is selected for this research is simple random sampling. This sampling method helps save time and resources. It is a reliable method in which every single participant is chosen randomly. The main objective for this is to create a diversified group of people that are differentiated in gender, age, and museum behaviors. Such an experiment needs to use a diverse group of participants, as it means that all outcomes produced in a study can be generalized compared to a standardized group of participants (for example, employees or students).

4.3.2 Institutions Covered

The research is covered in Taxila, the archeological site which is located in the province of Punjab, Pakistan, about 30 km north of Islamabad. Taxila city is well known for its Buddhism culture in the country. It consists of many Buddha statues on its premises and also the whole city can be seen that is 1000 BCE old. Also, the Taxila museum is rich in learning and gaining knowledge about Buddhism and also presents the history and culture of Buddhism, in a variety of well-designed galleries, and presents the historical, antique, and patrimonial heritage.

4.3.3 Control Group Interviews

Interviews were taken with the five participants through social media i.e. Facebook, on 19th April 2022. These are the participants who visited the museum without any VR technology. These participants are the random people that were selected from the groups of Taxila Museum on Facebook and their responses were retrieved by sending them the link to the questionnaire. All five participants gave their responses positively. It took almost two weeks to get the responses from all the participants.

Table 1 demonstrates the answers of the participants to the given questions.

After examining the responses of the participants, it was simplified that a visit to the museum in its natural state was not much successful. As one female participant did not receive the proper engagement and did not enjoy the visit. The other four

participant's answers designate that they enjoy the visit and also got a lot of information regarding the history. Two female participants said that they did not feel entertained and did not take the advantage of their visit to get much knowledge. But three people were satisfied with the visit to the museum as they have an interest in the history and old civilization of Buddha.

Some of the answers showed that due to the lack of interest in the museum they took the pictures to reduce their boredom. It also showed that museums are monotonous places for the youth as they lack interest in history. So in their opinion, there would be such places where they could find entertainment. That is the reason some participants mentioned that their visit to the Taxila museum was over one year and they did not wish to visit it again. This indicates that they have no engagement with the museum. Also, all five participants did not wish to visit the museum again after their last visit.

Table 1: Control Group Interviews with the Result

Questions	Maham (30yrs)	Fahad (25 yrs)	Javeria (28 yrs)	Faizan (36 yrs)	Areeba(27 yrs)
When was your last visit to the Taxila Museum?	2 years back	3 months ago	1 year ago	6 months ago	5-6 months ago
For which purpose your visit was?	I visit with my Office colleagues	My purpose was to know more about Buddhism history	Just visited along with the university trip	To gain knowledge about the old civilization .	With friends
Can you describe	I saw several	I took pictures	The museum	The visit to the	The museum

the Taxila museum visit in detail?	utensils, clothes, stones, and Buddha statues and read some information that caught my attention, and took photos	of the sculptures and ancient things but did not have much interest in reading history	was beautiful and I took pictures.	museum was very fruitful. Learned a lot about their cultural heritage, lifestyle, and religion. Also visited the ruins of Sirkap and Julian. Overall it was a good experience .	was beautiful and it has a lot of history of Buddhism. I gained some information , but I did not understand most of them.
What did you feel inside the museum?	It is an interesting place to visit but somehow boring as well	It is a good place and rich in history to gain knowledge	I enjoyed the place	Everything in that ancient city is preserved perfectly. It seems like history has come alive.	It is a nice place and has a lot of information
In your opinion, is the Taxila	I don't think so	Yes it is a good place to	No, it is not because it	Yes, the museum is worth	yes

museum worth visiting?		visit	is not too interesting for young people	visiting because it contains a very rich history of Taxila city.	
Did you read more than 50% of the information in the Taxila Museum? / YES or NO	Yes I read it but then felt bored	No, I didn't have much interest and just took the pictures	No	Yes a few pieces of information about interesting things	No
Did you visit the museum again after returning back?	No	No	No, I didn't	No	No

4.3.4 Treatment Group Interviews:

At first, permission from the Taxila museum was taken from the head office which is the archeological department of Taxila museum to conduct the research in the museum as a researcher of Master's degree. The permission letter can be viewed in **Appendix C** part. After getting permission I took the research by interviewing random people who were visiting the Taxila Museum. At first, I explained to the participants about the research project and about the questions that were asked then

they visit the museum and after that, they were taken separately to a discreet place for the interview.

4.3.5 Treatment Group-Face-to-Face Interviews:

Face-to-face interviews were conducted in the Taxila museum. I selected random people who were coming to visit the museum. Before entering the museum, I asked the participants for an interview about the Taxila museum so that they can be mentally prepared and visit the museum accordingly. The interviews were conducted on May 16, 2022, to June 9, 2022, which is almost one month.

Each participant after they finished their tour of the museum were taken separately to a quiet place for the interview and then explained why the interviews are being conducted. First I told them about myself and then gave the overview of my thesis research and the topic. I also explained to them first the idea of using VR technology and showed them the VR videos with the help of the application on the mobile and also the 3D drone videos that I made through the drone camera. The purpose of those interview questions was to find out their views about the museum and also examine their engagement level with the museum. Secondly, to gather feedback on the participant's perception of gaining knowledge and information from their visit to the museum and what they think about using VR technology in the museum. All the interviews were documented of each participant. These interviews were recorded with verbal permission from all the participants and the interviews of every participant can be seen in detail in the interviews section of Appendix A.

4.3.6 Analyzes of Treatment Group Data:

12 questions were interviewed each of the 10 participants after visiting the Taxila museum to assess their emotional engagement. The question was open-ended questions in which the participants openly answered according to their feeling and understanding. Participants were asked to describe their experience of the museum but most of them answered that they enjoyed the visit because of its rich history of the Buddhism period. 7 participants were visiting for the first time and they said that they will also recommend visiting the Taxila museum to their friends and relatives.

Also, every 10 participants who were interviewed give thought that they will visit the museum again. Every participant showed interest in the museum because of its history but only two of the participants said that "we feel bored here so there

should be some interactive things and some fun activities for the children that attract them towards the museum”. Four participants said that they are only visiting with their family but never heard of the museum, and five participants said that they have heard about the museum from other people and also read in the school books so that’s why they were visiting to get more knowledge about the history and culture and one participant said that “we were passing by so thought to visit Taxila museum”.

