

Application of Multimedia Tools in Student Achievement

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Abstract

Information and communication technologies (ICT) have been a way of life. ICT can be used in various aspects and areas. We have been using ICT in agriculture, business, education, health, finance, banking, etc. Across the past thirty years, ICT has fundamentally changed the practices and procedures of nearly all forms of enterprise within business and governance. The study aimed to measure the effect of using multimedia tools in the "Statistics and Computer Application" curriculum on the students' academic achievement. The researcher has implemented quantitative research methodology and the experimental method (true experimental design) as research design tools. To carry out the study, the study area was the secondary school of Salyan, pursuing ISc. Ag., and the sample size was 80 students majoring in statistics and computer applications. The analysis and interpretation of the data above yield the result that the development of science education has been rather slow. There is a significant difference between the results of the control group (taught using traditional teaching methods) and the experimental group (taught using ICT multimedia techniques), i.e., the experimental group has better quality in statistics and computer application than the control group. So, if we can implement ICT multimedia techniques in teaching learning activities, it should be provided with adequate instructional materials and initiatives involving them in teaching learning, decision-making processes, training, workshops, and implementing 21st-century-based learning. Several factors, like student behaviour, ICT environment at school, digital illiteracy of parents, digital awareness, home environment, computer lab, projector, email internet facilities, teacher education, and teacher training, have affected student achievement in learning in higher secondary schools. From the analysis of the study, it has been concluded that student achievement was better in the experimental group than in the control group.

Keywords: education, ICT, multimedia, achievement, motivation

Background and context of the study

Information and Communication Technology (ICT) education and education in ICT are two different aspects and disciplines. ICT Education deals with obtaining degrees and certificates in Computer Engineering, Science, Application, Information Technology, Information Systems, Information Management, etc., while ICT in Education deals with the use and application of different ICT tools, apps, and programs that assist in managing the electronic education (e-education) and learning management system (LMS) for effective delivery of classroom activities in 21st century education.

The ICT Education Master Plan 2013 has given a framework for providing ICT education from elementary to secondary school. The ICT Education Master Plan 2013 has identified four major components, such as ICT infrastructure, connectivity, content, and human resources, to implement ICT education and education through ICT.

In education, multimedia is widely used, particularly in e-content and the teaching and learning process. Because of developments in information technology and science, much advancement has been produced this century, and these have also had an impact on the teaching profession and the education system as a whole. In this technique, the learners act as passive recipients while the instructor directs the learning process and supplies the lecture material. Pupils are well-versed in utilizing this technological breakthrough in education. Different sorts of learners can access alternative forms of learning through interactive multimedia.

(Anekwe, 2019) carried out a study on "Effect of multimedia utilization on secondary school students' performance in home economics" and illustrated its importance as students' awareness of the subject matter is raised, their comprehension of the issue is improved, and their learning is deepened with the aid of multimedia tools. Compared to traditional teaching approaches, multimedia instruction has been seen favourably. It is said to be a potent tool that improves instruction across a range of subject areas. Any computer tool that combines text, audio, images, and videos to instruct or educate students on a particular subject is referred to as multimedia. Both text and images are used in multimedia content. The use of multimedia in the classroom enables the presentation of educational material in a way that is more engaging, motivating, and artistic. Teachers can offer comprehensive information to

efficiently meet learning objectives by using multimedia to combine text, animation, images, and other educational elements into a unified package.

Instructors in higher education are under pressure to provide more effective and efficient learning environments and educational experiences to their students. In colleges and universities, teaching serves as an important vehicle for achieving institutional goals of enhancing students' knowledge and learning and engaging them in the learning community to prepare them for future citizenship. Therefore, educators are always looking for ways to make their educational initiatives more effective. The learning experience in higher education has shifted paradigms from an instructor-focused approach to learner-centered pedagogical methods (Hsu & Wolfe, 2003).

Multimedia is content that uses a combination of different forms of content, such as text, audio, images, animations, video, and interactive content. Multimedia contrasts with media that use only rudimentary computer displays, such as text-only or traditional forms of printed or hand-produced material.

Multimedia allows teachers to integrate text, graphics, animation, and other media into one package to present comprehensive information for their students to achieve specified course outcomes. Multimedia permits the demonstration of complicated processes in a highly interactive, animated fashion, and instructional material can be interconnected with other related topics in a more natural and intuitive way (Crosby & Stelovsky, 1995).

