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Science Teachers' Perceptions of Factors Influencing Senior School Students' Performance in STEAM

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ABSTRACT

The perspectives maintained by scientific educators concerning the factors that influence the academic performance of senior high school students in the domains of STEAM have a significant impact on shaping the educational landscape in Kwara State, Nigeria. By addressing the existing limitations in research and comprehending the intricacies that affect students' accomplishments in STEAM subjects, educational practitioners and policymakers possess the potential to implement focused interventions aimed at augmenting the calibre of instruction and fostering a workforce that is well-prepared for the future. This study investigated science teachers' perceptions of factors influencing senior school students' performance in STEAM in Kwara State, Nigeria. This study was descriptive research of a survey type. A purposive sampling technique was used to select 81 science teachers from Kwara State. Four research questions were generated and answered using frequency count and percentage while three hypotheses formulated were tested using Chi-square at 0.05 level of significance. The instrument used was the researcher-designed titled Teachers Perception Factors Affecting Students' Performance Questionnaire (TPFASPQ). Findings revealed that there was a significant difference between science teachers' perceptions of factors influencing students' performance in STEAM based on academic qualification, teaching experience and school location. The study concluded that language barriers and

ARTICLE INFO

Article History:
Submitted/Received 24 July 2023
First Revised 28 November 2023
Accepted 7 December 2023
First Available online 18 December 2023
Publication Date 26 December 2023

Keyword:
Science Teachers' Perception,
Factors influencing,
Students' performance,
STEAM

occasional pregnancy among female students are some of the social and cultural issues influencing their performance in STEAM. The study recommended that the government should make available standard laboratories and adequate equipment to enable effective teaching of STEAM and also school administrators should employ qualified science teachers and organize in-service training for the teachers.

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1. INTRODUCTION

STEAM education is an interdisciplinary strategy that combines Science, Technology, Engineering, Arts and Mathematics. It is an essential component of the educational system of the twenty-first century that equips students to become more technologically advanced. To promote STEAM education in schools, science teachers are essential. They are in charge of giving students the information and abilities required for success in STEAM fields. Therefore, it is critical to comprehend how science teachers in Kwara State view the factors that affect senior school learners' performance in STEAM.

In Nigeria, interest in STEAM education has grown over the past years and Kwara State has been at the forefront of these initiatives. The examination of STEAM education and its accompanying obstacles in Kwara State possesses considerable importance, given the potential impact it may exert on the prospects of students, the economic prosperity of the state, and its standing in the global arena. By addressing these challenges, those invested in the subject can strive towards establishing an educational environment that imparts the requisite skills and knowledge to students, enabling them to flourish in STEAM disciplines and ultimately contributing to the overall advancement and triumph of the state. Students' progress in higher education and the workforce will be directly impacted by how well they succeed in STEAM topics. The opinions of science teachers regarding the elements affecting senior school students' STEAM performance in Kwara State are crucial to comprehend. It's crucial to remember that the opinions of science teachers in Kwara State, Nigeria, may differ depending on their background, the environment, and the particular opportunities and difficulties the area presents.

Teachers' academic qualification is one of the critical factors that drive students' academic performance. Teachers' academic qualification is a particular skill or type of knowledge and experience teachers possess that makes him or her suitable to teach. Teachers' qualification could therefore mean all the skills a teacher requires to teach effectively. Owolabi and Adebayo (2012) examined the effect of teacher's qualification on the performance of senior secondary school students in physics, the study revealed that students taught by teachers with higher qualifications performed better when compared with students taught by lower qualifications.

Several factors influencing the performance of students in STEAM subjects have been identified by researchers (Ibezim, 2018, Edeh & Vikoo, 2013, Oyelekan et al., 2015, Irfan & Shabana, 2012, Albert et al., (2014)). Ibezim (2018) identified teachers' gender, workload, parent; socioeconomic status and academic background as factors that influence students' performance in science. Edeh and Vikoo (2013) identified study style, teacher expectancy,

DOI: https://doi.org/10.17509/edsence.v5i2.60767
p-ISSN:2685-2489 | e-ISSN:2685-2535

previous preparation and students' attitude/interest as being the factors that influence students' performance in science. Oyelekan et al (2015) opined that instructional strategies are key factors influencing students' performance in Science subjects, especially chemistry. Irfan and Shabana (2012) found that communication, learning facilities, proper guidance and family stress are the factors responsible for students' performance. Albert et al (2014) attributed the problem of students' poor performance to an inadequate supply of teaching and learning resources such as chemicals, charts, apparatus, models, local specimens, instructional strategies, laboratories, textbooks, and libraries.

