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EFFECTS OF VIDEOTAPE MEDIATED INSTRUCTION AND PEER-TUTORING STRATEGY ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN BASIC SCIENCE AND TECHNOLOGY IN EKITI STATE, NIGERIA

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Abstract

The research investigated the impact of Video-Tape Mediated Instruction and Peer-Tutoring Strategy on the academic performance of Secondary School students in Basic Science and Technology in Ekiti State, Nigeria. Employing a quasi-experimental design with a non-equivalent, pretest, post-test, control group setup, the study focused on junior secondary class two (JSS2) students. A total of 240 students from intact classes were randomly assigned to either the experimental or control groups. Data collection utilized a self-constructed instrument named Basic Science and Technology Achievement Test (BASATAT), which underwent validation for face and content. Reliability was ensured through the test-retest method, yielding a coefficient of 0.75. Research questions were addressed using mean and standard deviation analysis, while hypotheses were tested with a significance level of 0.05 using analysis of covariance (ANCOVA). Pre-test results indicated no significant differences in mean scores among the groups, confirming their homogeneity. However, post-test results revealed significantly higher mean scores in the experimental groups compared to the control group. The findings suggest that integrating both video tape mediated instruction and peer-tutoring strategy can effectively enhance students' achievement in Basic Science and Technology. Therefore, it is recommended that teachers adopt these methods to improve teaching outcomes in the subject.

Keywords: Basic Science and Technology, Convectional Method, Peer-Tutoring, Students' Achievement, Video Taped Instruction.

Introduction

It is widely acknowledged that science and technology play crucial roles in the development of a nation. According to Achufusi (2015), advancements in science and technology are closely linked to the strength of science education. Therefore, investing in science and technology education is essential for nations aiming to achieve self-reliance and

independence (Otor, 2013). In today's modern era, the integration of science and technology for sustainable development is a key indicator of a nation's status as developed or developing.

Effective teaching and learning of science and technology are vital, particularly at the junior and senior secondary school levels, to foster national development. Basic Science, formerly known as integrated science, is a fundamental component of education in Nigeria, taught from primary through junior secondary levels. The curriculum aims to:

i. Cultivate interest in science and technology among learners.
ii. Equip students with fundamental knowledge and skills in science and technology.
iii. Enable students to apply scientific and technological knowledge to address societal needs.
iv. Provide students with opportunities for careers in science and technology (Basic Science and Technology Curriculum, BSTC, 2012).

Basic Science and Technology education at the junior secondary level serve as a foundation for further studies in core science subjects like Physics, Chemistry, and Biology (Arokoya and Obun, 2014). Mastery of Basic Science and Technology is crucial for students aspiring to pursue science-oriented courses at higher education levels.

Despite the significance of Science and Technology education, student achievement in the subject, both internally and externally, has been a cause for concern. To shed light on this issue, the researcher conducted a brief analysis of students' performance in basic science and technology in Ekiti State secondary schools between 2009 and 2019. The findings of this analysis are summarized in the table below:

Table 1: Summary of the analysis of students' performance in basic science and technology in Ekiti-state 2009-2019

YEAR	Number of Candidate	Number Passed	%	Number Failed	%
2009	16,590	16,306	98.28	284	1.71
2010	17,190	16,685	97.09	505	2.84
2011	19,201	18,430	95.98	771	4.02
2012	15,120	14,540	96.16	580	3.84
2013	18,211	18,211	100	-	-

2014	16,241	15,839	97.52	402	2.48
2015	20,930	20,400	97.47	530	2.53
2016	19,210	18,610	96.88	600	3.12
2017	14,148	13,828	97.74	320	2.26
2018	15,096	14,694	97.34	412	2.73
2019	18,164	17,792	97.95	372	2.05

Source: Ministry of Education Science and Technology, Ado Ekiti, Ekiti-State (2021)

A thorough examination of the student performance analysis depicted in the table above reveals that students demonstrated exceptional performance only in the year 2013, achieving a 100% pass rate. However, as noted by Adeoluwa (2013), true resolution of learning problems is attained when student performance reaches 100%, a benchmark yet to be achieved in the years under review.

