KIU Journal of Education (KJED)

Volume 5 Issue 1
Page 1 - 7

April – May 2025
https://kjed.kiu.ac.ug/

Perspectives of University Science Students on the influence of peer tutoring on Academic Performance and Critical Thinking Skills Acquisition

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Abstract

Peer tutoring has been found to improve secondary school students' academic performance; however, studies are scarce on higher education students. The focus of this study was the perception of science undergraduates on the influence of peer tutoring on academic performance and the acquisition of critical thinking skills. Four research questions guided the study, and two null hypotheses were tested. The study adopted a descriptive survey design. A simple random sampling technique was used to select the study sample. Structured questionnaires were administered to 250 students from two universities in Lagos State, however, only 224 (89.6%) were returned. The data collected were analysed using descriptive statistics, while the hypotheses were tested using inferential statistics. The findings showed that only a few university science students engage in peer tutoring regularly; many do not engage in peer tutoring at all, while some engage occasionally. Also, a high percentage of the students agreed that peer tutoring influences academic performance positively. Furthermore, it was deduced that there was a significant relationship between the extent of involvement in peer tutoring and the acquisition of critical thinking skills. It is recommended that university faculties, through the course advisers, should encourage their students to engage in peer tutoring with the many benefits associated with it.

Keywords: Science students, Peer tutoring, Academic performance, Skills acquisition, Undergraduates

Introduction

Academic performance and acquisition of skills are major goals of education at different levels. Therefore, many strategies have been engaged in attaining academic excellence among students in preparing them for living within the society gainfully after school. Academic performance is seen as the extent to which the learners can achieve the goals and objectives stated in the national curriculum of the topics in each subject. Goshi (2020) viewed academic performance as the knowledge gained by learners, and this is assessed by a teacher when marks are awarded.

Peer tutoring has been a strategy that has been used in various forms among school children. It is a strategy that has been found to bring about interactions among students. It can be used by teachers in the classroom to guide students in learning and also to provide insights into how students learn. Peer tutoring can be structured or unstructured. The structured is used as a teaching strategy by the teachers and students while the unstructured has the arrangement within the learners involved. In a structured peer tutoring class of elementary and secondary school learners, the teacher can group the learners using their ability, where a low-achieving learner is paired with a high-achieving learner. The high-achieving learner serves as the 'tutor,' while the low-achieving learner serves as the 'tutee' (Okeke and Okoye, 2023).

There are various benefits of peer tutoring. The benefits are often mutual, as both the tutor and the tutee share in the learning process. Okunuga and Nwafor (2022) opined that peer influence can be used as a driving force, which can bring about enhanced performance of the learners within the social group. Moreover, young learners, according to Peireira, Fillol, and Moura (2019), can use peer learning as an informal way of accessing knowledge even with the use of digital tools outside of school settings. Various skills have been observed to be acquired through peer interactions as they engage in the teaching-learning process. The positive and significant influence of peer tutoring on social skills, critical thinking, communication skills, and problem-solving have been observed to be acquired by students that engaged in peer tutoring (Pasion and Marcelo, 2024; Okunuga and Nwafor, 2022; Okunuga, Awofala and Osarenren, 2020)

Statement of the Problem

Peer tutoring, though found to be of benefit to students and teachers, has been besotted by many challenges. One of such is the advent of the internet, many search engines and social media that have made interactions between people to be on the low side. It is, therefore, pertinent to look at the perception of university undergraduates towards the influence of peer tutoring on their academic performance and critical thinking skills acquisition.

Peer tutoring, also known as peer teaching, has been used extensively as a structured instructional strategy where the teacher is involved in the teaching-learning process. Most of the studies that have been carried out are quasi-

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experimental research designs and majorly with secondary and primary school students. The use of unstructured peer tutoring by young adults such as tertiary institution students is expected. However, very few research on tertiary institution students' involvement with peer tutoring has been carried out. This study, therefore, seeks to use the perception of university students to provide feedback on the influence of peer tutoring on academic performance and critical thinking skills acquisition.

Theoretical Framework

Vygotsky's social cognitive theory

In his theory of social cognitive development, Vygotsky described the categories of development of learners based on cultural and social interactions. This study is hinged on the theory of Zone of Proximal Development (ZPD). Vygotsky (1978) stated that learners can learn from each other as they interact, thereby solving problems. He noted that factors such as social interactions with mutual communications and proper directions from teachers lead to learning among students. This is in support of peer tutoring, which is an indication that the academic performance of learners can be improved in a collaborative classroom. Peer instruction allows students to help one another in their ZPD as another student has a slightly more advanced understanding of the topic. The peer support that takes place will get the student to transition from what he is capable of doing into doing something possible with peer support (Vygotsky, 1978).