The place of ICT in education and training cannot be overemphasized. Its full integration into education helps to ensure quality education at various levels of education, such as primary, secondary, and tertiary. Despite the fact that some educators do not support the introduction and adoption of ICT into the school curriculum, the majority of educators strongly feel that ICT is the most valuable tool to overcome the problems being faced in the teaching-learning process. ICT has become a major tool in acquiring, processing, and disseminating adequate knowledge, especially in the 21st century. Multimedia programs provide different stimuli in their presentations, which include a number of elements, some of which are (Aloraini, 2005, p. 55–75): Texts, Spoken words, Sound and music, Graphics, Animations and pictures.

They support the user's work and innovation, which makes the possession of a computer a necessity for both the student and the teacher. As a result of the efficiency the multimedia programs achieved in the educational domain, the researcher sought to

subject these programs to research in order to find out the best style for presenting and applying them in a way that ensures their optimization in education.

The study problem is focused on finding out the influence of using multimedia techniques in teaching and their uses in education on the students' academic achievement, especially the higher secondary level students of the Nepalese college, in comparison with their colleagues who benefit from this curriculum through traditional education. This problem is made more specific in the following question:

What is the impact of using multimedia techniques in teaching the "Statistics and Computer Application" curriculum on the student's academic achievement?

1. Does the achievement of the student in statistics and computer application of control come from that experimental group?
2. Does the achievement of boys' students differ from that of girls' students in statistics and computer application at a higher secondary level?

Research Hypothesis

There is no significant difference between the achievements among the students in the Experimental (taught by using multimedia techniques) and Control (taught by using traditional methods) groups.

$H_0 = \mu_1 = \mu_2$ (Null Hypothesis)

$H_1 = \mu_1 \neq \mu_2$ (Alternative Hypothesis)

- i. Where μ_1 and μ_2 are respectively the corresponding mean score of the Control and experimental group of the Study.
- ii. There is no significant difference between the achievement of boys and girls in statistics and computer applications.

$H_0 = \mu_1 = \mu_2$ (Null Hypothesis)

$H_1 = \mu_1 \neq \mu_2$ (Alternative Hypothesis)

Where, μ_1 and μ_2 are respectively the corresponding mean scores of the control and experimental group of the Study. Therefore, we fail to reject the null hypothesis. tab

Literature Review

Reading the previous studies is essential for providing some scientific facts that support the study. Many researchers were concerned with studying the influence of the use of multimedia techniques on students' academic achievement and attitudes. The following are the most prominent studies: Ila Maris (1980) conducted a study

entitled Comparison of the Student's success and Change of attitude as a Result of two different educational cases. The study aims at comparing the efficiency of the teacher's traditional explanation and the multimedia method with the student's academic achievement and attitudes. The researcher used the experimental method, and the study was conducted on a sample comprising 80 students from the ninth grade. The sample is divided into two groups: one is controlled and the other is experimental. The researcher used (diagrams, tapes, and programmed film) achievement tests designed by him. The most important results are that the academic achievement of the experimental group students rose as a result of using the multimedia group, as there were statistically significant differences in the average achievement in favour of the experimental group students who used the multimedia group.

(Shakil, Faizi, & Haq, 2020) carried out a study on "Impact of Multimedia on the Academic Performance of the Students at Secondary School Level" which aimed to determine how multimedia affects Peshawar District secondary school pupils' academic achievement. The primary aim of the research was to ascertain the influence of multimedia on secondary school students' academic achievement. (ii) to evaluate how multimedia is used in the classroom and how it affects students' academic achievement. Twenty Peshawar District public schools, twenty heads, forty teachers, and forty secondary school students made up the research sample. The research tool utilized was the questionnaire. The researcher has recommended that the government should offer multimedia services to the school in light of the dearth of multimedia resources there.

