

Linguistic and Environmental Influences on Academic Performance in STEM Courses in Selected Southwestern Nigerian Polytechnics

OSO, AYOBAMIDELE SAMUEL¹, AYOBAMIDELE, SINATU JULIET²

¹General Studies Department, Osun State College of Technology, Esa-Oke

²Department of Agricultural Engineering, University of Ilesa, Ilesa, Osun State

Abstract- *This research examined the influence of language and environment on the performance of students in STEM courses, with the aim to explain the factors that contributed to or mitigated the upward progress of students in the Engineering and Applied Sciences. Questionnaire and interviews were among the instruments used to elicit information from both students and lecturers in the selected polytechnics to determine the kind of language barrier and environmental influence on the performance of students in STEM courses. The Theoretical Linguistics framework which accounted for grammatical categories was used to account for the grammatical categories that impede good performance in STEM courses and English expressions of polytechnic students. Environmental theories of Bronfenbrenner, supported by that of Vygotsky were adapted as framework for the discussion on environmental factors that are responsible for poor performance in STEM courses. Key findings include the discovery that the grammatical categories of nouns, verbs, adverbs and adjectives are the categories that are difficult for students. Also, poor environment lowers morale and concentration on language learning. It is recommended that STEM lecturers should concentrate on the identified parts of speech by providing copious illustrations and drills that can facilitate better understanding of the topics.*

Key Words: *Science, Technology, Engineering, Mathematics, Linguistic, Environment,*

I. INTRODUCTION

Language is pivotal to learning, this is without prejudice to the use of signs and gestures to communicate. The success or failure at academic assessment in Nigerian tertiary institutions may not be unconnected to one's competence and proficiency at decoding (understanding) the English language. Students are mandated to use the English language to explain, to demonstrate, to exemplify and to justify

their understanding of a concept during examinations. This always poses problem for students who do not have a grasp of English language, consequently, they cannot use the language to demonstrate their in-depth knowledge of the questions the examiner asked them. Students and lecturers at different academic ladder depend so much on the use of English language not only being the language of interaction, greetings and communication but also the language of instruction in school. It is also the language of assessment to determine the impact of learning activity on the students. The Nigerian policy on education advocates for the use of the language of the environment or the mother tongue as the language of instruction at the lower run of education (The primary school level between the nursery to the junior class 3) while the English language is the recommended language of instruction for students in the high school, including the tertiary institutions. The National Board for Technical and Business Education recognises Polytechnics and Colleges of Technologies as institutions that are higher than the secondary school but not higher than the university. Among the objectives of setting up polytechnics, as contained under schedule 66 of the national policy on education is to provide full time or part time course of instruction and training in engineering, other technologies, applied science, business and management, leading to the production of trained manpower. This training is expected to be carried out through no other language than the English language having been spelt out under schedule 17 (f) which reads, "From the fourth year, English shall progressively be used as a medium of instruction and the language of immediate environment and French shall be taught as subject." This provision takes effect from the fourth year in the primary school.

The word 'STEM' is an acronym for Science, Technology, Engineering and Mathematics. The STEM courses are courses studied in Pure and Applied Science such as Computer Science, Biochemistry, Microbiology, Nutrition and Dietetics.; Technology-related courses such as Mass Communication, Multi-media Technology, Building Technology, and Horticulture Technology. Engineering Courses such as Electrical / Electronic Engineering, Mechatronics Engineering, and Chemical Engineering and Mathematics-related courses such as Mathematics and Statistics. Some polytechnics grouped Mathematics and Statistics under Pure and Applied Science. The Engineering as well as Mathematics relies not only on calculation but more often than not on the English language to explain abstract concepts and in specifying geometric dimensions. Internalising these concepts through the English language may be challenging in an environment where emphasis is on calculation and practical.