After giving detailed information about the Virtual Reality technology to the participants all of them appreciated this idea and have a positive reaction to this. They were told about having the VR technology application on their mobile phones and also introducing this idea in the museum with VR glasses so that visitors can have a virtual tour of the Taxila museum. Most of the participants appreciated this idea and said to have this technology in the Taxila museum.

However, two participants were opposed to the idea of doing a mobile application of VR technology. They said that by doing the app on mobile instead it is better to visit physically to the museum and take a tour that would be a more enjoyable thing for the children and it will be fun.

4.3.7 Demography:

If the overall results can be discussed about the control and treatment group, it can be seen that a total of 15 participants took place in both experiences. 5 were in the control group and 10 were in the treatment group. In the control group, there were 2 male and 3 female participants who were in their 20s and 30s age group, and 2 were having Bachelor’s degrees and 3 were having Master’s degrees. Whereas in the treatment group, there were 6 males and 4 females and their age ranges from 20 -40 years. There is one female participant whose age is 14.

The interviews were conducted with the visitors who were visiting the Taxila museum and they were categorized as the treatment group. They were grouped separately as those who came with the families and individual boys and girls. All participants in the treatment group participated actively and were keener to give the interview questions regarding the VR technology in the Taxila museum. The questions were interviewed in the Urdu language which is the native language of Pakistan. These interviews were recorded via video for the record and then it was interpreted into English for the research. All 10 participants agreed with the idea of

using VR technology in the museum and also appreciated if there would be an application of VR on mobile phones from where they can visit the museum virtually and get the information. In the treatment group, if the salary is concerned, 3 participants were earning 300 USD to 500 USD monthly salary and 4 participants are a student and not doing any job. 3 female participants are housewives and also not doing any job. In the education level, 7 participants are undergraduate and postgraduate whereas 3 participants are school students.

4.3.8 Limitations:

At the start of my research, I planned to use VR headsets to show the VR experience to visitors of the museum but unfortunately, I could not able to get this device due to certain reasons. At first, I found this device a bit expensive in Pakistani currency as it needs some controllers, a gear VR kit, and a hand joystick, secondly this device needs to have some VR software through which the device runs properly. Rather I made 360-degree videos from the mobile app and drone videos to show to the participants and gave them the idea of VR.

I also could not reach a lot of people for the interviews because I took 10 interviews and the opinion of all the participants was almost the same about using VR technology in the Taxila museum.

4.3.9 Analysis:

The aim of this research is to explore the observations of the interviewees on the use and practice of VR technology in the Taxila museum. In terms of museum context, VR plays a vital and multidimensional role.

It is said to be a challenging thing to use VR in order to replace the real gallery experience and to deliver a gallery experience in a virtual environment. That's not what it's good for. It's good for offering a different kind of experience. So, the use of VR technology is to create experiences that people can't get anywhere else. People only walk into museums and galleries all over the world. So implementing this idea in the museums makes something else for the visitors that they can enjoy visiting the museums.

The analysis of the data consists of both the control group and treatment group participants. In the control group, interviews were taken with the five participants on

Facebook. These participants visited the museum without VR knowledge. These random people were selected from the groups of Taxila Museum on Facebook and their responses were retrieved by sending them the link to the questionnaire. All five participants gave their responses positively. It took almost two weeks to get the responses from all the participants. The question that was asked about their last visit to the museum was between 5 months to 2 years back from their responses. The answer to the question of the purpose of visit to the museum was that they had a random visit to the museum with their family and friends but the participant Fahad and Faizan said that they visited the museum to gain more knowledge about the old civilization of Buddhism and to know more about their way of living and culture that used to be in the past. So it seems that they got an interest in history and visiting historical places. On the question that was asked about the museum and how they felt after visiting the museum, so all 4 participants answered that they enjoyed visiting the museum and gained a lot of knowledge about the history but one participant named Maham was not much happy and answered that she felt bored. Another question that was asked from the participants that will they visit the museum again 3 participants answered that they found the museum interesting and they will visit again but 2 participants Maham and Javeria said that they found it not much interesting so they will not visit it again. Whereas in the last question about reading the description inside the museum, I got the answers from the participants as only one participant read all the information and took more interest but the rest 4 answered that they did not take much interest and just took the pictures and rest they felt bored. So if we analyze the results of the overall responses of the control group, we can infer that participants have no such engagement with the museum. It was a kind of boredom for them and they just enjoy taking pictures. They visited the historical place but they found nothing attractive about the history only they were fascinated by some of the artifacts from the old civilization.

Therefore, the responses that were collected from the participants in the treatment group were also very supportive in order to know their emotions regarding the VR technology. In the treatment group, simple random sampling was done as random people were selected who were visiting the museums. The interviews were conducted with a total of 10 participants and each one was asked 12 questions. At first, the participants were shown 3D virtual videos, and knowledge was given about

using VR technology in the museum. Then they were questioned that how they liked this new technology and what they think about using VR technology in the museum. So, if analyses can be done of all participants, then all of the 10 appreciated the idea of having such kind of entertainment in the museum. They think that if there is an application for Taxila museum with 3D videos and images then it is also very useful for those who are living far away and cannot come, whereas they also cherished having the VR tour of the museum physically visiting the museum and getting the detailed information of everything. Some participants answered that as this is the era of technology and everyone takes interest in new things so this idea will attract especially the youth to visit the museum more frequently and they will also recommend it to others also. When the participants were asked the question that in gaining information how virtual reality plays a role, so in this they all had a very positive approach toward VR technology. According to their opinion, VR technology seems very helpful for getting information because if someone goes somewhere physically, they don't know what will the place look like but through VR goggles we can get all the information with audio and video by listening and seeing the 360-degree view of all the museum and the places of such ancient civilization. They also confer that it feels like a person is present in a real environment. Every 10 participants appreciated the idea of using VR goggles to get more information about the museum especially by listening to the audio. Three younger participants of all having aged 21 and 14 were very interested to experience the whole museum with the virtual technology (Headsets). As it has a more positive impact on the youth. They also think that it is more beneficial in developing an interest in history and culture. This will also push more tourism and develop adoption for the information and retain the cultural heritage and will enhance customer experience. According to the survey done with the visitors, they think that using VR technology is considered to be very beneficial for the cultural sites that are not easily visited by tourists, and also it will render the visit experience more memorable. It is concluded from the analysis of the results that people are well aware of VR technology but it is nowhere implemented in Pakistan in the museums. When the visitors were given the knowledge about this technology, they were excited to get the experience of it. This is all about leisure and entertainment. The people aged 36 and 40 years old wanted their children to use this technology in the museums so that they can get better knowledge and education about the history of Buddhism and their culture and the way of living in that century. The

