English Language Proficiency: A Predictor of Academic Performance in Biology

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ABSTRACT

English language is used as the medium of teaching in Ghanaian schools from Basic to the tertiary levels. Students at all stages of education are taught the content of school subjects through the use of the English language. As a result, how well students perform academically is mainly determined by their proficiency in English language. This paper therefore examined the relationship between English language proficiency and academic performance in Biology. The study employed a hybrid of ex-post facto and correlational research designs to determine the extent at which science students' performance in English language correlates with their academic performance in Biology. Secondary data in the form of Terminal examination scores and 2019 West African Senior Secondary School Certificate Examination (WASSCE) results in English language and Biology were analysed for 157 science students in four selected Senior High Schools in the Central and Western Regions. The Pearson Product Moment Correlation Analysis of the Statistical Package for Social Sciences (SPSS) was used to assess the degree of correlation between English language proficiency and academic accomplishment in Biology. The study observed that there was a positive correlation (r = 0.379, 0.479, 0.443 and 0.345) between English language performance and academic achievement in Biology in the terminal examination scores. The WASSCE scores revealed a positive and strong correlation (r = 0.825, 0.719) between English language and Biology. Based on these findings, it was recommended that since English language is extensively used in education as a whole, science teachers should teach language across the curriculum. That is, they must lay special emphasis on contextual proficiency more than on general proficiency in the language of learning and teaching (LOLT) when the need arises.

Keywords: Academic, Biology, Correlation, English, Proficiency

INTRODUCTION

Education is a universal practice that all societies engage in at all phases of development and has proven to tremendously improve children's cognitive capacity (Kuehnie&Oberfichtner, 2020; The Commonwealth of Learning, 2000). Education provides the foundation for healthy living through which knowledge is imparted, faculties trained, and skills developed (Bhardwaj, 2016; The Commonwealth of Learning, 2000). True education deals with knowledge that is regarded as worthwhile and capable of achieving a voluntary and committed response from the learner (Farrant, 1991, as cited in Byaruhanga, 2018). Language is the principal means by which education is disseminated or transmitted. Research has established that education and language are interdependent and the aims of education can only be achieved when language is properly used as the medium of instruction (Dube&Ncube, 2013; Nyamekye&Baffour-Koduah, 2021). It must therefore be noted that for language to remain, survive, and be appreciated, then it has to be taught in schools (Dube&Ncube, 2013; Maphosa, 2021). Because language has a huge impact on educational attainment, instructional language has always been a source of conflict, particularly in multilingual communities (Curdt-Christiansen, 2016). Ghana, as a multilingual and multicultural society with about 83 languages (Owu-Ewie, 2013) lacks a national unifying local language. This has led to the adoption of the

English language as a medium of intra-national and international communication. More crucially, English language has become the 'heart' around which Ghana's educational system survives without which one cannot progress in the educational sector (Dako&Quarcoo, 2017). Apart from being a required subject that must be passed at all levels of education, English language serves as the language of instruction (LOI) for almost all educational courses from thebasic school to the tertiary level in Ghana. This being the case, the deterioration in academic achievement and educational standards in Ghana has been attributed to students' low performance in English language in national examinations (Akowuah*et al.*, 2018; Yeboah, 2014). Proficiency in the LOI is, in fact, a significant element in educational success (Nyarko*et al.*, 2018).

Despite the existence of a few studies that suggest a link between LOI and academic achievement in some way, there is still a misunderstanding and scepticism about the existence of a link between test scores and actual performance. Wilkinson & Silliman (2008) postulated that students' academic achievement is dependent on their mastery of the LOI. As Malekela (2003) points out, if the learner is handicapped in the LOI, learning may not take place since the instructor and the learner will not be interacting. As a result, the LOI has a significant impact on students' overall performance. In terms of the connection between English Language Proficiency (ELP) and academic accomplishment, it is assumed that students who have a high level of English proficiency will perform well in English as a subject as well as in other academic courses (Wilson &Komba, 2012). Santiago & David (2019) also investigated the relationship between academic performance in Biology and second language competency, and found out that there was a positive significant association between English language and Biology achievement scores. The study further revealed that students encountered enormous problems learning Biology using English as the LOI and this was especially so for students in the public schools.

Some study findings' have also indicated that the teaching of English language and Science requires different pedagogical skills and therefore students who perform well in English language do not reflect the same performance in science subjects such as Biology, Physics and Chemistry (Oyoo&Semeon, 2015).

As a result of these contradictory findings, it is necessary to investigate further and establish how English language competency predicts students' academic achievement in science subjects in Ghana.