Researchers have identified several factors that may hinder academic success in science instruction, including unfavorable environmental conditions, lack of relevant instructional materials, teachers' qualifications, and insufficient support from school management (Asubiojo & Aladejana, 2019). Nonetheless, the most significant factor highlighted by researchers is the adoption of ineffective and uninspiring teaching strategies by educators (Peter, 2017). Instructional strategies have long been a concern for teachers worldwide, with research indicating their potential contribution to subpar academic achievement. Therefore, instruction should prioritize a learner-centered approach over a teacher-centered one.

This study focuses on the utilization of video-tape instruction and peer-tutoring strategy. Video tape instruction involves the use of video tapes to deliver information, ideas, and experiences to learners (Shedrack & Robert, 2016). It serves as a potent tool to broaden communication channels between teachers and students, potentially enhancing learning outcomes (Ekom & Edem, 2015). Research by Agommuoh and Nzewi (2003) suggests that utilizing video-tape instruction in the classroom can increase the likelihood of student learning, retention, and overall achievement. Additionally, the incorporation of color, sound, and motion in video-taped instruction is appealing to learners, enhancing their engagement and comprehension (Owolabi & Ogini, 2014). Educational technologists also advocate for the high potential of video-taped instruction in the teaching and learning process (Abimbade, 2001).

Studies such as Ejimonye et al.'s (2020) research on the effect of videotaped and slide-taped instructions on students' performance in elementary school Mathematics have demonstrated the superiority of video-based instruction over traditional classroom methods. However, conflicting viewpoints exist in the research literature regarding the efficacy of instructional media, particularly in the context of basic science and technology. This suggests the need to carry out further research on the effects of video mediated instruction on students' Achievement in Basic Science and Technology.

On the other hand, tutoring involves knowledgeable individuals providing support to those with lesser skills in an interactive and organized manner. It has been observed that peer tutoring can be particularly beneficial for shy children, enabling them to share their thoughts freely and enhance their learning experience (Uyim & Nonye, 2019). Peer tutoring is a flexible instructional strategy where students serve as both tutors and tutees, aiming to improve academic performance through peer interaction (Adedejo, 2013).

Numerous studies, such as Offordile et al.'s (2021) investigation into the impact of peer tutoring on students' academic achievement in Physics, have highlighted the positive effects of peer tutoring on learning outcomes and socialization. Similarly, Njoku et al. (2020) found that peer tutoring significantly improved students' achievement in mathematics, with female students benefiting slightly more than their male counterparts. However, despite its advantages, peer tutoring programs may encounter challenges related to individual student differences and classroom behavior, emphasizing the need for structured and supervised implementation.

Given the potential benefits of both video-tape mediated instruction and peer tutoring, this study aims to explore their combined effects on academic achievement in Basic Science and Technology.

Statement of Problems

In recent years, there has been a noticeable decline in the comprehension and academic performance of students in Basic Science, both in internal assessments and external

examinations. This trend has raised significant concerns among stakeholders and individuals vested in education.

Basic Science serves as the foundational science subject for students at the junior basic level, laying the groundwork for their further studies in core science subjects at higher levels. Given its pivotal role, the underperformance of students in Basic Science poses a considerable obstacle to the advancement of science and technology in the country.

Various research studies have explored the factors contributing to students' poor achievement in Basic Science and Technology. Among these factors are the lack of effective instructional methods, insufficiently qualified Basic Science teachers, inadequate student engagement in laboratory activities, and insufficient support from school management. However, it is apparent that the instructional strategies employed by teachers may significantly influence student academic achievement in Basic Science and Technology.

Therefore, this study aims to investigate the potential impact of utilizing video-tape mediated instruction and peer tutoring strategies on the academic achievement of Basic Science and Technology students in secondary schools in Ekiti State, Nigeria. By exploring these instructional approaches, the research seeks to identify effective methods to enhance student learning outcomes in the subject.

Purpose of the Study

The primary aim of this research is to investigate the impact of video-tape mediated instruction and peer-tutoring approaches on the academic performance of secondary school students in Basic Science and Technology within Ekiti state, Nigeria. Specifically, the study aims to:

1. determine the mean achievement scores of students exposed to video-tape mediated instruction and traditional teaching methods in Basic Science and Technology.
2. determine the mean achievement scores of students exposed to peer-tutoring and traditional teaching methods in Basic Science and Technology.

