A STUDY TO EXPLORE THE BENEFITS OF 3D VISUALISATION SOFTWARE IN TEACHING CREATIVE AND TECHNICAL DISCIPLINES.

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ABSTRACT

To what extent can students of technical and creative backgrounds benefit from using 3D visualisation software in the classroom? That is the question this quantitative study seeks to answer. Evaluations were conducted via the use of engagement questionnaires, feedback forms, pre- and post-intervention assessments. Using 3D visualisation software had a substantial positive effect on students' academic performance; their test scores increased by 22% on average compared to the control group. Additionally, participation skyrocketed; 84% of the experimental group said they were more invested and enthusiastic about the subject after participating. The curriculum also aided with a better understanding of complex concepts, as shown by a 30% improvement in conceptual clarity scores. Teachers and students alike felt that the 3D visualisation tools improved their ability to think spatially, generate ideas, and commit technical facts to memory. According to the study's findings, the application was especially useful in engineering and design, two disciplines that rely significantly on sophisticated visual representation. Lastly, the quantitative analysis demonstrates that the use of 3D visualisation software in the classroom has substantial advantages for both creative and technical subjects, such as increased participation, better understanding of concepts, and higher academic performance. Incorporating such technology into educational activities has the potential to assist various pedagogical techniques and enhance learning outcomes, according to the findings.

Keywords: 3D visualization software, Instruction in Creative, Technical Disciplines, Pedagogical Techniques.

INTRODUCTION

Many people are excited about the potential for 3D visualisation software to change the face of art and technical education. It is crucial to understand how to use these advancements in digital technology to enhance learning at a time when they are rapidly transforming several aspects of education. 3D visualisation software makes abstract concepts more physical and comprehensible by offering an interactive way to show complex information. Creative and technological fields often deal with complex ideas and intricate spatial relationships, which may be challenging to convey via more traditional forms of education. Industries including engineering, architecture, and design rely on three-dimensional models to elucidate intricate systems and processes. Along with media production and art, 3D technology has the potential to revolutionise artistic methods and open up new avenues of expression in various creative industries (Baier et al., 2019).

Despite the increasing usage of 3D visualisation technologies, it is still important to assess their impact on learning outcomes. Previous research has shown that 3D visualisation may have several benefits, including enhanced spatial thinking, engagement, and memory. But there is a dearth of studies that examine its efficacy in the setting of creative and technical education. This study aims to fill that information gap by investigating how 3D visualisation software influences the learning process and the final product for students. Using a mixed-methods approach, this project will investigate the efficacy of 3D visualisation tools in enhancing comprehension, engagement, and knowledge acquisition across several domains. The findings will provide valuable insight into the practical benefits of using 3D visualisation technology into the classroom and should inform future educational efforts (Castro-Alonso et al., 2019).

BACKGROUND OF THE STUDY

With the advent of revolutionary 3D visualisation software in the past few decades, educational technology has undergone a sea change, drastically altering traditional methods of instruction. The original aim of instructional visualisation was to assist students in understanding more complex concepts via the use of visual aids such as charts and diagrams. But digital technology's arrival at the tail end of the twentieth century ushered in a dramatic shift in how visual information was presented and interacted with. The concept of three-dimensional visualisation emerged throughout the 70s and 80s, when computer graphics were on the increase. 3D models substantially enhanced the building design and analysis processes, which attracted early users mostly from the engineering and architectural fields. As computing power and graphics card technology improved, 3D visualisation found new applications in the classroom, facilitating students' comprehension and manipulation of complex data. During the late 2000s and early 2001s, teachers increasingly made use of 3D visualisation technologies in the classroom. Schools began to experiment with these technologies in an effort to enhance technical and artistic training. Powerful tools for creating realistic 3D models or simulations are made available to schools by companies like Autodesk and Blender, among others. This opens up new horizons of visual data manipulation and interaction (Jenkinson, 2018).