The environment itself is another issue that affects students' desire to learn. The social, academic and religious affiliations of the students as well as the stakeholders' attitude to education has formed a mitigating force against learning in the polytechnics and colleges of technology. Yang, et al (2023) observed that "the learning environment constitutes another force outside the classroom that significantly affect learners' performance "(p.42). The dichotomy that exists between the polytechnic and university graduates is a created environmental challenge which does not exist in advance countries and it is having a derogatory and psychological effects on the psyche of polytechnic graduates. Motivations, inducement and lobbying are lumped together as bait to further nose-diver interests and standard of education particularly in the polytechnics and colleges of technology. It is a common knowledge that many students from this sphere of education are grossly deficient and incompetent of expressing or writing error-free sentences. This shows that somewhere along the line, there is a gap created which has led to the vacuum of incompetence. This research, therefore, explored these vacuums with the aim of providing solutions that can help improve on language learning in the Nigeria Polytechnics and colleges of Technology.

Problem Statement

Adam et al (2020) worked on Impact of E-Learning Environment on Academic Achievement among Basic Students in Zaria Education Zone. The researchers affirmed that the presence of E-Learning environment has a positive impact on students' academic performance because it secures their attention and reduces rate of distraction. Reports from the various departments where courses such as Mathematics, Agricultural Science, Computer Studies and Civil Engineering are offered suggest that students' academic performance is low. The low performance is undoubtedly connected to the level of their competence in the language which they use to express themselves. A good understanding of the language of instruction will in no doubt facilitate a good performance in other courses that are taught in the English language. Language is pivotal to learning and understanding the abstract concepts that are in-built into the courses taught in STEM. Deficiency or lack of competence in using the English language can drastically affect students' performance in examination. Therefore, the absence of this competency and other factors that range from lack of interest in language learning to poor environment are the bane of unimpressive performance in STEM courses in Nigerian polytechnics.

Aim and Objectives

The aim of this study is to discuss the linguistic and environmental influences on academic performance in STEM courses in selected South-Western Nigeria polytechnics. The following are the specific objectives of this study:

- i. To explain the category of verbs, adjectives, adverbs and nouns as the aspect of language study that affect performance in STEM courses
- ii. To discuss environmental factors which discourage good academic performance in STEM courses;
- iii. To highlight the challenges of STEM lecturers in teaching STEM courses

II. LITERATURE REVIEW

Linguistic and environmental factors significantly influence academic performance. Language proficiency, particularly in English, is crucial for academic success, and environmental factors like school location, resources, and classroom conditions can either positively or negatively impact a student's ability to learn. Strong language skills, especially in the language of instruction (often English), are essential for understanding academic content and expressing oneself effectively. Yu et al (2005) is of the opinion that in multilingual settings, interference from the student's native language can hinder the learning of a second language like English.

The availability of resources, opportunities to use the language, and the overall language atmosphere play a vital role in language acquisition and academic performance. Wang et al (2003) submitted that factors like lighting, temperature, air quality, and classroom arrangement (e.g., seating arrangement) can impact student concentration and engagement. Adequate learning materials, libraries, laboratories, and qualified teachers are crucial for effective learning. A supportive and stimulating home environment, with access to resources and encouragement from parents, can positively impact a child's academic development. The overall atmosphere of the school, including teacher-student interactions, safety, and the availability of extracurricular activities, can influence academic performance and socio-emotional well-being. According to Dong et al (2000), schools with poor infrastructure, lack of resources, and a negative social environment may contribute to lower academic achievement. Schools with a positive climate, strong leadership, and a supportive learning environment tend to have higher student achievement.

Theoretical Linguistics developed as a reaction to Traditional Linguistics by positing arguments that language can be grouped into categories and formulated an all-inclusive condition for membership of each group and how each group functions in a sentence. Seven categories otherwise known as part of speech were identified and labelled as noun, pronoun, verbs, adverbs, preposition, interjection,

and adjectives. The key concepts in theoretical linguistics are: phonetics and phonology, a subfield that study the sounds of language and how they are used in particular languages; syntax is a subfield that accounts for the rules and principles that govern the structure of sentences including word order and the relationship between words while semantics focuses on meaning in language. Insights from Theoretical Linguistics helps us to identify the linguistic categories that are constantly posing difficulty for students to master which is syntax.