Bulut (2019) conducted research on "An Analysis of the Effects of Multimedia Teaching on Student Achievement" by stating that multimedia settings refer to digital environments where various elements, such as visuals, audio, or a combination of both, are presented to engage individuals' auditory and visual senses. These settings find applications across diverse fields like film, advertising, tourism, commerce, and education. The study aimed to assess the impact of employing multimedia settings in social studies education on students' academic performance. Employing an explanatory sequential design, a mixed-method approach, the research indicates that while social studies instruction utilizing multimedia demonstrated notably positive effects on student achievement compared to traditional methods, these effects did not achieve statistical significance. Qualitative analysis suggested factors such as large

class sizes, varying levels of student readiness, and classroom noise might contribute to this outcome. Nonetheless, the study suggests that multimedia-based teaching enhances academic achievement, improves comprehension of topics, and fosters a more enjoyable learning environment compared to traditional approaches.

The purpose of the study was to determine whether multimedia learning packages could influence students' views about biology education in secondary schools. Both quantitative and qualitative research methods were used in the study.

Viador and EdD (2023) conducted a study to analyse how multimedia might be utilized in English classes to improve student participation and active learning. The study's subjects were the Grade 10 students of Sta. Maria National High School in Agusan del Sur, Sta. Maria, Trento. Pre- and post-tests were given to both the experimental and control groups. The experimental group received training using multimedia, while the control group received instruction by conventional means like speaking and chalk. The intervention significantly raised the academic achievement of the students. The use of a PowerPoint presentation, audio, video, flashcards, and charts as part of a multimedia-based teaching program was well received by the pupils.

Yunis's (2005) study entitled "The effectiveness of multimedia software to teach geometry in the second grade of preparatory schools" aimed at identifying to what extent multimedia software helps in the academic achievement of preparatory school students in the subject of geometry and its remembrance. The sample of the experimental study included 300 male and female students divided into two experimental and control groups; each group consisted of 150 male and female students. The experimental group was taught by a multimedia software program that contained the content of the geometry unit identified by the Ministry of Education in the Syrian Arab Republic. The results showed significant statistical differences in the average academic achievement of the experimental and control groups in the test conducted after the experiment in favor of the experimental group.

The study's objective is to evaluate how multimedia-based social studies instruction affects students' academic performance. The mixed method's explanatory sequential design was used in the study's creation. The study's main conclusion is that, although not statistically significant, social studies instruction in a multimedia environment had much better benefits for student achievement than traditional

instruction. The qualitative results revealed that noisy classroom environments, large class sizes, and high student academic preparation levels are the likely causes.

Mayer (2014), illustrated in his book about the effect of multimedia on learning, as multimedia learning suggests that instructional materials tailored to align with human cognitive processes are more effective in facilitating meaningful learning compared to those that do not. The cognitive theory of multimedia learning is rooted in three fundamental principles of cognitive science: firstly, that human information processing involves dual channels for visual/pictorial and auditory/verbal input (known as the dual-channel assumption); secondly, that each channel has a limited capacity for processing information (the limited-capacity assumption); and thirdly, that active learning involves a coordinated set of cognitive processes during learning (the active processing assumption). This theory delineates five cognitive processes involved in multimedia learning: the selection of relevant words from presented text or narration, the selection of pertinent images from displayed graphics, the organization of chosen words into a coherent verbal representation, the organization of selected images into a coherent pictorial representation, and the integration of these representations with prior knowledge. Learners face three cognitive demands during the learning process: extraneous processing (unrelated to instructional goals), essential processing (necessary for mentally representing essential material), and generative processing (aimed at comprehending the material). Instructional objectives include reducing extraneous processing (in cases of extraneous overload), managing essential processing (in cases of essential overload), and fostering generative processing (in cases of generative underuse). Effective multimedia instructional materials should be designed to facilitate appropriate cognitive processing during learning, without overwhelming the learner's cognitive capacity.

Conceptual Framework of the Study:

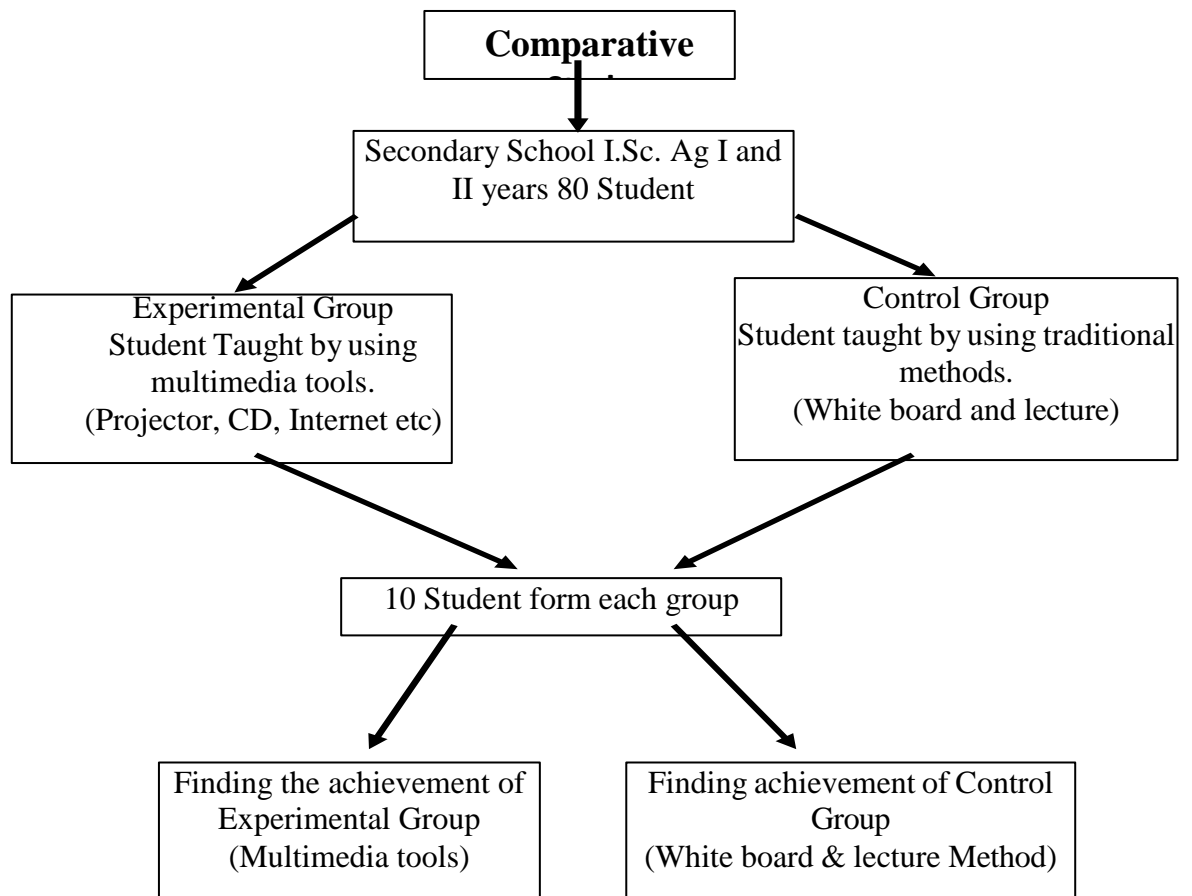


Figure 1: Conceptual Framework of Study

Methodology

The researcher used the experimental method (true experimental design) in studying the impact of an independent variable (a computer projector representation using multimedia) on a dependent variable (academic achievement). A comparison was made between the experimental group, which studied using a multimedia tool that uses multimedia techniques along with a teacher, and the other group, is a control group who studied using the traditional way of discussion and dialog, along with a teacher. The variables were controlled, which means that both groups are equivalent in terms of specialty, academic level, teacher, and teaching location, and the two groups have undergone pre- and post-academic achievement tests.

Study population sample size and sampling technique

For this study, the study population was the students of Higher Secondary School, Salyan in the academic years 2015–2016 in the ISC Ag. Their curriculum is statics and computer applications, and there were 80 students.

The sample was randomly taken from the ISC Ag, where two batches were selected from the Agriculture Science students in the two divisions. The researchers divided them into a control group and an experimental group for every 10- students taken randomly from each group during the test.

The experimental group was given a lecture on "Statistics and Computer Application" through a computer projector technique that uses multimedia, while the other group was given the same lecture using the traditional ways of teaching (teacher, lecture, discussion).

To conduct the experiment in the research, teaching and learning methodology, physical structure, psychological environment, ICT tools, and other facilities provided to students are observed and taken from the related sample.

Table 1: Sample size of the study

A	Experimental Group	1 (40 student) Every test 10 student taken randomly
B	Control Group	1 (40 Student) Every test 10 student taken randomly
II	Student	80
A	Boys	42
b.	Girls	38

The study tools

It is important to note that the researchers have experience teaching that curriculum. They created a presentation tool that employs multimedia to explain "Statistics and Computer Application." The presentation includes sound, images, video clips, and simulations.