person named Abdul Rahman, aged 31 years, gave clear reasons for using the VR headsets in the museum and what are its benefits. He gave his view that VR technology is very helpful for getting information because if a person does not know and has knowledge about a certain place then how he can visit that place. So, with the help of VR headsets, a person can see everything in 360-degree video form and get all the information by seeing and listening to the audio. He also mentioned that VR technology gives a feel of being present in the real world. According to Abdul Rahman, this idea should be implemented so that it can create awareness among people about the museum, and by promoting it to the youth they will get more information and it will benefit them to study the history. One female participant named Tayyaba also gave the opinion about VR that this technology will more likely attract youth as it is a new idea and this will help them to attract towards historical places. She also said that she will prefer using VR headsets rather than visiting in reality. Another participant named Imran Khan gave his spectacular views on this technology. He believed that by using VR headsets a person can gain more information by listening to the audio. VR technology is beyond everything and it will bring life to the museum. As this is the era of modern technology and the world is a global village so he thinks that VR is a good idea for the youth in getting information and it will attract more visitors. This is a very intensive experience for everyone. According to participant Anum, using VR headsets have more significance in gaining information rather than physically visiting historical places. This will increase the knowledge. It would be also interesting for the youth as they are very adventurous at this stage of technology.

From the average monthly earning of the people is around 300 to 500 USD it can be conferred that they can easily afford the use of this technology and also all the people that were visiting the museum have a master's and a bachelor's degree means that it would not be a problem for them to understand the use of this technology. Also giving them the experience of a virtual museum will bring more awareness among them as tourism is largely linked with this technology.

4.3.10 Discussion:

The research was conducted in the Taxila Museum of Pakistan after getting permission from the Archeological department of Taxila. In the research methodology, the qualitative method has been chosen and the sampling that is

selected for this research is simple random sampling. This method is a reliable way of choosing participants randomly for the interviews.

The research thesis aims to create interest among visitors in museums through VR technology to captivate their attention toward the history of Buddhism and to preserve its heritage among youth. This research also discovers the observations and experiences of people about VR to understand their opinions on this specific technology to be used in museums. The results show that visitors recognized the VR technology and have on-site experience in terms of learning opportunities. In fact, the interviewees believed that the VR application is a very constructive way to tour the museum, allowing them better access to information about the cultural site and its history and enabling them to experience the visit from a new perspective as compared with the traditional tour. The fact that it is also considered that VR technology produces a link and an emotional attachment along with escapism from reality. This explains very clearly that the visitors were willing to use VR applications in museums in the future and showed positive attitudes towards sharing the visit experience with their friends and families.

In this research, questions were interviewed two groups, the control, and treatment group. In the control group participants were asked random questions about their visit to the Taxila museum and their observations about the museum without the knowledge of VR technology whereas, in the treatment group, visitors were shown 360-degree VR videos to give knowledge about using VR technology in the museum. All the participants participated very actively and with great interest. All had a very positive approach towards VR technology and they think that it is a very good activity for all the people to be used inside the museums who find the historical places to be boring and less interesting.

The results that were analyzed from the control group participants were that they find the museums and historical places not much entertaining. In the treatment group, the answers were somehow the same as that of the control group but in this when the participants viewed the VR videos and got the experience and knowledge of VR, then they realized it was a very entertaining activity and they thought of visiting the museum again with this technology experience. Also, it will help to preserve the heritage, culture, and Buddhism artifacts. Moreover, individuals who experienced 3D

tours were more likely to revisit the museum and tag their friends or family along with those who did not use the VR technology during their museum visit. These findings support the hypothesis that individuals who take 3D museum tours adopt a more optimistic outlook and make plans to often visit historical sites. The findings of this study revealed that VR technology allows visitors to feel more engaged and immersed in the traditional exhibits of the museum by creating immersive experiences. Their findings also explained that VR can be used as an effective tool in promoting social responsibility, fostering awareness, and engaging people of all ages. Additionally, it can also help museums better prepare themselves for the future. Through virtual reality, history and culture come to life and it adds liveliness to the boring exhibitions. It also gives a different experience to the people that they have never felt before.

The hypothesis of this research, *“Visitors experiencing 3D tours of museums will have a more positive attitude and develop intentions of visiting historical places in reality”*, was considered true because all the participants appreciated the idea of using VR technology in the museum. According to the youth, it’s a very motivating activity to have that has a lot more entertainment and knowledge. The VR technology also creates the intention among visitors to visit historical places that seems boring to some people and it captivates their attention. This perception of VR technology experience will stay in their minds forever and arouse the feeling of visiting the museums on a regular basis. This study is also useful to individuals in the arts and entertainment sector. The results of this study indicate that VR technology enhances the experience of tourists and visitors. Therefore, this industry should consider incorporating VR technology into its services. Moreover, the findings of this study are important to tourists. To have a great experience in museums, they should consider visiting museums that have incorporated VR technology to see or experience historical, cultural, and scientific events or processes from another perspective. The aptitude of the visitors also concludes that they found a positive relationship between the technology and intentions of using it in the future as well.

Technologies are considered to be just a set of tools to place in service of a greater goal. Therefore, technology in museums must be the provision of providing the best and most pleasing experience with the actual content. Such technology must be an attention seeker to the visitors, accessible to people of all skills, and in service

of that higher goal, also to educate, inspire and motivate people to take action. Technology for technology's sake is not only an objective for museums. People should not divert themselves from what is new and shiny, but they should think about the people, about the mission, and what they can do to serve audiences in the best possible way in order to attract them towards new inventions.

Taxila museum should understand and make some efforts to introduce such technology that is very fruitful in attracting visitors specially the young generation towards the history as the ratio of visitors per year is already very less. Virtual reality can make the impossible possible. From the education sector to the entertainment sector, virtual reality opens new opportunities for the youth and can eradicate obstacles. Taxila museum can easily engage visitors by making a connection with virtual reality technology by introducing VR headsets. VR rises the interest in museum valuable assets and it can draw a deeper connection with the person. This project is likely to impress more people to think about art and technology, and how valuable it is. According to the hypothesis, the most important part of introducing this technology in the Taxila museum is to attract disabled people who can't visit the whole area of the museum and its surroundings. Disabled people do not need to go anywhere and with the VR headsets, they can able to visit the whole museum. This is the best way Taxila museum can increase its visitors by giving value to this technology. VR headsets will not only make a physical connection rather they will be emotional as well. It will create a spark among the visitors who would be thinking not to visit it again. The virtual museum also should meet the requirements of the people in the form of design, display, and communication skills.