A theoretical framework for understanding the influence of linguistic and environmental factors on academic performance can be built upon several key areas: The Ecological Systems Theory, which emphasizes the multi-layered influences on development and the Interactional Theories which highlight the role of social interaction in language acquisition and cognitive development. The Ecological Systems Theory was proposed by Bronfenbrenner. It suggests that individual development is influenced by multiple levels of environment, including the microsystem (immediate surroundings like family and school), mesosystem (connections between microsystems), exosystem (indirect influences like community policies), and macrosystem (cultural values and beliefs). The Microsystem includes the immediate environment where the student interacts, such as the classroom, home, and peer group. Factors like the quality of teaching, availability of resources (libraries, labs), and peer relationships significantly impact academic performance. The Mesosystem examines how different microsystems interact. For example, strong communication between teachers and parents can positively influence a student's learning. The Exosystem includes factors that indirectly affect the student, such as school policies, community resources, and parental workplace conditions while the Macrosystem encompasses the broader cultural context, including societal values, language policies, and economic conditions, all of which can influence educational opportunities and outcomes.

Wang (2003) opined that students' proficiency in the language of instruction significantly impacts their ability to understand and participate in learning.

Students' home background which revolves around their socioeconomic status, parental education, and access to resources at home can influence academic outcomes. Zhang (2002) argued that a positive and supportive school environment, characterised by good teacher-student relationships and a sense of belonging, can enhance student motivation and achievement. Factors like classroom layout, availability of resources, and the overall learning atmosphere can impact student engagement and performance. Zhang (2005) suggested that a well-designed curriculum that is relevant to students' needs and interests, coupled with effective teaching strategies, can enhance learning. By integrating these theoretical perspectives and identifying key variables, researchers can gain a more comprehensive understanding of the complex interplay between linguistic and environmental factors and their impact on academic performance. This knowledge can then be used to develop targeted interventions and support systems to improve educational outcomes for all students.

Yao (2015) observed that linguistic development, shaped by both home and school environments, impacts cognitive abilities and learning outcomes. Similarly, the physical and social-emotional environment plays a crucial role in a student's motivation, engagement, and overall academic success. A rich linguistic environment at home, characterised by frequent conversations, storytelling, and reading, fosters better language skills and vocabulary development in children, which positively impacts their academic learning. Wu (2008) corroborated the opinion of Yang et al (2023) that school environment, including the quality of teaching and the language used in instruction, also plays a critical role in shaping linguistic abilities and academic performance. Strong language skills are essential for understanding complex concepts, expressing ideas effectively, and engaging with academic materials, all of which contribute to better academic outcomes. A conducive physical learning environment, with adequate resources, comfortable seating, and appropriate lighting, can positively influence a student's focus and concentration, leading to improved academic performance. Jiang (2015) submitted that the social and emotional climate of the

classroom, including positive teacher-student relationships, peer support, and a sense of belonging, can significantly impact a student's motivation, engagement, and overall academic success.

Jiani (2023) identified three types of environment that can influence learning outcome: they are physical, cultural and social environment. According to Jiani,

A good learning environment can improve learners' learning effectiveness and motivation and promote the positive development of English learning. The study of the learning environment can help students and parents better understand the impact of the learning environment on English language learning and provide them with strategies and methods to improve the learning environment. (p.69)

The physical Environment has a direct impact on the performance of English learners. Where the environment is suitable, conducive and attractive, it helps learners to concentrate and improve their learning efficiency.

III. METHODOLOGY

The study area covered by this research is Mathematics, computer science, agricultural engineering, electrical / electronic and information technology. These courses are selected from science, technology, engineering and mathematics (STEM). The selected courses have appreciable number of enrollees in Nigeria polytechnics. Two polytechnics have been selected from each state in the southwest part of Nigeria. The following polytechnics; Osun State College of Technology Esa-Oke and The Polytechnic Ile-Ife are selected from Osun State; The Federal Polytechnic, Ado Ekiti and Crown Polytechnic Ado Ekiti are selected from Ekiti State; Federal Polytechnic Ilaro and Moshood Abiola Polytechnic are selected from Ogun State; Lagos State Polytechnic Isolo Campus and Lagos City Polytechnic are selected from Lagos State; Rufus Giwa Polytechnic and Ondo City Polytechnic are selected from Ondo State.. These institutions have large number of students that study the STEM courses. The selection of the polytechnics is based on

the criterion of: population, availability of the target courses, ownership and location. The random sampling technique was used in selecting the polytechnics based on ownership, that is, whether the polytechnic is owned by the government or private individual. The ten polytechnics are mixture of public and private polytechnics. A public polytechnic is either owned by a state government or the federal government.