With the assistance of the curriculum experts, the researchers administered a pre- and post-academic accomplishment test that covered every facet of the subject to gauge the various levels of academic achievement without memorization. There were 50 multiple-choice questions on the test; the student had to select the correct response from the four options provided.

The test was created objectively and given to a panel of arbitrators, who were curriculum teachers, to evaluate it in terms of its scientific content, student acceptability, and form clarity from both a pedagogical and scientific standpoint. A few questions were changed after learning about their opinions and recommendations, and the test was then released in its final version.

Data analysis tools

The following tasks were completed by the researcher using SPSS 25 and MS-Excel 2019 for data collection, cleaning, and analysis: Determine the standard

deviation, mean, and average mean. T-test to look at how the experimental and control groups' performances differ from one another. The SPSS software package was used to examine the study's data. For every item on the accomplishment test, the percentage frequency of the correct responses is shown. Furthermore, the t-test was used to determine whether there was a difference in multimedia use between the control and experimental groups, with a significance value of 0.05.

Result and finding

To determine how different factors, affect high school, including teachers' and students' ICT usage and skills, ICT adoption within a teacher community, and overall change processes in high school, the study set out to examine the effects of ICT in education from a variety of angles. The foregoing facts have been analysed and interpreted, and the conclusion is that science education has developed relatively slowly.

The results of the experimental group (taught using an ICT multimedia technique) and the control group (taught using a standard teaching method) differed significantly; the experimental group performed better in computer applications and statistics than the control group. Thus, in order to apply ICT multimedia techniques to teaching activities, they should be given proper training and initiatives that involve them in decision-making, teaching, training, workshops, and the implementation of 21st century-based learning.

Based on the study's research, the researcher was able to identify a number of factors that influence students' performance in computer applications and statistics when utilizing both traditional methods and multimedia techniques. The mean, standard deviation, and t-test were used to assess the scores of 42 boys and 38 girls, or 80 students (each test was administered to ten randomly selected children). The study's conclusion was reached after statistical analysis of the data gathered produced the outcome as below:

- i. The analysis of scores obtained by the experimental group in statistics and computer application achievement tests shows that 16% (8) students obtained distinction marks, 26% (13) students obtained first division, 28% (14) students obtained second division, 20% (10) students obtained third division, and 10% (5) students got failed results.
- ii. The analysis of scores obtained by the control group in statistics and computer application achievement tests shows that 4% (2) students obtained distinction

marks, 20% (6) students obtained first division, similarly, 18% (9) students obtained second division, 20% (10) students obtained third division, and 46% (23) students got failed results.

- iii. The mean scores of the control and experimental groups are 21.18 and 28.28, respectively. The average mean score of the experimental group is greater than the average mean scores of the control group. Hence, the achievement level of students in statistics and computer applications in the experimental group is better than that of the control group.
- iv. The mean score of the highest scorer in the experimental group is greater than that of the control group student by $(32.1 - 25.4) = 6.7$. The calculated t-value (i.e., 3.24) was greater than the standard tabulated value, i.e., 1.96, at the 0.05 significance level. Therefore, there was a significant difference in the achievement of the top scorer in the control group and the top scorer in the experimental group. Students who are top scorers in the experimental group have a higher level of achievement than those who are top scorers in the control group.
- v. The mean score of the lowest scorer of the experimental group is greater than that of the lowest scorer of the control group student by $(24.1 - 18.9) = 5.2$. The calculated t-value (i.e., 1.72) was smaller than the standard tabulated value, i.e., 1.96 at the 0.05 significance level. Therefore, there was no significant difference in the achievement of the students with the lowest score in the control group and the lowest score in the experimental group.
- vi. The mean score of the highest scorer control group is greater than that of the that of the lowest scorer experimental group by $(25.4 - 24.1) = 1.3$. The calculated t-value (i.e., 0.9099) was smaller than the standard tabulated value, i.e., 1.96 at the 0.05 significance level. Therefore, there was no significant difference in the achievement of students in the top-scoring control group and the lowest-scoring experimental group.
- vii. The mean score of the top-scoring experimental group student is greater than the lowest-scoring control group student by $(32.1 - 18.9) = 13.20$. The calculated t-value (i.e., 5.036) was greater than the standard tabulated value, i.e., 1.96, at the 0.05 significance level. Therefore, there was a significant difference in the achievement of the students of the lowest scorer in the control group and the top scorer in the experimental group. Students of the top