5. CONCLUSION:

This research describes qualitative research that uses the psychological framework and methods to deal with technological innovation in the exhibition hall, galleries or museums. This research points out that VR technology acts as a meeting point between museums and visitors for an engaging educational and amusing experience.

Virtual Reality technology is one of the most emerging technologies that have created a fundamental shift and created a reinvention of conventional principles within the museum enjoy. The predominant cause of museums is to show off the

paintings and preserve their aesthetic price to guide the site visitors to apprehend their context. In this research, it's miles mentioned that Virtual Reality technology is the quality approach to bring such content material due to the fact they could guide and form our ingenious ability. The use of VR-era software is to help the manner of museum which represents one of the fundamental factors of a differentiation strategy. Museums can grow their aggressive benefit over their direct competition with the aid of using enhancing the high-satisfactory of the journeying enjoy which may be achieved via the VR era. This era improves the elegance amongst site visitors. The paradigm of social verbal exchange is being unexpectedly converted because of the development in technology as humans are being ordinary to audio-visible media. Expectations and focus of the site visitors attending the museums are evolving too. In this research, Taxila Museum was selected for the Virtual Reality era as a way to talk successfully with the site visitors and a way to pay attention to youth. This research aimed to find out how Virtual Reality technology will enhance interest of the visitors inside the Taxila Museum and encourage them to visit the museum more frequently. This research aims to find out how Virtual Reality technology will enhance the visit of the people inside the Taxila Museum and encourage them to visit the museum more frequently. VR application is the most important thing that motivates visitors to participate more and adds value to their experience. In this way, they can explore the Taxila museum and find it a source of entertainment.

The demographic results of the participants show that despite the level of varying education and income, they do not have any impact of using VR technology. It can be said that some cultures have not adopted Virtual Reality technology that may help the museums to promote their cultural values, educational knowledge and to stimulate their ideas.

This research is all about the new idea of Virtual Reality technology to be introduced in the Taxila museum. This new impression is very beneficial for the tourists providing them with knowledge, education and also encouraging them to visit the museum with their young ones. This research is an initiative to use Virtual Reality inside the Taxila museum which is very effective for user participation. In the interviews, almost all of the participants appreciated this new idea and expressed their intentions to visit the museum again especially after the availability of the VR

technology. So, I can say that the engagement of the people is directly related to the experience. VR technology may have a great impact on the future of visitors.

Virtual Reality applications can attract more visitors by creating interest within different age groups. The museum can draw attention of youth and engage them to visit inside the Taxila museum by attaining their emotional, cognitive and behavioral movements that may happen through their understanding of information, consistent interaction and regular feedbacks. This is the easy way of understanding information, and escalate people feelings of pleasure and happiness at the museum. As the VR experience will be given inside the Taxila museum so this will escalate the number of visitors to the museum.

Virtual reality also acts as a source of inspiration or as a marketing tool. As a preview or taster of what can be found on a museum visit, virtual reality can serve to spark the interest and curiosity of people who might otherwise not have considered visiting the museum. Virtual reality applications on mobile phones can stimulate young people's interest to visit the museum and experience virtual reality technology. Technology enables museums to bring static objects to life through sounds, visual content, and special enhancements.

To conclude, VR technology has great development potential, because this technology can be a vivid, realistic image simulation of the museum and create a dynamic visiting environment for the audience. In the virtual environment, visitors can visit a variety of cultural relics and collections to provide audiences with an immersive sensory experience, thereby improving the quality and efficiency of audience. Therefore, VR technology should be implanted in the Taxila Museum for this purpose. With the rapid development of VR technology, virtual technology will surely improve the development of the museum and it will become the most visiting site.

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APPENDIX A

Survey Questionnaire

Participant -1

Name: Mudabbir Hanif

Gender: Male

Age: 38 years

Education: Master's in Economics

Income: 150K

- 1) How often do you visit the Taxila museum?
 - I am visiting the Taxila museum for the third time.
- 2) With whom are you accompanying to visit the museum?
 - This is a family visit and I am visiting with my wife and children
- 3) How did you come to know about the museum?
 - My wife took me to the Taxila museum four years back and after that, I came one year back again, and then this is my third visit to the Taxila museum.
- 4) In your opinion which part of the museum was most interesting?
 - I like the items that are displayed in the museum which cannot be seen on daily basis like different types of antique utensils, and the different types of Buddha poses and statues. Also, I like the old war equipment and we bring our kids to know all of these things to get knowledge of the old civilization and how the people used to live at that time.
- 5) Would you recommend this museum to be visited by others?
 - Definitely yes, no doubt.

6) Do you like the idea of using virtual reality technology in the Taxila museum?

- Yes, I like the idea of Virtual technology because if one can't come physically to visit the museum then virtually is the best thing to use. As there are very few guides present in the Taxila museum who cannot reach every person who comes to the museum so with this technology we can see the VR 360 videos along with the audio and description. So I think it has more advantage to get knowledge.

7) By using Virtual Reality technology, would you like to visit the museum again?

- Yes, definitely

8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?

- Virtual reality technology is a good platform for gaining information for those who have not visited the museum physically.

9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?

- Yes, it shows reality.

10) In your opinion, is it useful for the youth in inculcating interest in historical places while using VR Technology?

- It is good for the youth as well to get the information as this era is of social media so this technology will be entertaining for the youth.

11) If you were asked to choose what would you prefer, a VR visit or a real visit to the museum?

- I will prefer both because I also live near to Taxila Museum and I can come physically as well and if I want I can use this technology for my children as well.

12) Did you like visiting museums through social media by using VR technology or it is better to go there physically?

- Both have their advantage. I like visiting and using VR technology also.

Participant -2

Name: Warda

Gender: Female

Age: 14 years

Education: Grade 9

Income: None

1) How often do you visit the Taxila museum?

- It is my first trip to Taxila Museum

2) With whom are you accompanying to visit a museum?