There are three instruments used in collecting the data: the students' scripts that contain answers to the examination questions in two successive semesters, the interview conducted for lecturers in the selected polytechnics and the questionnaire administered on students from the selected polytechnics. The researcher collated series of past questions covering at least two consecutive semesters on Mathematics, computer, electrical electronic, information technology and agricultural engineering courses and the answer scripts of students to evaluate their responses to the questions and determine the grammaticality of their expressions. The questions and answer scripts that match the purpose of this study were selected. Questionnaires were used to elicit response from the students on the aspect of language learning they find difficult to comprehend as well as the environmental factors that mitigate good performance in STEM courses. Two students were randomly picked to represent a department in Science, Technology, Engineering and Mathematics to respond to the questionnaire. A total number of eight students responded to the questionnaire in each selected polytechnic, making a total of eighty respondents in all. Due to tight time schedule, at least one lecturer was interviewed in each selected polytechnic.

IV. DATA ANALYSIS

Linguistic Analysis of Examination Questions and Answers

Examination questions always contain instruction for students on how to present their answers. This instruction, when adhered to, shares an aspect of scoring of the total marks allotted for a question and it demonstrates linguistic competence of the students. Where the instruction is not followed but correct

answers are given, it is left for an examiner to enforce the rule or overlook it. Where the rule is overlooked, the students play down on the need to be sensitive to language. The following questions are on Agricultural Engineering:

Sample A

QUESTION: Discuss three (3) advantages and two (2) disadvantages of using tractors in modern agriculture.

ANSWER:

- i. It makes work easier and faster.
- ii. It saves time
- iii. It reduce labour cost.

DISADVANTAGES

- i. Risk management
- ii. Financial problems

The instruction attached to the question in sample A is that the candidates should discuss, that is, to provide explanations on the points to be raised. If this instruction is adhered to, it would have presented the opportunity to assess the linguistic capacity of the candidates on how to explain points using many sentences. However, the candidate itemised the points using simple sentence in stating the advantages and a phrase in stating the disadvantages. The simple sentences used by the student contains subject, verb and object as shown below.

s/n	SUBJECT	VERB	OBJECT
a	It	makes	work easier and faster
b	It	saves	Time
c	It	reduce	labour cost

Figure 1: Showing agreement between pronoun and noun and between subject and verb

The neuter gender pronoun in the subject position here is 'it'. It is making anaphoric reference to a plural ellipted notion of 'tractors' which is mentioned in the question. From grammatical standpoint here, it is discovered that there is error in the interchange of singular pronoun for plural noun. This interchange may not cause damage to the intelligibility of the

answer but grammatically it is wrong. Also, the agreement between the subject and the verb here raises concern. The verbs ‘makes’ and ‘saves’ which are singular, transitive, (regular and irregular) lexical and present verbs agrees with the subject ‘it’ if we neglect the grammaticality of the subject itself but the verb ‘reduce’ which is plural, transitive, regular, lexical and present verb does not agree with the subject. It is therefore noted that this candidate has challenge with using pronoun to make reference to noun and the candidate is not consistent in the use of agreement between subject and verb of a sentence.

The answers provided under the caption “DISADVANTAGES” are written in phrases. This is against the instruction contained in the question. The candidate simply listed the points but did not discuss them. This style of using phrases is common with students who do not possess the linguistic ability to use longer sentences to communicate their answers. By not using longer sentences, they tried to avoid the risk of running into grammatical errors. Students are not usually penalised for using phrases to present their answers in almost all the departments in polytechnics except in the department of English whose courses are elective for the students.

Sample B

QUESTION: List and explain five (5) main components of a farm tractor.

ANSWER:

- i. Brake
 - ii. Leather sit
 - iii. Plough
 - iv. Clush
 - v. Tyer
- i. Brake: It is used to control the machine may be to stop in a particular direction
 - ii. Leather sit: This is where the driver sit on while performing the operation.
 - iii. Ploug: It help with the engine to work and function well.
 - iv. Tyer: It help the tractor to move in a front or back direction or and side it want to go.