3. assess the average achievement scores of students when exposed to both video-tape mediated instruction and peer-tutoring methods compared to each method individually in Basic Science and Technology.
4. investigate whether there is a significant difference in the achievement scores between male and female students when exposed to video-tape mediated instruction in Basic Science and Technology.

Research Questions

The following research questions were raised to guide the investigation:

1. Does a significant difference exist in the mean achievement scores of students exposed to video-tape mediated instruction compared to those taught using conventional techniques in Basic Science and Technology?
2. Will there be a significant difference in the mean achievement scores of students exposed to peer tutoring versus those taught using conventional techniques in Basic Science and Technology?
3. Is there a significant difference in the mean achievement scores of students exposed to both video-tape mediated instruction and peer-tutoring techniques compared to each approach individually in Basic Science and Technology?
4. Do male and female students exhibit a significant difference in mean achievement scores when exposed to video-tape mediated instruction in Basic Science and Technology?

Research Hypotheses

The following hypotheses were tested at the 0.05 level of significance:

1. There is no significant difference in the mean achievement scores of Basic Science and Technology students taught with video-tape mediated instruction compared to conventional techniques.
2. There is no significant difference in the mean achievement scores of Basic Science and Technology students taught with peer-tutoring strategy compared to conventional techniques.
3. There is no significant difference in the mean achievement scores of Basic Science and Technology students taught with both video-tape mediated instruction and peer-tutoring technique compared to each strategy individually.

4. There is no significant difference in the mean achievement scores of male and female students exposed to video-tape mediated instruction in Basic Science and Technology.

Research Method

The study employed a quasi-experimental design involving non-randomized, pre-test, post-test control groups. Treatments were administered at three levels: video-tape mediated instruction group, peer-tutoring group, and a combination of video-tape mediated instruction and peer-tutoring group, while the control group received no treatment. The target population comprised all Basic Two Science and Technology students in Ekiti State secondary schools. A sample of 240 Basic Two Science and Technology students was randomly selected and assigned to experimental and control groups.

Data collection utilized the Basic Science and Technology Achievement Test (BASTAT) the instrument comprising two sections. Section A gathered respondents' bio data, while Section B consisted of 40 multiple-choice questions assessing cognitive learning in basic science and technology. The instrument was validated by experts in test and measurement, as well as two experienced Basic Science and Technology teachers, yielding a reliability coefficient of 0.75.

A pre-test was administered to establish students' baseline knowledge and academic homogeneity across the four groups. Experimental groups were instructed using video-tape instruction, peer-tutoring, and a combination of both, while the control group received conventional instruction. A post-test was then administered, and mean and standard deviation were computed for each group to address the research questions. Null hypotheses were tested at the 0.05 level of significance using inferential statistics, including t-tests and analysis of covariance (ANCOVA).

RESULTS

Research Question 1: Does a significant difference exist in the mean achievement scores between students instructed through video-tape mediated methods versus conventional techniques in Basic Science and Technology?

Table 2: Mean achievement scores comparison between students instructed via video tape mediated instruction and conventional techniques in Basic Science and Technology

Teaching Strategies	N	Pretest		Posttest	
		Mean	SD	Mean	SD
video tape instruction	60	13.85	2.67	25.75	1.68
Conventional	60	14.05	2.45	12.40	1.75

Table 2 displays the average achievement scores of students instructed through video-tape mediated techniques compared to conventional methods in Basic Science and Technology. The findings reveal that prior to treatment, students in the video-tape mediated instruction group had a mean achievement score of 13.85, while those in the conventional group scored 14.05. Following treatment, the video-tape mediated instruction group exhibited a higher mean achievement score of 25.75 compared to the conventional group's mean score of 12.40. This indicates a disparity in the mean achievement scores between students taught with video-tape mediated instruction and those taught through conventional methods in Basic Science and Technology.

Research Question 2: Is there a significant difference in the mean achievement scores between students exposed to peer tutoring and those taught through conventional techniques in Basic Science and Technology?

Table 3: Mean achievement scores comparison between students instructed via peer tutoring and conventional methods in Basic Science and Technology.