- scorer in the experimental group have a greater achievement level than those of the lower scorer control group.
- viii. The mean score of the experimental group boys is greater than that of the control group by $(27.40-23.8) = 3.6$. The calculated t-value (i.e., 3.920) was greater than the standard tabulated value, i.e., 1.96, at the 0.05 significance level. Therefore, there was a significant difference in the achievement of male students in the control and experimental groups. Students in the experimental group have a greater achievement level than those in the control group.
 - ix. The mean score of the experimental group female students is greater than that of the control group female students by $(28.36-18.76) = 9.6$. The calculated t-value (i.e., 1.057) was smaller than the standard tabulated value, i.e., 1.96, at the 0.05 significance level. Therefore, there was no significant difference in the achievement of girls' students in the control and experimental groups.
 - x. The mean score of the boy's students is greater than the girl's score in the control group by $(23.8-18.76) = 5.04$. The calculated t-value (i.e., 5.79) was greater than the standard tabulated value, i.e., 1.96, at the 0.05 significance level. Therefore, there was a significant
 - xi. Difference in the achievement of boys and girls students in the control group. Boys students in the control group have a greater achievement level than girls in the experimental group.
 - xii. The mean score of the boy's students is greater than that of the girl's students in the experimental group by $(28.30-27.40) = 0.9$. The calculated t-value (i.e., 1.73) was smaller than the standard tabulated value, i.e., 1.96, at the 0.05 significance level. Therefore, there was no significant difference in the achievement of boys and girls students in the experimental group.
 - xiii. The mean score of the boy's students is greater than that of the girl's students by $(25.610-23.54) = 2.07$. The calculated t-value (i.e., 1.46) was smaller than the standard tabulated value, i.e., 1.9, at the 0.05 significance level. Therefore, there was no significant difference in the achievement of boys' and girls' students.

Conclusion

The successful use of multimedia tools in the twenty-first century has elevated them to the status of an indispensable tool for assessing national development. Today's academics face a challenge from rapidly developing new information

technologies like multimedia, the internet, the World Wide Web, and other virtual technologies. The handling, disseminating, and handling methods, attitudes, and abilities must change in response to these technologies. As the twenty-first century goes on, a lot of issues are placing a great deal of pressure on the adoption of ICTs in classroom instruction. Traditional historical teaching has favoured certain materials above others, as was previously mentioned. Because of this, curricula that emphasize performance and competency, as well as the appropriate use of ICTs, are becoming more and more popular in contemporary settings. This is because ICT is a powerful tool that has the potential to change a lot of things, not limited to learning management systems.

Few students achieved the highest attainable score, and less than 50% of the test group obtained a mean score. Compared to the control group, a greater number of male and female students who scored above average were awarded distinction in the experimental group. Although further research is required, the level of achievement is satisfactory overall. One of the most important and innovative pedagogies for learning in the twenty-first century is the use of multimedia in education.

A multitude of factors, such as student behaviour, the school's ICT environment, parent digital illiteracy, digital awareness, the home environment, computer lab, projector, email, internet services, teacher education, and teacher training, all have an impact on student's achievement in learning in higher secondary schools. The analysis of the study has demonstrated that when secondary school pupils achieve greater degrees of accomplishment, their performance improves. Comparatively speaking, students in the experimental group performed better than those in the control group.

Implication of the study

This study is a very unique attempt to investigate the understanding and awareness of the impact of multimedia on academic performance in pupils. For other academics and researchers looking to do related studies in the sector, this discovery opens up new possibilities. Future discussions about the importance of methodically incorporating various multimedia tools and applications within the framework of teacher training will have a platform thanks to this study. Additionally, it gives other educators more motivation to be concerned about current rules to enhance their own experiences and more effectively carry out their professional responsibilities. As this article highlights the significance of having up-to-date information on pertinent topics

for teachers, it also encourages policymakers, those working in school education, school staff, and other stakeholders to benchmark the uses and application of multimedia tools and techniques.

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