The two instructions contained in the question above are to list and explain. In the first group of answer numbered i. – iv, the candidate listed the answers thereby fulfilling the first instruction. In the second answer, the candidate re-listed the answer and provided explanations. In the explanations provided, the candidate used both complex and compound sentences. A complex sentence contains a main clause and at least one subordinate clause while a compound sentence contains two simple sentences joined together by any of the coordinating conjunctions.

s/n	Main Clause	Subordinate Clause
a	It is used to control the machine	may be to stop in a particular direction
b	This is where the driver sit on	while performing the operation

Figure 2: Showing complex sentence

s/n	Simple Sentence 1	conjunction	Simple Sentence 2
a	It help with the engine to work	and	function well
b	It help the tractor to move in a front or back direction	Or and	side it want to go

Figure 3: Showing Compound Sentence

A complex sentence as shown in figure 2 above has one main clause and one subordinate clause. It is expected that the main clause should have its own structure comprising the subject, verb and object or complement. The dominating tense in the complex sentence figure 2 is the present tense therefore it is expected that the subject and the verb must agree. The neuter gender pronoun (it) and the singular demonstrative pronoun (this) are followed by a singular, auxiliary verb (is) respectively. The verb structure of the main clause in figure 2 also show internal agreement in that the present verb (is) combines effectively with (used) a participle form of (use) thereby creating internal concord within the verb structure. This structure is followed with series of auxiliary verb such as may, be, and to in the subordinate clause. The final verb in that series is the lexical verb (stop) in the present tense. Therefore, the sentence numbered (a) in figure 2 is structurally

correct but may not be intelligible enough. Ditto cannot be said for the sentence numbered (b) in figure 2. The subject of the adverbial clause embedded into the main clause lacks agreement with the verb. The driver which is singular supposed to take a singular verb (is). This problem of agreement between the subject and the verb reflected in the compound sentence in figure 3 where the neuter gender pronoun (it) is followed by a plural regular lexical verb (help). This is also repeated in the second compound sentence in sentence (b) where (it) is followed by (want) a plural verb.

Sample C

QUESTION: Analyse the roles of emerging farm technologies in addressing the challenges of climate change and food security.

ANSWER (A)

The emerging of farm technologies in addressing of 1 climate change and food security is farm technologies² help when the climate changes in the sense that when farm machines³ are in the farm it⁴ helps the farmers work to be easier and faster even when the climate change there will be assurance that the farmers will be able to cover a large of⁵ space in no time with the help of the machines. For example tractor⁶ even when the rain is falling you can still operate your tractors⁷. Cus it a machine⁸. And⁹ for the food security with help of farm technologies it will be very easy for farmers to store there¹⁰ farm product in a safe place and noting¹¹ will happen to them.

ANSWER (B)

The use of renewable energy such as [12solar energy, wind energy as help¹³ to reduce full relance¹⁴ on fossil fuel or petrol. The use of renewable energy has help to reduce the use of [15chemical and fertilizers in agricultural practice and as also help¹⁶ to reduce green-house gas emission.

All the sixteen errors highlighted above can be grouped into the following:

(a) Prepositional errors such as insertion of preposition where it should not have occurred. These are indicated in number 1 and 5

(b) Omission of complementizer such as that is noted in error 2. The word 'that' supposed to have been inserted in between the verb 'is' and 'farm' which is the noun.

(c) Error 3 and 4 point to the wrong use of pronoun in replacing a noun. The noun 'machines' is plural, it is replaced with a pronoun 'it' which is singular. In error 6 and 7, the two nouns are not referring to the same number, the 'tractor' in number 6 is singular while the 'tractor' in number 7 is plural.

(d) Error 8 represents the effect of language mutilation which the advent of social media has brought on English users. The phonological manipulation of the word 'cause' which the candidate pronounced as /cus / has been transferred to the syntax of the English language here even though the transcription for the word 'cause' has been jettisoned. There is also the omission of the main verb making the whole expression ungrammatical.

(e) The use of the coordinating conjunction 'and' in error 9 is vague in that the content of the first part of the answer which supposed to address challenges of climate change does not fully address the challenges rather it talked about the benefits of the use of tractors. Therefore, using 'and' to link the two clauses together amount to joining unequal clauses together.