Teaching Strategies	N	Pretest		Posttest	
		Mean	SD	Mean	SD
Peer tutoring	60	13.53	2.27	27.80	1.88
Conventional	60	14.05	2.45	12.40	1.75

Table 3 displays the average achievement scores of students instructed through peer-tutoring strategy compared to conventional methods in Basic Science and Technology. The findings reveal that before treatment, students in the peer-tutoring group had a mean achievement score of 13.53, while those in the conventional group scored 14.05. Following treatment, the peer-tutoring group exhibited a higher mean achievement score of 27.80 compared to the conventional group's mean score of 12.40. This suggests a difference in the mean

achievement scores between students taught with peer-tutoring and those instructed through conventional methods in Basic Science and Technology.

Research Question 3: Is there any significant difference in the mean achievement scores of students exposed to both video-tape mediated instruction and peer-tutoring techniques over the individual strategy in Basic science and technology?

Table 4: Mean achievement scores of students taught with both video-tape instruction and peer-tutoring and individual strategy of video tape instruction and peer-tutoring in Basic Science and Technology

Teaching Method	N	Pretest		Posttest	
		Mean	SD	Mean	SD
Video tape instruction	60	13.85	2.67	25.75	1.68
Peer-tutoring	60	13.53	2.27	27.80	1.88
Video tape instruction + Peer tutoring	60	13.32	2.40	31.82	1.62

Table 4 illustrates the average achievement scores of students undergoing various instructional methods in Basic Science and Technology. Prior to any treatment, students exposed to both video-tape mediated instruction and peer tutoring strategies had a mean score of 13.32, while those in the individual strategy groups scored 13.85 and 13.53 respectively. Upon receiving treatment, students taught with both methods achieved the highest mean score of 31.82, followed by those in the peer-tutoring group (mean=27.80) and the video-tape mediated instruction group (mean=25.75),. These findings suggest a significant difference in mean achievement scores among the instructional approaches employed.

Research Question 4: Is there a significant difference in the mean achievement scores between male and female students exposed to video-tape mediated instruction in Basic Science and Technology?

Table 5: Mean achievement scores of students instructed with video tape instruction, categorized by gender.

Gender	N	Pretest		Posttest	
		Mean	SD	Mean	SD
Male	19	12.79	2.82	25.84	2.36
Female	41	14.34	2.48	25.71	1.29

Table 5 displays the average achievement scores of male and female students who underwent video-tape mediated instruction in Basic Science and Technology. Prior to any intervention, male students had a mean score of 12.79, while female students scored 14.34. After receiving treatment, male students achieved a mean score of 25.84, and female students achieved a mean score of 25.71. These results suggest that there is no significant difference in the mean achievement scores between male and female students taught with video-tape mediated instruction in Basic Science and Technology.

Hypothesis Testing

Hypothesis 1: There is no significant difference in the mean achievement scores of Basic Science and Technology students instructed through video-tape mediated instruction compared to conventional techniques.

Table 6: Analysis of Covariance (ANCOVA) for students' achievement in video-tape mediated instruction and conventional groups.

Source	SS	Df	MS	F	Sig.	Partial Eta^2
Corrected Model	5348.404	2	2674.202	904.490	.000	.939
Intercept	1303.041	1	1303.041	440.725	.000	.790
Covariate (Pretest)	1.729	1	1.729	.585	.446	.005
Group	5345.953	1	5345.953	1808.150	.000	.939
Error	345.921	117	2.957			
Total	49357.000	120				
Corrected Total	5694.325	119				

$^{*}p< 0.05$

Table 6 displays the difference in the mean achievement scores of students instructed through video-tape mediated instruction and conventional methods in Basic Science and Technology. The analysis yielded a computed F-value of 1808.150 with degrees of freedom 1 and 117, which was statistically significant at the $p<0.05$ level. Consequently, the null hypothesis was rejected, indicating a significant difference in the mean achievement scores between students taught with video-tape mediated instruction and those taught through conventional methods in Basic Science and Technology. The treatment accounted for approximately 93.9% of the observed variance in the mean achievement scores (Eta2 =

0.939). Further details regarding the mean differences among the estimated marginal means descriptive statistics of the groups, post-adjustment for other effects in the model, are provided in Tables 7.