- This is a school trip and I am with my old teachers, my class fellows, and my family.

3) How did you come to know about the museum?

- In 5th Grade, I studied about Buddha and ancient civilization in books and now I am visiting this museum.

4) In your opinion which part of the museum was most interesting?

- I enjoyed seeing different Buddhas and old things.

5) Would you recommend this museum to be visited by others?

- Yes, sure

6) Do you like the idea of using the virtual reality technology of the Taxila museum?

- Yes, it is very helpful, especially for those who even cannot visit the museum physically.

7) By using Virtual Reality technology, would you like to visit the museum again?

- Yes

8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?

- I think by using VR technology we can get good information because I visited here but some of the things I could not understand but by using the VR application we can get more information.

9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?

- Yes of course.

10) In your opinion, is it useful for the youth in inculcating interest in historical places while using VR Technology?

- It is very useful because the VR application benefits people who cannot have an approach to the Taxila museum and live very far. It will also interest youth as it is a new technology for them.

11) After using the new technology of VR are you going to inform your family and friends about your experience of visiting the museum via VR?

- Yes, definitely.

12) If you were asked to choose, what would you prefer, a VR visit or a real visit to the museum?

- I will prefer VR technology.

Participant -3

Name: Abdur Rehman

Gender: Male

Age: 31 years

Education: Business Administration Graduate

Income: Nil

1) How often do you visit the Taxila museum?

- This is my first visit to the museum.
- 2) With whom are you accompanying to visit a museum?
- I am with my family members and cousins
- 3) How did you come to know about the museum?
- I have an interest in visiting historical places, it is my hobby. I have been to many places but now I am visiting the Taxila museum for the first time.
- 4) In your opinion which part of the museum was most interesting?
- I am more concerned about the coins as I am also studying old coins and this is my hobby. Other than that, I also like different Buddha statues and utensils of old civilization.
- 5) Would you recommend this museum to be visited by others?
- Yes, of course, I will also tell my brother as he is a vlogger so he can come here and make a story about the Taxila museum and people can come for a study trip as we can gain a lot of knowledge about history from here.
- 6) Do you like the idea of using virtual reality technology in the Taxila museum?
- Yes, it is a very good idea as this is the time of technology so people will enjoy using it.
- 7) By using Virtual Reality technology, would you like to visit the museum again?
- yes
- 8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?
- VR technology is very helpful for getting information because when we go somewhere physically, we don't know what will the place look like but through VR applications we can get all the information with audio and video by listening and seeing the 360-degree view.
- 9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?
- Yes, it feels like you are present in the real environment.

- 10) In your opinion, is it useful for the youth in inculcating interest in historical places while using VR Technology?
- It will be very useful for the youth because as compared to other countries we don't have much awareness about this technology so by using VR people will get more information. We should approach youth and promote this VR technology as it will be beneficial for them to study history.
- 11) After using the new technology of VR are you going to inform your family and friends about your experience of visiting the museum via VR?
- Yes, definitely
- 12) If you were asked to choose, what would you prefer, a VR visit or a real visit to the museum?
- First, I will study the Taxila museum through a VR application and after that, I will visit physically as well.

Participant -4

Name: Asad ullah Munawar

Gender: Male

Age: 21 years

Education: Engineering

Income: nil

- 1) How often do you visit the Taxila museum?
- This is my first visit
- 2) With whom are you accompanying to visit a museum?
- I am here with my class fellows as it is a school visit.
- 3) How did you come to know about the museum?
- I hear from the local people who are living near to museum and also studied books.
- 4) In your opinion which part of the museum was most interesting?

- I like the things in the museum that are ancient and antique. I also came to know about the technology of people that how they used to live.
- 5) Would you recommend this museum to be visited by others?
- Yes, I will recommend to others to visit Taxila Museum.
- 6) Do you like the idea of using the virtual reality technology of the Taxila museum?
- Yes
- 7) By using Virtual Reality technology, would you like to visit the museum again?
- Yes, I will visit the museum again and experience the VR technology in the museum.
- 8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?
- It is good in gaining information if we don't know much by visiting it physically.
- 9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?
- Yes, it feels like that.
- 10) In your opinion, is it useful for the youth in inculcating interest in historical places while using VR Technology?
- Yes, it will be useful for the youth because as people are losing interest in visiting museums so VR technology will help them gain information easily about the old civilization.
- 11) After using the new technology of VR are you going to inform your family and friends about your experience of visiting the museum via VR?
- Yes, for sure I will recommend it.
- 12) If you were asked to choose what would you prefer, a VR visit or a real visit to the museum?

- I think both are good on their own. By using VR, we can get information through virtual images and videos, and physically visiting is also good.

Participant -5

Name: Tayyaba Sajjad

Gender: Female

Age: 36 years

Education: Master's Economics

Income: nil

1) How often do you visit the Taxila museum?

- I have been visiting the museum two times and this is my third visit to the museum

2) With whom are you accompanying to visit a museum?

- I am visiting with my husband and children

3) How did you come to know about the museum?

- I live near to the museum so that's why I know.

4) In your opinion which part of the museum was most interesting?

- Overall I like everything inside a museum that is present like old people's clothes, jewelry, and utensils that they used to eat their food. Everything is very unique.

5) Would you recommend this museum to be visited by others?

- Yes of course

6) Do you like the idea of using virtual reality technology in the Taxila museum?

- Yes, I like the idea of using VR in the Taxila museum.

7) By using Virtual Reality technology, would you like to visit the museum again?

- Yes, I will visit again the museum and experience the VR headset.

8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?

- I think by using this VR technology we can get more information on everything in detail.

9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?

- Yes, by using VR technology it feels like present in reality.

10) In your opinion, is it useful for the youth in inculcating interest in historical places while using VR Technology?

- It will also interest youth as it is a new technology for them. And this will attract youth more towards historical places.

11) After using the new technology of VR are you going to inform your family and friends about your experience of visiting the museum via VR?

Yes exactly.

12) If you were asked to choose what would you prefer, a VR visit or a real visit to the museum?

I will prefer VR because it is a new and interesting thing.

13) Did you like visiting museums through social media by using VR technology or it is better to go there physically?

- I will prefer both.

Participant -6

Name: Shehzad

Gender: Male

Age: 40 years

Education: Intermediate

Income: 100k

1) How often do you visit the Taxila museum?

- I am visiting the museum for the first time.