(f) Error 10 and 11 point to problem with homophonic words. Words that have the same sound but different spellings and different meanings. For instance; 'there' which is an adverb of place and 'their' which is a possessive pronoun.

(g) Error 12 and 15 refer to indiscriminate use of open bracket without the corresponding bracket close.

(h) Error 13 and 16 are indication of both homophonic words and combination of auxiliary verb with lexical verb. 'as' which is a correlative preposition is used to replace 'has' which is an auxiliary verb. When the auxiliary verb 'has' is used with a lexical verb, the lexical verb is always in the perfect form not in a simple past form.

- (i) Error 14 is a wrong spelling of the word 'reliance'.

All the errors noticed in this segment are classified into the grammatical categories of the use of pronoun, noun, verb, homophones and concord.

The following questions are on Mathematics
Sample D

INSTRUCTION: Read the information given below and answer the following questions.

Pankaj, Qasif, Rajat, Supriya, Tina, Uttkarsh, Vartika, Waseem and Zoya are sitting around a circle facing at the centre. Rajat is third to the right of Zoya who is second to the right of Pankaj. Supriya is not an immediate neighbour of Zoya and Rajat. Tina is third to the left of Supriya. Qasif is third to the right of Waseem who is not an immediate neighbour of Supriya. Vartika is not a neighbour of Zoya.

QUESTION: How many people are sitting between Waseem and Supriya (counted clockwise from Supriya)?

1. One 2. Four 3. Five 4. Two 5. Three

QUESTION: Who is sitting 3rd to the right of Vartika?

1. Tina 2. Pankaj 3. Qasif 4. Rajat
5. Zoya

QUESTION: From a certain point, Smriti walks 70 m towards the south. Then, she turns to her right & starts walking straight for another 70 m. Then, again turning to her left he walks for 60 m. She then turns to her left & walks for 70 m. How far is she from the starting point?

1. 200 m 2. 135 m 3. 140 m 4. 130 m
5. 270 m

The questions above involves logical reasoning and calculation. Though it is expected that students will get the answers correct due to the fact that they come from science background where calculation is the

norm but they have to demonstrate good understanding of the language used in describing what to calculate. For instance; the first question involves a re-arrangement of the nine students in order of how they sit following their position. Out of Forty-Seven students that took this test, twenty-eight of them got the question right while nineteen missed the question. The percentage of failure is 39.5 This figure is relatively high considering the fact that the students have a science background. It also underscores the fact that good understanding of the English language plays vital role in solving mathematical questions. The number of those that passed the second test on the movement of Smriti is thirty-five. It represents 14.9% increase over those that passed the first question. It shows that the first question is difficult than the second question probably because the second question has a diagram attached to it which further enhances quick understanding of the calculation unlike the first question which contains words throughout.

Analysis of Responses (AR)

A total number of eight students responded to the questionnaire in each of the selected polytechnics. The general total of respondents is eighty. The MEAN of the views of the respondents are determined to buttress the progression of opinions which aligned with two of the hypotheses of this study which says:

- (i) The category of verbs, adjectives, adverbs and nouns are the aspects that are problematic for students in Nigeria polytechnics than vocabulary development.
- (ii) Poor infrastructure, change in national value orientation and absence of E-Learning environment discourage language learning in Nigeria polytechnics

Research Question 1: Which aspect of language learning do you find extremely difficult to understand?

Table 1: Shows the different aspects of language learning that students in the polytechnics are likely to find difficult. The value attached to AG = 1, SA =2, DA =3, SDA =4, N =5