Table 7: Estimated Marginal Means for Treatment on achievement scores of students in Basic Science and Technology

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
video-tape mediated instruction	25.755	.222	25.315	26.195
Control	12.395	.222	11.955	12.835

Table 7 illustrates that students instructed through video-tape mediated instruction achieved higher estimated marginal mean scores in Basic Science and Technology compared to their counterparts in the conventional group. Additionally, the results indicate a significant mean difference in achievement scores between students exposed to video-tape mediated instruction (mean = 25.755) and those in the conventional group (mean = 12.395).

Hypothesis 2: There is no significant difference in the mean achievement scores of Basic Science and Technology students instructed with peer-tutoring strategy compared to conventional techniques.

Table 8: Analysis of Covariance (ANCOVA) for students' achievement in Peer-tutoring and conventional groups.

Source	SS	Df	MS	F	P	Partial Eta^2
Corrected Model	7115.026	2	3557.513	1073.381	.000	.948
Intercept	1323.665	1	1323.665	399.379	.000	.773
Covariate (Pretest)	.226	1	.226	.068	.794	.001
Group	7037.972	1	7037.972	2123.513	.000	.948
Error	387.774	117	3.314			
Total	55984.000	120				
Corrected Total	7502.800	119				

$^{*}p< 0.05$

Table 8 demonstrates the difference in the mean achievement scores of students instructed with peer tutoring and conventional methods in Basic Science and Technology. The analysis yielded a computed F-value of 2123.513 with degrees of freedom 1 and 117, which was

statistically significant at the $p<0.05$ level. Consequently, the null hypothesis was rejected, indicating a significant difference in the mean achievement scores between students taught with peer-tutoring and those taught through conventional methods in Basic Science and Technology. The treatment accounted for approximately 94.8% of the observed variance in the mean achievement scores (Eta2 = 0.948). Further details regarding the mean differences among the estimated marginal means descriptive statistics of the groups, post-adjustment for other effects in the model, are provided in Table 9

Table 9: Estimated Marginal Means for Treatment on achievement scores of students in Basic Science and Technology

Group	**Mean**	**Std. Error**	**95% Confidence Interval**	
			Lower Bound	**Upper Bound**
Peer tutoring	27.805	.236	27.338	28.272
Control	12.395	.236	11.928	12.862

The findings in Table 9 indicate that students instructed through Peer tutoring achieved higher estimated marginal mean scores in Basic Science compared to their counterparts in the conventional group. Furthermore, the results reveal a significant mean difference between the achievement scores of students subjected to peer tutoring instructional strategy (mean = 27.807) and those using the conventional method (mean = 12.395).

Hypothesis 3: There is no significant difference in the mean achievement scores of students taught with both video-tape mediated instruction and peer-tutoring technique compared to the individual strategy in Basic Science and Technology.

Table 10: Analysis of Covariance (ANCOVA) for students' achievement taught with both video-tape mediated instruction and peer-tutoring strategies and the individual strategy.

Source	**SS**	**Df**	**MS**	**F**	**P**	**Partial Eta^2**
Corrected Model	1143.752	3	381.251	126.869	.000	.684
Intercept	4405.797	1	4405.797	1466.121	.000	.893
Covariate (Pretest)	.941	1	.941	.313	.577	.002
Group	1139.995	2	569.998	189.679	.000	.683
Error	528.892	176	3.005			
Total	147422.000	180				
Corrected Total	1672.644	179				

****p< 0.05***

Table 10 depicts the difference in the mean achievement scores of students instructed with both video-tape mediated instruction and peer-tutoring, as well as the individual strategy of video-tape mediated instruction and peer-tutoring in Basic Science and Technology. The analysis yielded a computed F-value of 189.679 with degrees of freedom 2 and 176, which was statistically significant at the $p<0.05$ level. Consequently, the null hypothesis was rejected, indicating a significant difference in the mean achievement scores among students taught with both video-tape mediated instruction and peer-tutoring, and those using the individual strategy of video-tape mediated instruction and peer-tutoring in Basic Science and Technology. The treatment accounted for approximately 68.3% of the observed variance in the mean achievement scores (Eta2 = 0.683). Further details regarding the mean differences among the estimated marginal means descriptive statistics of the groups, post-adjustment for other effects in the model, are provided in Table 11.