Purpose of the Study

The main purpose of the study is to examine the perspectives of university science undergraduate students on the influence of peer tutoring on academic performance and the acquisition of critical thinking skills. The specific objectives were to:

1) determine the extent to which science undergraduates engage in peer tutoring;
2) find the extent to which university science students engage in peer tutoring based on gender;
3) examine the perception of science undergraduates on the influence of peer tutoring on academic performance; and
4) examine the perception of science undergraduates on the influence of peer tutoring on the acquisition of critical thinking skills.

Research Questions

1) To what extent do university science undergraduate students engage in peer tutoring?
2) To what extent do male and female university science students engage in peer tutoring?
3) What are the perceptions of science undergraduates on the influence of peer tutoring on academic performance?
4) What are the perceptions of science undergraduates on the influence of peer tutoring on the acquisition of critical thinking skills?

Research Hypotheses

This research tested the following null hypothesis

1) There is no significant difference in the perception of male and female science undergraduates on the influence of peer tutoring on academic performance
2) There is no significant relationship between the extent of engaging in peer tutoring and the acquisition of critical thinking skills

Literature Review

Peer interactions for academic purposes have been given different terms such as peer teaching, peer tutoring, or peer instruction. In whatever way it is coined, it describes the interactions between peers for learning purposes. Peer tutoring has been found to improve academic performance and skills among young learners. Okunuga and Nwafor (2022) found that secondary school chemistry students engaged more in the use of reciprocal peer teaching than class-wide and cross-age peer teaching strategies.

Peer Tutoring and Academic Performance

The study of Ullah, Tabassum, and Kaleem (2018) showed that peer tutoring enhanced the academic achievement of secondary school biology students taught with the peer tutoring teaching strategy significantly when compared with those taught with the conventional lecture and demonstration methods. Peer tutoring also had a significant effect on biology students' knowledge, comprehension, and application levels of the cognitive domain. Kiewra, Kauffman, and Shi (2017) also reported that peer teaching brought about an improvement in the academic performance of students in Biology. Okunuga and Adeleke (2024) found that the peer instruction strategy brought about an improvement in the achievement of secondary school students in chemistry. They found further that students showed positive attitude towards peer instruction strategy, therefore recommended that it should be incorporated into the teaching and learning strategies used in the teaching of chemistry, an abstract and experimental science. This means that peer tutoring can be used extensively and across science subjects.

Pasion and Marcelo's (2024) findings showed that there was a significant improvement in achievement, understanding, and problem-solving skills acquisition of students engaged with peer tutoring in mathematics, especially in areas found to be difficult, such as sequences, polynomials, and polynomial equations. When students have high expectations in the peer instructional strategy and all the benefits associated with the use, they tend to perform better than those who do not have. Ugo and Oliweh (2024) reported that peer teaching offered mathematical students a friendly learning environment, which led to improved performance in mathematics achievement tests given to them. Pasion and Marcelo (2024) also found a positive correlation between academic performance and students' perceived benefits from peer tutoring. Considering the arts subjects, Guerrero, Urdiales, Villarreal, Castro, & Martínez

(2018), in their study, found the use of peer tutoring as a teaching and learning strategy to improve the achievement of low-performing students significantly in English Language. Okeke and Okoye (2023) discovered that the use of class-wide peer tutoring among university business education students enhanced academic achievement in spreadsheets when compared to the achievement of those taught using the traditional method. Peer tutoring has been advocated to be one of the instructional strategies in primary and secondary schools (Okunuga and Adeleke (2024); Pasion and Marcelo (2024); Ullah, Tabassum, and Kaleem (2018)). Further research on peer instruction describes how it encourages students to collaborate and discuss concepts, allowing them to journey through their ZPD (Erdogan & Mufutau, 2020).

Peer Tutoring and Skills Acquisition

Students who can build up arguments and construct their knowledge of a subject matter are perceived by Okunuga, Awofala, and Osarenren (2020) to exercise critical thinking skills, which can further be developed as students engage in peer tutoring. In this vein, Awofala, Ojo, Okunuga, Babajide, Olabiyi, and Adenle (2019) were of the view that learners put their brains to work. Peer tutoring has also been found to improve the acquisition of skills among learners. Different studies have shown that divers' skills can be enhanced if peer tutoring is gainfully used by teachers. Peer learning improved cooperation and interpersonal skills among students (Carvalho and Santos, 2019). Okunuga and Nwafor (2022) found that peer tutoring helped in improving social skills and influenced the acquisition of communication skills, which is one of the 21st century skills while Pasion and Marcelo (2024), in their study found that secondary school mathematics students, engaged in peer tutoring, showed a strong positive correlation between academic performance and critical skill, communication skills, social skills and problem-solving skills acquisition.