Therefore, teachers need to have the required qualifications to teach at various levels of education. Experience is knowledge or skill in a particular job or activity which you have gained because you have done that job or activity for a long time. Teachers with more training and experience are more likely to hold on child child-centred beliefs and engage in similar pedagogical practices, which can be associated with better learning outcomes (Abnuom et al., 2018).

Umar et al (2019) examined the predictors of academic performance in biology among public secondary school students in Kwara State, Nigeria. The findings of the study revealed that there was a significant relationship between teachers' experiences and teachers' qualifications on student academic performance. Most of the previous studies reviewed were not guided by Science teachers' perceptions of factors influencing students' performance in STEAM subjects. Also, some of the studies were not focused on science teachers' qualifications and experience together. It was also observed that most of the previous studies were not carried out in Kwara State, Nigeria. It is thus imperative visible that there is a need to bridge this gap in the location of this study. Perceptions held by science educators regarding the determinants of academic achievement amongst high school seniors in STEAM subjects are of utmost importance in comprehending and augmenting educational outcomes. Consequently, it becomes imperative to scrutinize these perceptions to identify potential areas necessitating intervention and support. By acquiring an understanding of the viewpoints espoused by educators, we can more effectively comprehend the obstacles and prospects that exist within the realm of senior high school STEAM education. The objective of this investigation is to delve into the diverse factors that science educators posit as influential to students' performance in STEAM subjects, thus imparting invaluable insights to inform the development of efficacious strategies and interventions designed to bolster scholastic accomplishments in these domains.

The main purpose of this study was to investigate the perceptions of science teachers on factors influencing students' performance in STEAM subjects in Kwara State, Nigeria. Specifically, the study investigated;

I. Perceptions of science teachers on factors influencing students' performance in STEAM subjects,
II. perceptions of qualified and unqualified science teachers on factors influencing students' performance in STEAM subjects,
III. Perceptions of highly experienced, moderately experienced and low experienced teachers on factors influencing students' performance in STEAM subjects, and
IV. perceptions of rural and urban school science teachers on factors influencing students' performance in STEAM subjects.

DOI: https://doi.org/10.17509/edsence.v5i2.60767
p-ISSN:2685-2489 | e-ISSN:2685-2535

The following research questions were generated:

I. What do science teachers perceive as factors influencing students' performance in STEAM subjects?
II. Is there a difference in the perceptions of qualified and unqualified science teachers on factors influencing students' performance in STEAM subjects?
III. Is there a difference in the perceptions of highly experienced, moderately experienced and low experienced science teachers on factors influencing students' performance in STEAM subjects?
IV. Are there any differences in the perceptions of rural and urban school science teachers on factors influencing students' performance in STEAM subjects?

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

H_{01}: There is no significant difference between qualified and unqualified teachers' perceptions of factors influencing students' performance in STEAM subjects.

H_{02}: There is no significant difference between highly experienced, moderately experienced and less experienced teachers' perceptions of factors influencing students' performance in STEAM subjects.

H_{03}: There is no significant difference between rural and urban teachers' perceptions of factors influencing students' performance in STEAM subjects.

2. METHODS

This study employed descriptive research survey information on the perceptions of science teachers on factors influencing students' academic performance in STEAM subjects in Kwara State. Four research questions and four hypotheses were generated. The target population includes all science teachers in government-approved secondary schools in Kwara State. The technique of multistage sampling was employed to guarantee a representative sample. This technique involves the combining of the population into clusters, followed by the random selection of clusters for exclusion from the sample (Adeoye, 2023). This method supports capturing the multitude of differences within the population and ensures that the sample accurately reflects the entirety of the population. Similarly, a quota sampling method was utilized to select science teachers with diverse qualifications and experience. The purpose of this method was to ensure that the sample encompasses teachers with varying expertise and backgrounds, thereby facilitating a comprehensive comprehension of the factors that influence students' performance in STEAM subjects. Through the purposeful selection of teachers, the study can acquire insights from a vast array of perspectives and experiences within the teaching community. Ninety-one (91) science teachers from rural and urban areas including qualified and unqualified, experienced and less experienced ones participated in this study.