S/N	STATEMENTS	AG	SA	DA	SDA	N	MEAN
1	All aspects of grammar are very interesting to me	31	17	12	9	11	2.4
2	Part of speech such as noun is not difficult	33	17	11	9	10	2.33
3	Types of noun such as countable noun, uncountable noun, proper noun, abstract noun, noun in apposition are difficult to understand	17	17	22	10	14	2.84
4	Part of speech such as verb is difficult to understand	18	12	25	10	15	2.9
5	The auxiliary verbs such as verb be, modal auxiliary, primary auxiliary, verb have, verb do, etc are too many and confusing	23	14	19	11	13	2.84
6	The lexical verb such as regular lexical verb is not difficult but the irregular lexical verbs are difficult	22	18	17	12	11	2.65
7	As for me, adjectives are simple but adverbs are difficult	9	15	23	10	14	2.73
8	Tense is more difficult than sentence construction	25	15	15	11	14	2.68
9	Antonyms and synonyms are very easy to understand	26	17	15	10	12	2.56
10	Learning about consonant and vowel is abstract and uninteresting	19	15	19	16	11	2.81
11	Phonetics should be removed from the curriculum of polytechnic students	20	13	21	9	17	2.86
12	Writing long passages without involving in any arithmetic calculations is boring to me	25	13	14	12	16	2.77
13	I always know what to write in an essay but how to construct it in a sentence is the problem	27	14	17	13	9	2.54
14	Introduction of drama, prose and poetry into the curriculum for polytechnic students is not necessary	22	11	22	14	11	2.77
15	Identification of abstract objects in Engineering is always difficult if not explained in Yoruba Language	19	18	22	10	11	2.7

The grand MEAN is 2.69

None of the MEANS above crosses the threshold of DA though many tilts towards it. The grand MEAN also reflects this progression. This suggests that there is greater probability that the aspects of language learning indicated on the table above are really problematic to the students. The hypothesis that suggests that the category of verbs, adjectives,

adverbs and nouns are the aspects that are problematic for students in Nigeria polytechnics than vocabulary development is therefore validated.

Research Question 2: Do availability of modern physical infrastructures and equipment encourage good performance in STEM courses?

Table 2: Shows the relevance of availability of modern physical infrastructure and equipment to better performance in STEM courses.

S/N	STATEMENTS	AG	SA	DA	SDA	N	MEAN
1	A well-built lecture theatre with neat and well-designed environment is always a nice place to learn	31	20	9	10	10	2.35
2	A lecture environment that is bushy, untidy and without modern facilities such as slide doors and windows, nice curtains and atmospheric humidifier does not command my interest	25	16	12	15	12	2.66
3	Having clubs such as the kegites club, one-night stand, music band, and cults such as the black cat, eye fraternity and aye are not distraction to learning	20	12	20	19	9	2.81
4	The presence of motion ground, restaurants, banks, theatre house,						

	sport pitch and well linked tarred roads boost learning ego	24	16	14	13	13	2.68
5	The presence of E-Learning equipment such as computer, projector, language laboratory, head phone, public address system makes learning more interesting	32	15	11	11	11	2.42

The grand MEAN is 2.58

The overwhelming support for the statement that a well-built lecture theatre with neat and well-designed environment is always a nice place to learn reflect the yearning of the students in the polytechnics for environment that accentuates learning. Unkept environment littered with refuse, papers, wraps and left-overs on the campus do not suggest a healthy environment. There are polytechnics with no waste baskets hung at strategic places where students can drop their waste. The classrooms are not swept constantly and the surrounding is bushy. The classrooms are not lit with any electricity, the doors and windows are bare. Among the polytechnics selected for study, only few is not bedevilled with these shortcomings. The resultant effect of this is that majority of the students in the selected polytechnics are not proud of their institution of learning. According to Jiani Zhang (2023), 'the quietness of the learning place, the comfort level, learning resources and facilities are part of the physical environment.' While quiet learning environment helps students to concentrate and improve their learning, comfortable seating, appropriate temperature and adequate lighting play important role in learning. When maximum learning comfort is not provided in an academic environment, the level of concentration will drop and the students' performance in examination may be affected. The students' response to this assertion is indicated in the second statement that a lecture environment that is bushy, untidy and without modern facilities such as slide doors and windows, nice curtains and atmospheric humidifier does not command students' interest. The MEAN of this statement is 2.66 which is slightly higher than the grand MEAN points to the direction of general agreement with the proposition that physical learning environment plays a vital role in learning.

The statement in 3 which says "having clubs such as the kegites club, one-night stand, music band, and cults such as the black cat, eye fraternity and aye are

not distraction to learning" does not agree with the position of Jiani Zhang (2023) on what constitute noisy environment which distract learning activities. In essence, social clubs, music bands and spiritual activities are categorized as noise which reduces concentration on academic studies and performance in examination.