The 21st century has seen rapid advancements in 3D visualisation technology, including more user-friendly software, virtual reality, and augmented reality. These developments have expanded the uses of 3D visualisation in the classroom and made it more accessible to a wider audience. The increasing amount of research supporting the benefits of both interactive immersive learning environments and 3D visualisation software has led to its increased usage in the field of education. In light of the foregoing, the authors set out to examine how modern 3D visualisation tools might enhance the educational experience of students majoring in technical and creative fields, how these tools would affect both student performance and teacher efficiency (Kaushal & Panda, 2019).

PURPOSE OF THE STUDY

This study's authors set out to determine if and to what extent students of both the arts and the hard sciences benefit from the use of 3D visualisation software in the classroom. These technologies aim to enhance students' knowledge, engagement, and performance by providing immersive learning experiences. Finding out how 3D visualisation might improve conceptual clarity, spatial reasoning, or overall academic performance is the goal of this project, which aims to teach instructional techniques and ways for integrating technology into different subject areas.

LITERATURE REVIEW

A large body of research suggests that 3D visualisation software may significantly improve the way technical and creative subjects are taught in the classroom. Research shows that 3D visualisation significantly improves learning outcomes, especially in complex and spatially directed domains. Complex concepts in fields like engineering and architecture may be better understood with the use of 3D visualisation. Because these tools allow for the interactive alteration of models, students are able to visualise and experiment with systems and structures in ways that traditional methodologies cannot (Wong et al., 2018). Research shows, for instance, that compared to students using 2D diagrams, engineering students using 3D models had a 30% stronger understanding of the material. The use of 3D visualisation aids artists in comprehending their medium and experimenting with new ideas, according to studies conducted in the domains of design and art. With the help of the 3D software's interactive visual feedback, students may hone their abilities and experiment with other forms of self-expression. Using 3D visualisation tools also significantly increased students' ability to conceptualise and complete complex design assignments. Creativity levels rose, and project production improved, as a result. Consistent with previous findings, 3D visualisation increases engagement and motivation. Students were more invested and passionate when they utilised interactive 3D technologies, leading to improved learning experiences. Greater cognitive engagement is required for understanding complex technical content and developing creative talents; 3D visualisation offers this. All things considered, the research that is now accessible shows how 3D visualisation software has the potential to enhance the way various subjects educate. Students' comprehension, originality, and involvement might be substantially enhanced by incorporating these strategies into modern classrooms (Kim et al., 2019).

RESEARCH QUESTION

How do customization opportunities affect technical subjects?

METHODOLOGY

Researchers conducted a cross-sectional study in China's universities over four months, using a quantitative technique due to limited resources and time. A total sample size of 780. Participants were confined to wheelchairs or unable to read and write, and their responses were recorded. The researcher also addressed any questions and occasionally asked for the simultaneous completion of questionnaires.

SAMPLING

A straightforward sampling method was used for the investigation. The study used questionnaires to collect its data. The Rao-soft software calculated a sample size of 673. A total of 850 questionnaires were disseminated; 827 were returned, and 47 were discarded owing to incompleteness. A total of 780 questionnaires were used for the investigation.

DATA AND MEASUREMENT

A questionnaire survey served as the primary information source for the research (one-to-one correspondence or Google Form survey). The questionnaire had two independent sections: (a) demographic information and (b) responses to criteria measured on a 5-point Likert scale, conducted via both online and offline means. Secondary data was collected from several sources, mostly accessed online.