- 2) With whom are you accompanying to visit a museum?
 - I am visiting with my wife and children.
- 3) How did you come to know about the museum?
 - I knew it from my children as they studied in their books.
- 4) In your opinion which part of the museum was most interesting?
 - I found everything interesting.
- 5) Would you recommend this museum to be visited by others?
 - Yes of course.
- 6) Do you like the idea of using virtual reality technology in the Taxila museum?
 - Yes, I like it because we can get detailed information from this within the museum.
- 7) By using Virtual Reality technology, would you like to visit the museum again?
 - Yes, this is very interesting.
- 8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?
 - With this VR app, we can get more information as compared to visiting physically.
- 9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?
 - Yes, it is like that
- 10) After using the new technology of VR are you going to inform your family and friends about your experience of visiting the museum via VR?
 - Yes
- 11) If you were asked to choose, what would you prefer, a VR visit or a real visit to the museum?
 - I will prefer VR.
- 12) Did you like visiting museums through social media by using VR technology or it is better to go there physically?

- I like the idea of using VR technology.

Participant -7

Name: Imran khan

Gender: Male

Age: 33 years

Income: 110K

1) How often do you visit the Taxila museum?

- This is my first visit to the museum

2) With whom are you accompanying to visit a museum?

- I am visiting with my friends

3) How did you come to know about the museum?

- We had some information about the heritage before that's why we came to see the museum.

4) In your opinion which part of the museum was most interesting?

- We saw the Buddhism period that was 540 BC old which was interesting and liked their lifestyle and way of living.

5) Would you recommend this museum to be visited by others?

- It depends on the interest of the people.

6) Do you like the idea of using virtual reality technology in the Taxila museum?

- I like the idea because first we can see the app and get information about the museum then we can come physically and visit the museum.

7) By using Virtual Reality technology, would you like to visit the museum again?

- yes

8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?

- I think by VR technology we can get more information by listening.

9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?

- Yes, it looks like reality

10) In your opinion, is it useful for the youth in inculcating interest in historical places while using VR Technology?

- As this is the era of modern technology and the world is a global village so I think VR technology is a very good idea for youth in getting information.

11) After using the new technology of VR are you going to inform your family and friends about your experience of visiting the museum via VR?

- Yes, we will share this with our friends.

12) If you were asked to choose, what would you prefer, a VR visit or a real visit to the museum?

- VR visit

Participant -8

Name: Anum

Gender: Female

Age: 33 years

Education: Master's in Chemistry

Income: No job

1) How often do you visit the Taxila museum?

- This is the first time I am visiting the museum

2) With whom are you accompanying to visit a museum?

- I came with my husband and children

3) How did you come to know about the museum?

- Just heard the name of the museum so now come to visit here for the first time.

- 4) In your opinion which part of the museum was most interesting?
 - I like the jewelry items from the past that those Buddhist girls used to wear, also I like the Buddha pictures and statues
- 5) Would you recommend this museum to be visited by others?
 - Yes, I will recommend seeing the museum and also other historical places.
- 6) Do you like the idea of using virtual reality technology in the Taxila museum?
 - Yes, I like the idea of VR technology.
- 7) By using Virtual Reality technology, would you like to visit the museum again?
 - Yes, because by using VR glasses we can visit the museum by sitting at one place rather than visiting physically all the places.
- 8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?
 - I think by using VR technology we will get to know about the museum but by physically visiting I think we can gain more information.
- 9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?
 - Yes, we can feel like we are in reality.
- 10) In your opinion, is it useful for the youth in inculcating interest in historical places while using VR Technology?
 - Yes, I think it would be interesting for the youth as well because people are more into adventurous things nowadays.
- 11) After using the new technology of VR are you going to inform your family and friends about your experience of visiting the museum via VR?
 - Yes definitely.
- 12) If you were asked to choose, what would you prefer, a VR visit or a real visit to the museum?
 - Real visit

Participant -9

Name: Eisha

Gender: Female

Age: 21 years

Education: Graduation

Income: Nil

- 1) How often do you visit the Taxila museum?
 - I a visiting the museum for the first time
- 2) With whom are you accompanying to visit a museum?
 - My brother and sister
- 3) How did you come to know about the museum?
 - My cousin brought me with her to visit the museum.
- 4) In your opinion which part of the museum was most interesting?
 - I like the ancient jewelry in the museum and their utensils.
- 5) Would you recommend this museum to be visited by others?
 - Yes, I will.
- 6) Do you like the idea of using virtual reality technology in the Taxila museum?
 - Yes, this idea is good as this is the era of technology so I think this is a very entertaining thing to introduce in the museum.
- 7) By using Virtual Reality technology, would you like to visit the museum again?
 - Yes, I will like to visit the museum again and experience VR technology.
- 8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?
 - It is a good idea as it is a new technology in the museum that would be interesting for everyone.
- 9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?

- By seeing the VR video, it looks like reality and we are present there.

10) In your opinion, is it useful for the youth in inculcating interest in historical places while using VR Technology?

- Yes, it will be interesting for the youth to experience this technology in the museum.

11) After using the new technology of VR are you going to inform your family and friends about your experience of visiting the museum via VR?

- Yes, I will recommend my friends about this.

12) If you were asked to choose, what would you prefer, a VR visit or a real visit to the museum?

- I will prefer the VR application on my mobile to visit the museum virtually.

Participant -10

Name: Faizan

Gender: Male

Age: 33 years

Education: Master's degree in project management

Income: 15k

1) How often do you visit the Taxila museum?

- I have visited the museum 3 to 4 times before

2) With whom are you accompanying to visit a museum?