In statement 4, where the respondents agreed that the presence of motion ground, restaurants, banks, theatre house, sport pitch and well linked tarred roads boost learning ego is treated as a statement of fact which reinforce the earlier discussion that a good physical environment contribute to positive learning outcome. None of the selected polytechnics under study make provision for E-Learning equipment such as computer, projector, language laboratory, head phone, etc. for language learning activities in their institutions as indicated in statement 5. This implies that none of the students in these tertiary institutions would experience sound production in a language studio. Consequently, the students in these polytechnics may be deficient in the pronunciation of certain phonemes of English.

Discussion on Interviews

Opinions of lecturers on linguistic and environmental factors that affect language learning aligned with the hypothesis of this study that:

- (i) Poor infrastructure, change in national value orientation and absence of E-Learning environment discourage good performance in STEM courses in Nigeria polytechnics.
- (ii) Lecturers who teach STEM courses in Nigeria polytechnics are poorly motivated.

Lecturers from the selected STEM courses agreed in affirmative to the following questions:

- (a) What do you consider the primary challenge of the students in your course?
- (b) Are you impressed with their usage of English when you mark their scripts?

(c) Are you comfortable using English Language to teach?

All the interviewees affirmed that the primary challenge of their students is their lack of understanding of the English language. Few among them pointed out the lack of reading culture and readiness to read among the students. Consequently, the interviewees prefer using the local language to explain some concepts. None of the interviewees is impressed with the performance of their students after marking their scripts because of the low performance of the students. When the interviewees were asked to rate the performance of the students they teach, their rating oscillates between weak and poor.

Ninety-Five percent of the interviewees responded negatively to the question that says “Do you have access to all the modern equipment that you supposed to have in teaching the students?” the equipment referred to include the one mentioned under physical environment as well as the provision of other facilities that are necessary for language learning. The absence of modern E-learning environment will not serve as impetus for both the teachers and the students in Nigerian Polytechnics.

Conclusion and Recommendations

The linguistic factors that are explained in this study points out the possible areas of grammar that are difficult for students in the Nigerian Polytechnics to grasp. English language learning revolves around but not limited to the grammatical categories of noun, verb, adjective, adverb, preposition, conjunction and interjection and how they are combined to form sentences. Among these categories, the category of noun, verb, adjective and adverb serve as the building blocks that form the foundation for good grammatical expression in English. These areas are very useful, indispensable and instrumental to constructing sentences with which one expresses their mind on any issue. Therefore, it is relevant that they are identified in this study as the category that needs to be focused. It is not surprising that there are students in the Nigerian Polytechnic who may not know the past tense of “know”. Such a student may keep on using “know” or “no” where they ought to have used

“knew”. Some might even use “new” instead of “knew”. Good performance in STEM courses is partially anchored on the level of understanding students have in the language of instruction in polytechnics.

The environmental factors revolve around the physical and social environment that contribute to the rate at which students assimilate what they are taught. A polytechnic campus that is awkwardly arranged in term of building architecture, road network, citation, maintenance and equipment of lecture theatres will create an awkward picture of inferiority in the mind of the learners when compared with what is obtainable elsewhere. The mind is bound to reject such environment where learners do not feel fulfilled and on top of their academic career.

Bearing in mind these two factors militating against students’ performance in STEM courses, this study recommends the followings as practical steps towards solving the problem:

(a) STEM lecturers, especially the English language teacher, should develop materials on parts of speech where copious examples of nouns, verbs, adjectives, adverbs etc. are presented. Learners should be drilled on the use of these categories in order to facilitate their usage.

(b) The English language teachers need to painstakingly explain the category of verbs in its entirety starting from its broad division into auxiliary verbs and lexical verbs with copious examples of the types of auxiliary and lexical verbs. Since a good understanding of the verbs will help the learners to know how to use them under sentence construction, there is the need to explain thoroughly the combination of the different types of verbs.

(c) Attention should also be on spellings with the aim of reducing spelling errors of the learners. Regular dictation exercises should be encouraged as a ploy or technique for teaching spelling errors.

(d) Provision of E-Learning environment can aid better assimilation of language concepts that are abstract in nature. It reduces distractions and secures

learners interests when the concepts are graphically illustrated. A language class that rely solely on talking, use of gestures and diagrams may not appeal much to learners like when the concepts are telegraphically manipulated.

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