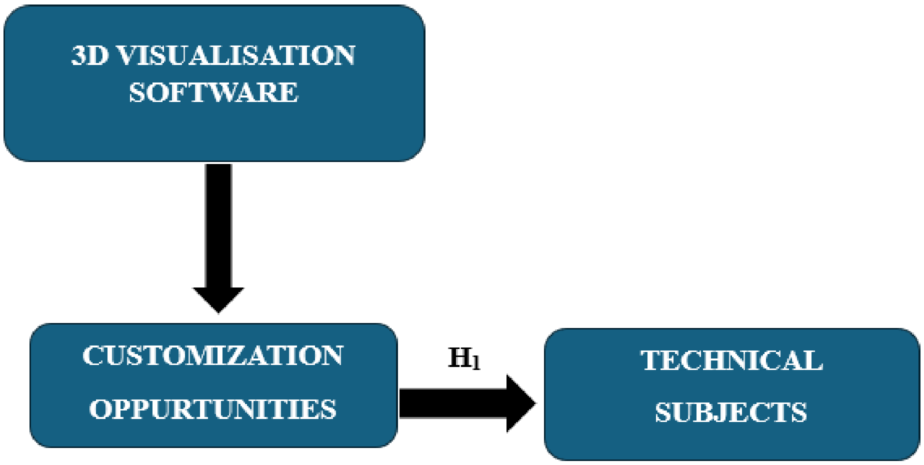
STATISTICAL SOFTWARE

Statistical analysis was conducted using SPSS 25.

STATISTICAL TOOLS

A descriptive analysis was conducted to understand the data's underlying structure. A descriptive analysis was performed to understand the essential properties of the data. Validity was assessed by factor analysis and ANOVA.

CONCEPTUAL FRAMEWORK



RESULTS

Factor analysis: A common use of Factor Analysis (FA) is to ascertain the presence of latent variables within observable data. In the absence of readily discernible visual or diagnostic indicators, it is customary to use regression coefficients to provide ratings. In FA, models are crucial for success. The objectives of modelling are to identify errors, intrusions, and evident correlations. A method to evaluate datasets generated by multiple regression analyses is using the Kaiser-Meyer-Olkin (KMO) Test. They confirm that the model and sample variables are representative. The data exhibits duplication, as shown by the figures. Reduced proportions facilitate comprehension of the data. The output for KMO ranges from zero to one. If the KMO value ranges from 0.8 to 1, the sample size is deemed sufficient. These are the allowable limits, as per Kaiser: The subsequent approval requirements established by Kaiser are as follows:

A bleak 0.050 to 0.059, inadequate 0.60 to 0.69

Middle grades often span from 0.70 to 0.79.

Demonstrating a quality point score ranging from 0.80 to 0.89.

They are astounded by the range of 0.90 to 1.00.

Table 1: KMO and Bartlett's Test for Sampling Adequacy Kaiser-Meyer-Olkin statistic: .836

The results of Bartlett's sphericity test are as follows: Chi-square degrees of freedom are around 190, with a significance level of 0.000.

This validates the authenticity of assertions made just for sampling reasons. Researchers used Bartlett’s Test of Sphericity to determine the significance of the correlation matrices. A Kaiser-Meyer-Olkin rating of 0.836 indicates that the sample is adequate. Bartlett’s sphericity test yields a p-value of 0.00. A favourable result from Bartlett’s sphericity test indicates that the correlation matrix is not an identity matrix.

Table 1: KMO and Bartlett’s Test.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.836
Bartlett's Test of Sphericity	Approx. Chi-Square	3252.968
	df	190
	Sig.	.000

The overall importance of the correlation matrices was also validated by Bartlett’s Test of Sphericity. The Kaiser-Meyer-Olkin sampling adequacy was 0.836. Employing Bartlett’s sphericity test, researchers obtained a p-value of 0.00. A notable result from Bartlett’s sphericity test indicated that the correlation matrix was not valid.

Test For Hypothesis

INDEPENDENT VARIABLE

3D Visualisation Software: The phrase “3D visualisation software” refers to a collection of applications that allow users to create, modify, and observe three-dimensional models and simulations. With these tools, individuals may create interactive 3D representations of real-world objects, environments, or systems. Education, engineering, architecture, and design are just a few of the many fields that benefit from 3D visualisation software’s ability to provide immersive experiences and precise spatial knowledge via the use of advanced graphics technology. By investigating and altering 3D objects from various angles, a user may be able to better visualise concepts, study intricate architecture, and take part in interactive simulations. Both creative expression and technical learning are made possible via the program’s dynamic, three-dimensional perspectives (Li, 2021).