Peer Instruction and Gender

Gender differences have been observed in science, Technology, Engineering, and Mathematics. It has been shown that women are underrepresented in positions in the workplace. Peer instruction is proposed as an instructional strategy that can bring about a reduction in gender differences and improve the academic performances of females due to the friendly learning environment it presents to learners (Osim, 2020; Iwuanyanwu, 2019). Peer tutoring has been perceived to encourage the development of self-confidence and cultivate critical thinking values, bringing about cooperation instead of competition among peers (Oluwatoyin and Abiola, 2021; Ogunyemi, Ajayi and Isola, 2020).

Methodology

The study adopted a descriptive survey research design to investigate the perception of science students on the influence of peer tutoring on their academic performance as well as the extent to which it influences the acquisition of innovative skills.

The population of the study consists of university science and science education students from two universities in Lagos state, Nigeria. The research instrument was a structured questionnaire to elicit information from the students. The questionnaire was reviewed, and the reliability coefficient was found to be 0.82. This is high and an indication that the questionnaire is reliable. The questionnaires were administered by two research assistants. Two hundred and fifty (250) science undergraduates were randomly selected and administered with the questionnaire. A total of 224 (89.6%) respondents filled out and returned valid questionnaires. The data collected from the responses of the science students to the questionnaire were statistically analysed using frequencies, means, and standard deviations to answer the research questions, while the hypotheses were tested using non-parametric correlation statistics.

Analysis and Results

The data analysis was carried out using descriptive statistics, independent sample tests, and non-parametric correlation statistics. The data were verified and found to have satisfied all statistical assumptions required for a non-parametric correlation analysis.

Results

1) To what extent do science undergraduate students engage in peer tutoring?

To determine the extent to which science undergraduate students engage in peer tutoring, science students' responses to the items on if they engage in peer tutoring and the extent to which they do were used to answer this question. This is shown in Table 1

Table 1: Science undergraduates' engagement with peer tutoring

Extent of engaging in peer tutoring	Frequency	Percent	Mean	Std. Deviation
Often	22	9.8		
Sometimes	44	19.6		
Rarely	85	37.9		
Never	73	32.6		
Total	224	100		
Mean			2.0670	.95644

Table 1 shows that 32.6% of university science undergraduate students never engaged in peer tutoring, whereas 67.4% engaged in peer tutoring at various levels. However, only 9.8% of the students engaged extensively in peer tutoring, while the majority (37.9%) of the students only engaged in peer tutoring once in a while.

The mean value of 2.07 indicates that the extent of engagement of university science students in peer tutoring is only on average. This low mean value is, however, a result of the 32.6% of the science students that never engaged in peer tutoring. This is also represented in a bar chart in Figure 1.

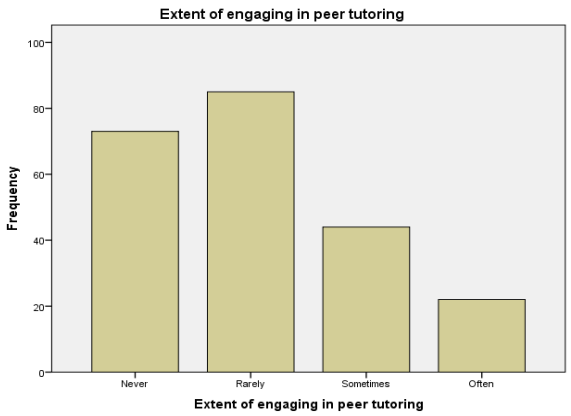

Figure 1: Extent of students' engagement in peer tutoring

2) To what extent do male and female science undergraduate students engage in peer tutoring?