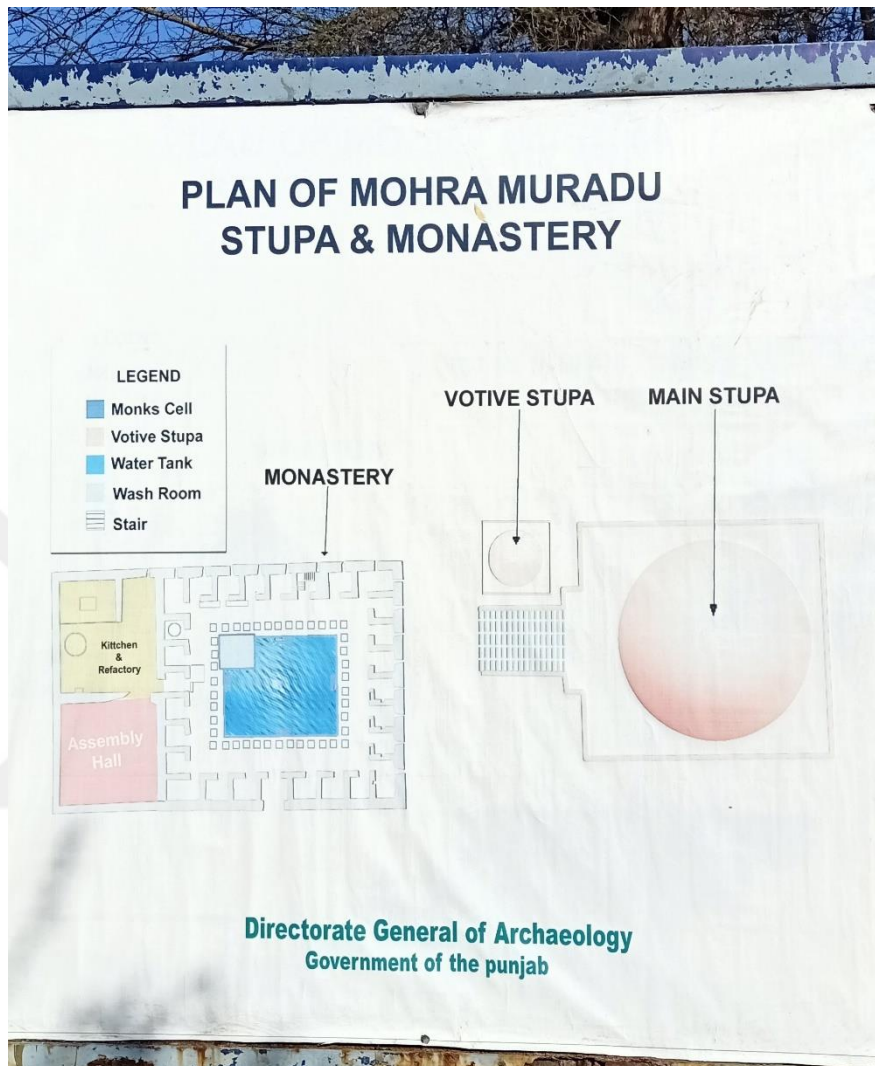
- I came with my family, sister, and cousin.

3) How did you come to know about the museum?

- I came on a school trip for the first time then I came to know about this museum.

- 4) In your opinion which part of the museum was most interesting?
 - I like the old ornaments and utensils that were used at that time.
- 5) Would you recommend this museum to be visited by others?
 - Yes
- 6) Do you like the idea of using virtual reality technology in the Taxila museum?
 - Yes, I like the idea and also if we download the VR application on our mobiles then we can virtually visit the museum and get detailed information about everything.
- 7) By using Virtual Reality technology, would you like to visit the museum again?
 - Yes, definitely I will visit again and experience this technology.
- 8) What did Virtual Reality technology add to your visit to Taxila Museum in gaining information?
 - We get more information through VR technology as compared to visiting everything physically.
- 9) While using VR technology, did you feel as if you were present in a virtual world and the reality of being physically present on location?
 - It shows like a physical presence
- 10) In your opinion, is it useful for the youth in inculcating interest in historical places while using VR Technology?
 - Yes, in my opinion youth will be more attracted to this technology as it will be new for them in gaining knowledge
- 11) After using the new technology of VR are you going to inform your family and friends about your experience of visiting the museum via VR?
 - Yes definitely.
- 12) If you were asked to choose, what would you prefer, a VR visit or a real visit to the museum?
 - I will choose a VR visit to the museum as it is more interesting to get information by seeing and listening to the audio.

APPENDIX B: Map of Region of Taxila



APPENDIX C: Permission letter from Taxila Museum



No.DGA-II (78)/Arch/2022/496
DIRECTORATE GENERAL OF ARCHAEOLOGY
GOVERNMENT OF THE PUNJAB
TOURISM DEPARTMENT

Dated the Lahore, 15th April, 2022

✓ To

Ms. Verda Shahid D/O Shahid Nazir,
House #303, Street -8, Sector-B, Askari 14,
Adiala Road, Rawalpindi.

Subject: PERMISSION FOR THESIS RESEARCH STUDY AT TAXILA MUSEUM, TAXILA DISTRICT RAWALPINDI.

Please refer to the letter No.E70270217-302.08-446 dated 04-04-2022 received through email from YEDITEPE University, Istanbul regarding the subject cited permission.

I am directed to inform you that the Competent Authority has accorded permission for the Research Study (Thesis on the Use of VR Technology to Enhance Museum Visitor: A Case Study for Taxila Museum in Pakistan) at Taxila Museum Taxila upto 1st July 2022 subject to the following conditions:-

1. No research activity will contradict the existing Acts/Laws of Directorate General of Archaeology.
2. You are allowed to do research work from Sun Rise to Sun Set.
3. No other students except you will be allowed against this permission.
4. Site Incharge will be on board regarding your research activities, if he/she forbids to do any action contradict to law you must obey.
5. This permission is purely for research thesis, no commercial activity will be done.
6. No hurdle will be created with research work in daily affairs of Museum.
7. A copy of research work will be submitted in the Museum.


Assistant Director
(Admin)

No. & date even.

Copy for information and necessary action to:

1. The VC YEDITEPE University Istanbul.
2. The Director Archaeology.
3. The Incharge Taxila Museum Taxila.
4. PA to Director General