The instrument used to obtain information from the respondents was the researcher-designed Teachers Perception of Factors Affecting Students' Performance Questionnaire (TPFASPQ). The instrument was appropriately validated by three lecturers in the Department of Science Education, University of Ilorin. The reliability was analyzed using Cronbach's Alpha with 0.88 reliability index. Descriptive and inferential statistics were used to analyze the data.

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p-ISSN:2685-2489 | e-ISSN:2685-2535

Research questions were answered using frequencies and percentages while the null hypotheses were tested using chi-square statistics at 0.05 level of significance.

3. RESULTS AND DISCUSSION

Research Question 1: What do science teachers perceive as factors influencing students' performance in STEAM subjects?

Table 1 presents the factors influencing students' performance in STEAM subjects as perceived by science teachers in Kwara state, Nigeria. Their responses were converted to frequencies and percentages to answer the research question. Perceived Social and cultural issues influencing students' performance in STEAM subjects are language barrier and occasional pregnancy among female students. Another factor perceived to influence students' performance in STEAM is inadequate science teachers when compared with the number of students in a class. Perceived student-related factors influencing their performance are students' attitudes and truancy. Other factors perceived by science teachers that influenced students' performance in secondary schools include; lack of orientation, parent educational background, school location, socio-economic status of parent and insufficient apparatus.

Table 1. Frequency and percentage of Factors Influencing Students' Performance in STEAM as Perceived by science teachers in Kwara State

S/N	Questions	Responses	Frequency	%
1	**Social and cultural factors**	Language barrier	50	50
		Occasional pregnancy	30	40
		Nomadic life	11	10
		Total	91	100
2	**Teacher-related factors**			
	Number of Chemistry teachers	Adequate	20	20
		Not adequate	71	80
		Total	91	100
	Are Chemistry teachers attending lessons regularly?	Yes	9	90
		No	1	10
		Total	10	100
	Teachers' use of resources	Satisfactory	10	100
		Not satisfactory	0	0
		Total	10	100
	Teachers 'attitude	Agree	8	80
		Disagree	2	20
		Total	10	100
3	**Student-related factors**			
	Students' attitude towards Chemistry	Agree	9	90
		Disagree	1	10
		Total	10	100
	Truancy by students	Agree	10	100
		Disagree	0	0
		Total	10	100

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p-ISSN:2685-2489 | e-ISSN:2685-2535

4	**Other factors**			
	Lack of orientation	Agree	9	90
		Disagree	1	10
		Total	10	100
	Parent's educational background and economic status	Agree	7	70
		Disagree	3	30
		Total	10	100
	Environment/ Location	Agree	6	60
		Disagree	4	40
		Total	10	100
	Adequacy of laboratory equipment	Yes	3	30
		No	7	70
		Total	10	100

Research Question 2: Is there a difference in the perceptions of qualified and unqualified science teachers on factors influencing students' performance in STEAM subjects?

Table 2 shows the difference in the responses of qualified and unqualified science teachers on the perceived factors influencing students' performance in STEAM subjects. This is revealed in the difference in the observed frequency of qualified teachers' less than its expected frequency for agree (874/895.69) but greater for disagreed (347/325.31) respectively while the observed frequency of unqualified teachers greater than its expected frequency for agreed (778/756.31) but lesser for disagreed (253/339.04) respectively. This implies that there is a difference in the perceptions of qualified and unqualified science teachers on factors influencing students' performance in STEAM subjects.

Table 2. Cross-tabulation Frequency for Qualified and unqualified science teachers' Perception

Qualification	Frequency	SA	A	D	SD	Total
Qualified	Observed	409	465	223	124	1221
	Expected	437.00	458.69	217.96	107.35	1221
Unqualified	Observed	397	381	179	74	1031
	Expected	369.00	387.31	184.04	90.65	1031
Total		806	846	402	198	2252

$H0_1$: There is no significant difference between qualified and unqualified science teachers' perceptions of factors influencing students' performance in STEAM subjects.