Table 11: Estimated Marginal Means for Treatment on achievement scores of students in Basic Science and Technology

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Video-tape mediated instruction	25.742	.224	25.299	26.184
Peer tutoring	27.801	.224	27.359	28.243
Video-tape mediated instruction + Peer tutoring	31.824	.224	31.382	32.267

Upon initial inspection of Table 11, it is evident that students instructed with both video tape mediated instruction and peer-tutoring achieved the highest estimated marginal mean scores in Basic Science (mean = 31.824), followed closely by those exposed to the individual strategy of peer-tutoring (mean = 27.801), and video-tape mediated instruction (mean = 25.74).

Hypothesis 4: There is no significant difference in the mean achievement scores of male and female students exposed to video-tape mediated instruction in Basic Science and Technology.

Table 12: Analysis of Covariance (ANCOVA) for students' achievement in video-tape mediated instruction group by gender.

Source	SS	Df	MS	F	P	Partial Eta^2
Corrected Model	3.120	2	1.560	.542	.585	.019
Intercept	1227.889	1	1227.889	426.427	.000	.882
Covariate (Pretest)	2.884	1	2.884	1.001	.321	.017
Gender	.866	1	.866	.301	.585	.005
Error	164.130	57	2.879			
Total	39951.000	60				
Corrected Total	167.250	59				

p> 0.05

Table 12 displays the disparity in the mean achievement scores of male and female students instructed with video-tape mediated instruction in Basic Science and Technology. The analysis resulted in a computed F-value of 0.301 with degrees of freedom 1 and 57, which was not statistically significant at the p>0.05 level. Therefore, the null hypothesis was not rejected, indicating no significant difference in the mean achievement scores of male and female students taught with video-tape mediated instruction in Basic Science and Technology. Additionally, less than 1% of the observed variance in the mean achievement scores (Eta2 = 0.005) can be attributed to gender.

Discussion

The study aimed to explore the effects of video-tape mediated instruction and peer tutoring strategy on secondary school students' achievement in Basic science and technology, employing a pretest-posttest equivalent group design. Prior to treatment, a pretest was administered in previously covered areas of Basic science and technology.

The findings of the study indicate that when students were taught Basic science and Technology using interactive methods like video-tape mediated instruction and peer tutoring, they performed significantly better than when taught using conventional methods. Additionally, there was a significant difference in the mean achievement scores of students taught with both video tape mediated instruction and peer tutoring strategy concurrently compared to when using individual strategies alone in Basic Science and Technology. A brief examination of the estimated marginal means in Table 11 reveals that students instructed with both video-tape mediated instruction and peer tutoring achieved the highest

estimated marginal mean score of 31.824 in Basic science and technology, compared to those using the individual strategy of peer tutoring (27.801) and video-tape instruction (25.742). These findings align with previous studies by Agommuh and Nzewi (2003), Vassary (2010), and Offordile et al. (2021), affirming that students taught using video-tape mediated instruction and peer tutoring techniques outperform those taught using conventional methods.

Conclusion

The results suggest that exposing students to both video-tape mediated instruction and peer tutoring strategies significantly enhances their performance in Basic science and technology compared to using individual strategy. However, it was also observed that students exposed to the individual strategies of peer tutoring and video tape instruction performed better than those taught using conventional methods in Basic science and technology.

Recommendations

Based on the findings, the following recommendations are proposed:

1. Teachers should incorporate video-tape mediated instruction and peer tutoring strategies in teaching Basic science and technology and other related science courses, as it has been proven to enhance students' achievement in the subject.
2. Teachers overseeing peer tutoring sessions should implement a reward system to reinforce and motivate students' task behavior and participation.
3. Stakeholders in Basic science and technology education should organize regular seminars, workshops, and conferences to equip teachers with the necessary skills to effectively utilize video-tape mediated instruction and peer - tutoring strategies in lesson delivery.
4. While peer tutoring was found to be productive as an instructional strategy, it may be more effective if used as a supplementary and supporting instructional technique rather than the primary method.
5. Authors of Basic science and technology textbooks should present concepts using video tape mediated instruction and peer-tutoring strategies to enhance student engagement and understanding.

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