APPENDIX D: Taxila Museum Pictures

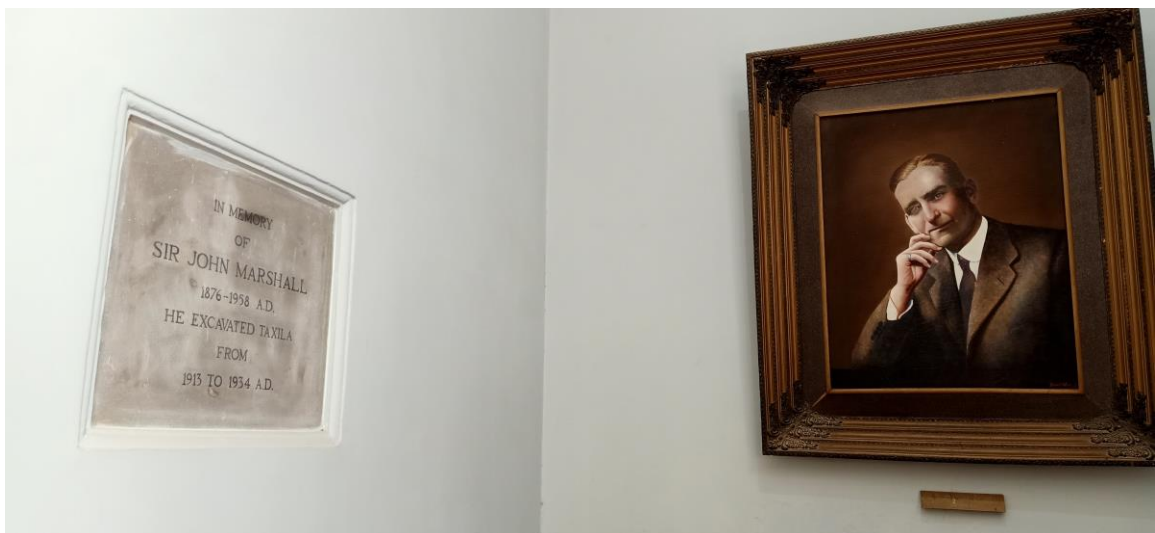
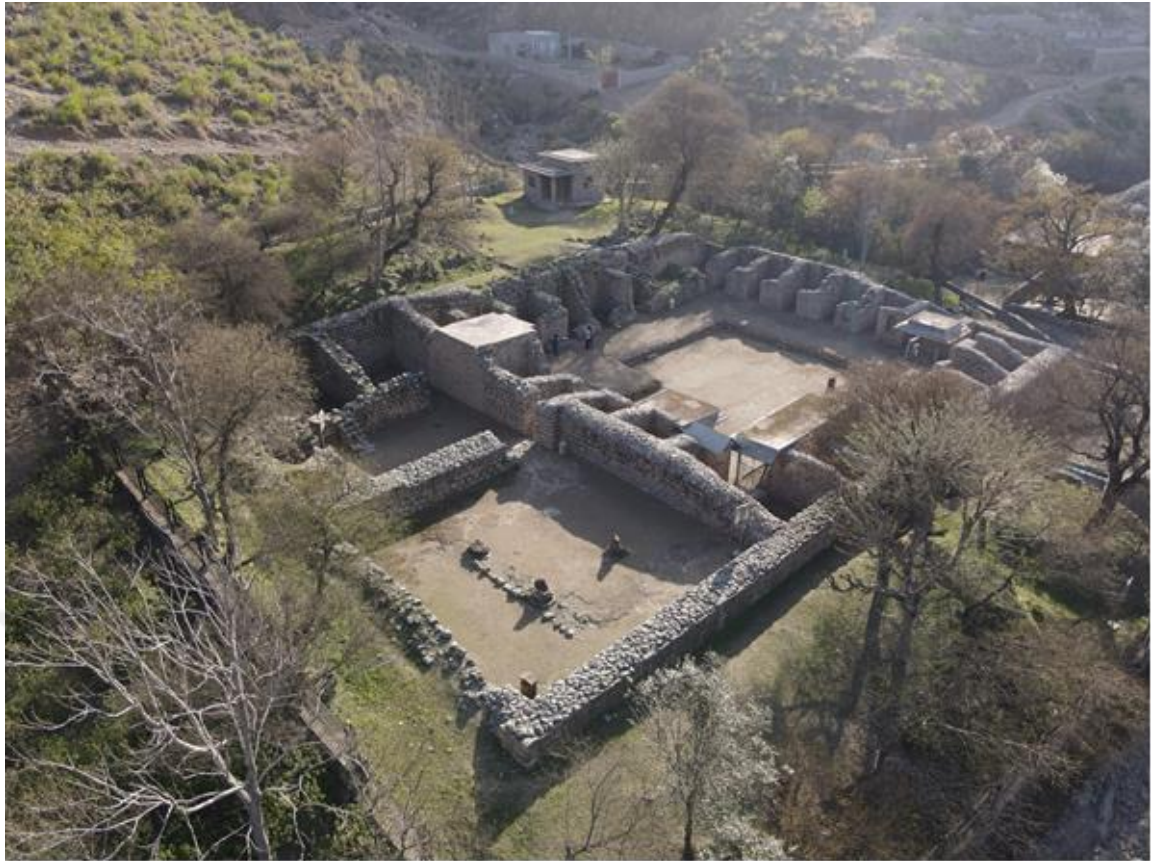
















سورج دیوتا کا مجسمہ
Image of the Sungod
Sirkap
2nd Cent B. C. - 2nd Cent A. D.



مہاتما بڈھ کا طبع کاری والا مجسمہ
Gilded Image of Buddha
Provincance Unknown
2nd -3rd Cent A. D.



Aramic Inscription.
This inscription found from the masonry of a wall at Sirkap (Taxila) is the only example of the use of Aramic (from which Kharoshti Originated) in the north west region of Pakistan. It mentions the ruler Priyadarsi and his queen and sons from which it seems that it was used in the first half of the 3rd century B. C. by the Mauryan Empror Ashoka who ruled over Taxila at that time.

آرامی تحریر
اس تحریر کو ۱۹۳۱ء میں سرکپ (تکسیلا) کے ایک دیوار سے ملا گیا تھا۔ یہ تحریر
معدنی کے اداسی نام سے آرمی تحریر کا نام ہے۔ یہ
پاکستان میں اب تک کی کوئی مثال نہیں ملے۔ اس تحریر کے
تقریباً ۱۰۰۰ سال پہلے کے ہونے کا اندازہ لگایا گیا ہے۔
اس میں حکمران پریادارسی، اس کی ملکہ اور بیٹوں کا ذکر ہے۔
اس سے پتا چلتا ہے کہ یہ تحریر پہلے ۳۰۰ ق م کے پہلے
میں لکھی گئی تھی۔





بودھا کی پامان کے مزار میں
BUDDHA IN ABRAHAMICUS
Buddha - Gandhara - Pakistan
Date: 1st Century A.D.



The Container of the Relics Presented by the Kingdom of Thailand
on the Occasion of the 70th Anniversary of Thailand-Pakistan Diplomatic Relations On 10

Sacred Relics of Lord Buddha