Table 3 reveals the chi-square of perceptions of qualified and unqualified science teachers. The Chi-square calculated value of 10.00 is greater than the critical value of 7.82 at 3 degrees of freedom. Hence, hypothesis 1 was rejected. This implies that there was a significant difference between qualified and unqualified science teachers' perceptions of factors influencing students' performance in STEAM subjects.

Table 3. Chi-square of Independent for qualified and unqualified science teachers' perception

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p-ISSN:2685-2489 | e-ISSN:2685-2535

Qualification	SAA	DSD	Total	df	X^2cv	X^2tv	Remark
Qualified	874	347	1221				
				3	10	7.82	Sig.
Un Qualified	778	253	1031				
Total	1652	600	2252				

SAA= Strongly Agreed Agree, DSD=Disagree Strongly Disagreed
df=degree of freedom, cv=calculated value, tv= critical value.

Research Question 3: Is there a difference in the perceptions of highly experienced, moderately experienced and low experienced science teachers on factors influencing students' performance in STEAM subjects?

Table 4 shows that there is a difference in the perceptions of highly experienced, moderately experienced and low experienced science teachers on factors influencing students' performance in STEAM subjects as reflected in the observed frequency of less experienced teachers for agreed greater than its expected frequency (373/338.58) but lesser for disagree (100/126.02), and the difference in the observed frequency of moderately experienced teachers greater than its expected frequency for agree (538/510.56) but, lesser for disagree (158/185.43), while the difference in the observed frequency of highly experienced teachers is less than its expected frequency for agree (741/798.46) but greater for disagree (342/288.54) respectively.

Table 4. Cross-tabulation Frequency for highly experienced, moderately experienced and low experienced science teachers

Experience	Frequency	SA	A	D	SD	Total
Less Experienced	Observed	198	175	80	20	473
	Expected	169.29	169.29	84.43	41.59	473
Moderately Exp.	Observed	244	294	125	33	696
	Expected	249.10	261.46	124.24	61.19	696
Highly Experienced	Observed	364	377	197	145	1083
	Expected	387.61	406.85	193.32	95.22	1083
Total		806	846	402	198	2252

$H0_2$: There is no significant difference between highly experienced, moderately experienced and less experienced science teachers' perceptions of factors influencing students' performance in STEAM subjects.

Table 5 reveals that there was a significant difference between experienced, moderately experienced and less experienced teachers' perceptions of factors influencing students' performance in STEAM as the Chi-square calculated value 63.37 is greater than the critical value of 7.82 at 6 degrees of freedom. Hence, null hypothesis 2 was rejected. This implies that the teachers perceived differently the factors influencing students' performance in STEAM subjects in terms of their years of teaching experience.

Table 5. Chi-square of Independent for highly experienced, moderately experienced and low experienced science teachers

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p-ISSN:2685-2489 | e-ISSN:2685-2535

Experience	SAA	DSD	Total	df	X^2cv	X^2tv	Remark
Less Experienced	373	100	473				
Moderate Exp.	538	158	696	6	63.37	7.82	Sig.
Experienced	741	342	1083				
Total	1652.00	600.00	2252.00				

SAA= Strongly Agreed Agree, DSD=Disagree Strongly Disagreed
df=degree of freedom, cv=calculated value, tv= critical value.

Research Question 4: Are there any differences in the perceptions of rural and urban school science teachers on factors influencing students' performance in STEAM subjects?

Table 6 show the influence of school location on science teachers' perceptions of factors influencing students' performance in STEAM subjects as reflected in observed frequency of urban area lesser than its expected frequency for agree (1102/1143.67) but greater for disagree (457/415.36) while the difference in observed frequency of rural area is greater than its expected frequency for agree (550/508.37) but lesser for disagree (143/184.64) respectively.

Table 6. Cross-tabulation Frequency for rural and urban school science teachers

Location	Frequency	SA	A	D	SD	Total
Urban	Observed	552	550	289	168	1559
	Expected	557.97	585.66	278.29	137.07	
Rural	Observed	254	296	113	30	693
	Expected	248.03	260.34	123.71	60.93	
Total		806	846	402	198	2252

$H0_3$: There is no significant difference between urban and rural science teachers' perceptions of factors influencing students' performance in STEAM subjects.