Table 2: Science undergraduates' engagement with peer tutoring based on gender

Extent of engaging in peer tutoring * Gender Crosstabulation

Extent of engaging in peer tutoring		Gender		Total
		Male	Female	
Never	Count	25	48	73
	% within Gender	30.50%	33.80%	32.60%
Rarely	Count	31	54	85
	% within Gender	37.80%	38.00%	37.90%
Sometimes	Count	15	29	44
	% within Gender	18.30%	20.40%	19.60%
Often	Count	11	11	22
	% within Gender	13.40%	7.70%	9.80%
Total	Count	82	142	224
	% within Gender	100.00%	100.00%	100.00%

Table 2 above shows that the percentages of male and female Science undergraduates who never engaged in peer tutoring are respectively 30.5% and 33.8%, which are close to each other. This implies that, on average, over 60% of the Science undergraduates engaged in peer tutoring across gender. The percentages of those who engage in peer tutoring at different extents are also close to each other except for those who engage often in peer tutoring where male has 13.4% and females have only 7.7%. This is an indication that male students often engage more in peer tutoring as compared to their female counterparts.

3) What are the perceptions of science undergraduates on the influence of peer tutoring on academic performance?

Table 3: Descriptive Statistics of students' perspectives on the influence of peer tutoring on academic performance

Extent of engaging in peer tutoring		Gender		Total
		Male	Female	
Never	Count	25	48	73
	% within Gender	30.50%	33.80%	32.60%
Rarely	Count	31	54	85
	% within Gender	37.80%	38.00%	37.90%
Sometimes	Count	15	29	44
	% within Gender	18.30%	20.40%	19.60%
Often	Count	11	11	22
	% within Gender	13.40%	7.70%	9.80%
Total	Count	82	142	224
	% within Gender	100.00%	100.00%	100.00%

The mean values in Table 3 show that university science students perceived that peer tutoring has a positive influence on academic performance. However, the mean value of 2.64 for the item on 'best students engage in peer tutoring' is less than 3.00, which is an indication that some of the students think that the best students in the class do not necessarily engage in peer tutoring.

To determine if there is any significant difference in the perception of males and females concerning the influence of peer tutoring on academic performance, the following hypothesis was postulated and tested.

Hypothesis

H_0: There is no significant difference in perception of male and female science undergraduates on the influence of peer tutoring on academic performance

Table 4a: Non-Parametric Correlation Analysis

Spearman's rho		Gender	Peer tutoring on Academic performance
Gender	Correlation Coefficient	1	-0.074
	Sig. (2-tailed)	.	0.27
	N	224	224
Peer tutoring on Academic performance	Correlation Coefficient	-0.074	1
	Sig. (2-tailed)	0.27	.
	N	224	224

Table 4b: Hypothesis Test Summary

Null Hypothesis	Test	Sig	Decision
The distribution of peer tutoring on academic performance is the same across categories of gender	Independent samples Mann Whitney U Test	0.269	Retain the null hypothesis

The significance level is 0.05.

From the non-parametric correlation analysis in Table 4a between the dependent variable, Peer tutoring on academic performance, and the independent variable, Gender, a non-significant value of 0.270 was obtained. This implies the acceptance of the null hypothesis. This is also confirmed in Table 4b by the Mann-Whitney U test with a non-significant value of 0.269 at 95% confidence interval. Hence, the perception of male and female science undergraduates on the influence of peer tutoring on academic performance are

the same, and by Table 3, both genders perceived that peer tutoring influences academic performance.

4) **What are the perceptions of science undergraduates on the influence of peer tutoring on the acquisition of critical thinking skills?**

Table 5: Rating of level of critical thinking skills

Level of skills	Frequency	Percent	Mean
High	75	34.6	
Average	135	62.2	
Low	7	3.2	
Missing	7		
Total	224	100	
Statistic			2.3134

Table 5 shows that the majority of university science students rated themselves average (62.2%) on their level of critical thinking skill. This is further confirmed by the mean value of 2.313 on a scale of 1-3.

Table 6: Extent of Peer tutoring on critical thinking skills acquisition

Extent of peer tutoring on critical thinking skills	Frequency	Percent	Mean
Very Great extent	28	13.0	
Great Extent	109	50.5	
Little Extent	76	35.2	
Not at All	3	1.4	
Missing	8		
Total	224	100	
Statistic			2.7500

From Table 5, we observed that 13.0% and 50.5% of science students agreed that peer tutoring has a very great extent and great extent influence, respectively, on critical thinking skills acquisition of science undergraduate students. This is illustrated in the bar chart in Figure 2