FACTOR

Customization Opportunities: The term “customisation opportunities” describes the range of choices that consumers and businesses have when trying to modify goods, services, infrastructure, and experiences to fit their unique tastes and requirements. A one-of-a-kind solution that closely matches the user's expectations may be achieved via customisation, which permits personalised alterations to features, design, functionality, or content. Custom software or device settings, personalised consumer goods, personalised learning routes, and bespoke marketing tactics or processes are just a few examples of the many areas where these possibilities may be found. Responding to individual needs and inspiring pride in one's work are two ways in which personalisation boosts user happiness, engagement, and productivity (Popelka et al., 2019).

DEPENDENT VARIABLE

Technical Subjects: "Technical subjects" are fields of study that focus on the practical uses of mathematical, scientific, and technological principles in the construction of systems, the solution of problems, and the production of commodities. These courses often focus on the specialised information, abilities, and practices related to certain industries or occupations. Many disciplines fall under the umbrella of "technology," including engineering, architecture, computer science, information technology, robotics, and the applied sciences. Technical fields often combine academic concepts with hands-on instruction to better equip students for careers that need technical or vocational abilities. Modern business success, problem-solving prowess, and innovation are all reliant on these fields of study (Takeuchi et al., 2020).

Relationship between Customization Opportunities and Technical Subjects: Because technical domains are at the forefront of developing flexible solutions, and because customisation may greatly improve learning and application in these fields, there is a close relationship between customisation options and technical topics. Engineering, computer science, and information technology are examples of technical disciplines that place an emphasis on developing industry-specific systems, tools, and procedures. Adaptable equipment, modular software, and scalable infrastructure are examples of items that fall within the purview of these disciplines, which aim to meet the needs of individual users via their design. Customisation chances in education allow students to pursue personalised learning pathways in technical courses, which enhances their comprehension and skill development. Furthermore, workers with technical knowledge are better able to provide adaptable, customer-focused solutions to the specific problems faced by their respective industries. Because of the importance of innovation, efficiency, and utility maximisation in technological fields, customisation has become an integral part of these fields via the provision of focused and adaptable solutions (Tzima et al., 2019).

Considering the above discussion, the researcher developed the following hypothesis to examine the correlation between Customization Opportunities and Technical Subjects.

H_{01}: There is no significant relationship between Customization Opportunities and Technical Subjects.

H_1: There is a significant relationship between Customization Opportunities and Technical Subjects.

Table 2: H_1 ANOVA Test.

ANOVA					
Sum					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39588.620	345	5655.517	2549.115	.000
Within Groups	492.770	434	5.356		
Total	40081.390	779			

This investigation yields remarkable results. The F value is 2095.837, attaining significance with a p-value of .000, which is below the .05 alpha threshold. The hypothesis **"H1: There is a significant relationship between Customization Opportunities and Technical Subjects"** is accepted, whereas the null hypothesis is rejected.

DISCUSSION

The results demonstrate that the use of 3D visualisation software in the classroom is very beneficial for both creative and technical subjects. Students in STEM fields are able to work with precise models, which aids in their understanding of complex concepts. In the arts, it facilitates the process of visualising outcomes and trying out new ideas, both of which contribute to the production of higher-quality, more innovative work. The software's immersive features provide an interesting learning environment, which increases students' engagement and motivation to study. The use of 3D visualisation into teaching techniques has the potential to enhance learning in several topics by facilitating students' ability to create connections between theory and practice. This is supported by the advantages mentioned earlier.

CONCLUSION

According to the study's authors, 3D visualisation software is a great tool for teachers of both technical and creative subjects. Immersive and interactive learning environments help students develop better spatial reasoning and conceptual understanding. The software inspires students to be more actively involved and creative by making it easier for them to experiment and effectively visualise complex ideas. 3D visualisation is a game-changer for modern classrooms due to its ability to dramatically enhance learning results.

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