Table 7 reveals that there was a significant difference between urban and rural science teachers' perceptions of factors influencing students' performance in STEAM subjects as the Chi-square calculated value of 31.28 is greater than the critical value of 7.82 at 3 degrees of freedom. Hence, hypothesis 3 was rejected. This implies that urban and rural science teachers had contrary perceptions of factors influencing students' performance in STEAM subjects.

Table 7. Chi-square of Independent for urban and rural science teachers' Perception

School Location	SAA	DSD	Total	df	X^2cv	X^2tv	Remark
Urban	1102	457	1559				
				3	31.28	7.82	Sig.
Rural	550	143	693				

SAA= Strongly Agreed Agree, DSD=Disagree Strongly Disagreed
df=degree of freedom, cv=calculated value, tv= critical value.

The findings from this study revealed that science teachers perceived social and cultural issues influencing students' performance in STEAM subjects as the language barrier and

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p-ISSN:2685-2489 | e-ISSN:2685-2535

occasional pregnancy among the female students, lack of orientation, parent educational background, school location, socio-economic status of parent, truancy by students and insufficient apparatus. However, it is crucial to recognize the constraints of our investigation. One plausible constraint is the dependence on the self-reported perspectives of the educators, which has the potential to introduce partialities into the data. Moreover, the applicability of our discoveries may be confined to Kwara State exclusively, where the study was executed. By acknowledging these constraints, we intend to augment transparency in our research and inspire forthcoming studies to contemplate these variables when interpreting and implementing our findings. Teachers' perceptions were similar as they were the main implementers of these resources. This finding is corroborated by Eugene and David (2017) who reported that learners' lack of motivation, English as a medium of instruction, learning environment, and availability of instructional materials in schools significantly influence students' academic achievement in science. The authors further stated that when teaching facilities are available and used appropriately the students would acquire skills that are vital to them. It also agreed with the study (2013) which reported that the availability of instructional materials/resources influences the academic achievement of students in science. The outcome of this study showed that academic qualification significantly influences science teachers' perceptions of factors influencing students' performance in STEAM subjects. It was obvious that qualified teachers did not perceive most of the factors that unqualified teachers perceived as influencing students' performance in STEAM subjects. This could be due to the lack of objectivity of the respondents or improper understanding of the questions. Hence, the teachers' academic qualifications could influence their perceptions of these factors. However, this finding is supported by Mohammed et al (2015) who discovered that teachers' qualification influences their perceptions and Nbina (2012) who reported that efficient and effective teachers who are professionally and academically qualified promote science learning in schools.

This study also revealed that there was a significant difference between science teachers' perceptions of factors influencing students' performance in STEAM subjects as teachers with less and moderate experience perceived factors that influence students' performance in STEAM subject's contrary to what the experience teachers perceived. This implies that teachers' experience can affect the perceptions of factors influencing students' performance in STEAM subjects. This finding corresponds with the study of Edu and Edu (2013) and Dogan and Yildiz (2013) who revealed that experience/years of service significantly influence teachers' perceptions of these factors. This study provides foundational perspectives of science educators about the factors that influence the academic achievements of students in STEAM disciplines. Examining the integration of digital tools, virtual simulations and online resources in STEAM classrooms could lead to a more profound understanding of how technology impacts the learning process and influences students' academic achievements. In addition, future researchers can focus on investigating the impact of socioeconomic factors on the academic performance of students in STEAM subjects by examining variables such as access to educational resources, socioeconomic status and cultural background achievements of students in STEAM education.

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p-ISSN:2685-2489 | e-ISSN:2685-2535

4. CONCLUSION

This study concluded that language barrier, occasional pregnancy among the female students, lack of orientation, parent educational background, school location, students' unwillingness to learn, socio-economic status of parents, truancy by students and insufficient apparatus are factors perceived by science teachers influencing students' performance in STEAM subjects. It further concluded that there was a significant difference between science teachers' perceptions of factors influencing students' performance in STEAM subjects based on academic qualification, teaching experience and school location.

AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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DOI: https://doi.org/10.17509/edsence.v5i2.60767
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DOI: https://doi.org/10.17509/edsence.v5i2.60767
p-ISSN:2685-2489 | e-ISSN:2685-2535

DOI: https://doi.org/10.17509/edsence.v5i2.60767
p-ISSN:2685-2489 | e-ISSN:2685-2535

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