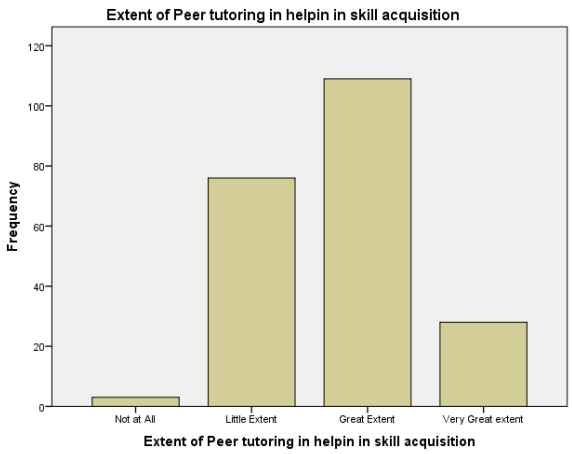

Figure 2: Extent of influence of Peer Tutoring on skill acquisition

Further analysis in the objective of this research was to consider the relationship between the extent of engaging in peer tutoring and critical thinking skills acquisition. The hypothesis to test is stated as follows:

Hypothesis

H_0: There is no significant relationship between the extent of engaging in peer tutoring and the acquisition of critical thinking skills.

This hypothesis is tested using a non-parametric correlation analysis as given in Table 7.

Table 7: Non-Parametric Correlation Analysis

Spearman's rho		Extent of engaging in PT	Rating level of CT skill acquisition	Extent of PT in helping in CT skill acquisition
Extent of engaging in PT	Correlation Coefficient	1	0.104	.230**
	Sig. (2-tailed)	.	0.128	0.001
	N	224	217	216
Rating level of CT skill acquisition	Correlation Coefficient	0.104	1	.389**
	Sig. (2-tailed)	0.128	.	0
	N	217	217	216
Extent of PT in helping in CT skill acquisition	Correlation Coefficient	.230**	.389**	1
	Sig. (2-tailed)	0.001	0	.
	N	216	216	216

**. Correlation is significant at the 0.01 level (2-tailed).

The p-value of 0.001, which is significant, indicates that the extent of engaging in peer tutoring has a significant relationship with the acquisition of critical thinking skills by university science students. Hence, we reject the null hypothesis and accept the alternative hypothesis. We also observed that the p-value, 0.128, which is a non-significant statistical value, shows that there is no relationship between the extent of engaging in peer tutoring and how the students perceived their level of skill acquisition.

Discussion of Findings

The findings of this study reveal that university science students, on average, engage in peer tutoring, though some responded that they had never taken part in it. Among those that engage in peer tutoring, only very few engage in it often; most of them engage in peer tutoring once in a while. This can be expected as university students in Lagos state are not all given hostel accommodation on the university campus where meaningful interaction can take place at evening hours after the day's lectures. This can lead to students coming to school only when they have lectures. There may be the need for further research to determine the factors determining the engagement of university students in peer tutoring.

The level at which university science students engage in peer tutoring is not gender biased. However, according to this study, male students tend to engage in peer tutoring more often than female students.

The respondents agree that peer tutoring positively influences academic performance as well as the acquisition of critical thinking skills. This is in agreement with various

quasi-experimental studies reported in literature (Okunuga and Adeleke (2024); Pasion and Marcelo (2024); Okeke and Okoye (2023); Ullah, Tabassum and Kaleem (2018); Guerrero *et al.* (2018), though these were majorly carried out with secondary school students. Peer tutoring has been revealed to influence skills acquisition. The acquisition of skills is also supported by Okunuga, Awofala, and Osarenren (2020)

The finding also showed that the perspectives of science undergraduates fall in line with Vygotsky's (1978) theory of Zone of Proximal development (ZPD). This is an indication that peer tutoring can be used to improve tertiary institution students' academic performance. This performance can be enhanced more if undergraduate students are allowed to engage in structured peer tutoring. The results from the study of Erdogan and Mufutau (2020) also supported the theory of ZPD as it relates to peer teaching, especially in STEM.

Both male and female science undergraduates' perceptions of the influence of peer tutoring on academic performance are the same. However, female students need to be encouraged to participate more in peer tutoring to bring about the building of self-confidence and acquisition of critical thinking skills, based on the study of Oluwatoyin and Abiola (2021).

Conclusion

The study investigated the perspectives of undergraduates on the influence of peer tutoring on academic performance and critical thinking acquisition. It can be inferred from the findings of the study that peer tutoring leads to improved academic performance and the acquisition of critical thinking skills among university science students. Therefore, university science students should be encouraged to engage more regularly in structured peer tutoring to enhance their academic performance.

Recommendations

From the findings of this study, it can be recommended that there is a need to engage university science students in structured peer tutoring. This can be organised by the faculty through their course advisers, especially with students in 100 and 200 levels. Students can then be encouraged to continue with unstructured peer tutoring at higher levels.

Female university science students should be encouraged to engage in peer tutoring more regularly to be partakers of the benefits of peer tutoring.

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