Problem Statement

Research studies have revealed that students encounter great difficulties learning Biology concepts in English language and this is particularly so for those who are second language (ESL) learners (Heppner & Leong, 1997). Enemarie, Ogbeba&Ajayi (2018) observed low academic performance of students in Biology during the West African Senior High School Certificate Examinations (WASSCE). It is very disappointing to note that there is a public agitation owing to students' abysmal performance in Biology, as substantiated by the Chief Examiner's reports of the West African Examination Council (WAEC) in recent years (WAEC, 2016 & 2017). The reports evidently revealed that only few students obtained the minimum credit pass in Biology, which happens to be one of the requirements to study science-related programs in higher institutions. The low academic achievement in Biology for the WASSCE has often been blamed on students' lack of mastery of English language, which is the medium through which knowledge in school subjects is communicated to learners (Lyamine&Mlambo, 2016).

The excessive 'jargon' load in Biology has also been established as a barrier to developing conceptual understanding and core competences (Zukswert*et al.*, 2019) and this is quite perturbing to Biology educators. Such 'jargons' or challenging terminologies are mostly derived from Latin, Greek, German, French etc. and using English in teaching such concepts is a great concern for Biology scholars (Ali *et al.*, 2022; Kauser& Shah, 2019). In view of this, students find it difficult comprehending these terminologies and this additionally contributes to their poor performance in Biology (Araoye, 2013). On this note, one can ascertain that the use of English language in teaching Biology has tremendous effect on the performance of students because English language is invariably taught in more or less complete isolation

from the teaching of Biology.

This study therefore seeks to examine the extent at which students' English language competency correlates to the academic achievement in Biology in some selected Senior High Schools in Ghana.

Objective

1. To determine the extent at which students' performance in English language correlates with their academic performance in Biology.

Research Questions

1. To what extent does the performance of students in the English language correlate with their performancein Biology?

LITERATURE REVIEW

The focus of Senior High School education in Ghana has largely been on science as a practical subject. This is quite true, for science is regarded as an empirical subject (Hooker, 1994). However, for most students, the most difficult aspect of understanding science is mastering its language (Markic& Childs, 2016; Rahman & Ali, 2015; Wellington & Osborne, 2001). One of the most essential features of science is the variety of words and concepts it uses (Wellington & Osborne, 2001).

According to research, language is critical for student achievement on examinations in content-based disciplines like science (Aina, Ogundele&Olanipekun, 2013). Abedi*et al*. (2004) in their research review concluded that students' language background is strongly associated with test performance. The language of instruction has an impact on the performance of students in science. Mji&Makgato (2006) observed that language was an indirect factor in a study they conducted to examine factors associated with High School students' poor performance in mathematics and science in South Africa. The study found that some students had a challenge grasping some concepts in mathematics and physical science, and that the usage of English as a language of instruction in these disciplines was an issue.

Many science educators are much concerned about the language used to teach science. As Wellington & Osborne (2001) put it:

Learning science is, as in many ways, like learning a new language. In some ways it presents more difficulty in that many of the hard, conceptual words of science – such as energy, work, and power – have a precise meaning in science and sometimes an exact definition, but a very different meaning in everyday life (p.5).

Lemke (1998) also highlights that the language of science is multi-semiotic. That is, science does not use words alone to communicate; instead scientific communication is reliant on words, graphs, charts, diagrams, symbols, equations and pictures. The language of science adopts a range of features which students will find peculiar. It avoids colloquial forms, it uses unfamiliar technical terms such as 'mitosis' and 'meiosis' and familiar words such as 'energy', 'force' and 'power' in unfamiliar contexts. It avoids personification and the use of metaphorical and figurative language (Lemke, 1990).

In a study on language and concept development in primary school children in Ghana, it was concluded that Ghanaian language should be used in scientific instructions because children will readily acquire process skills like conceptualization and hypothesising in their own language (Collison, 1972, as cited in Owu-Ewie, 2012).

The linguistic research of Chomsky has had significant effects on contemporary psychology, philosophy, and science (Barman, 2012). According to Chomsky (2002), language is a natural entity, an element of the human mind which is physically represented in the brain and part of the biological attribute of the species.

This suggests that language ability is innate because the human brain is biologically predisposed to learning new languages (Chomsky, 1965, as cited in Barman, 2012). Linguistic competence results from a species-specific innate language capacity that exists independently of other cognitive capacities (Radford *et al.*, 1999).

Chomsky's theory of language competence is termed nativist. Chomsky point out:

> The language faculty has an initial state, genetically determined; in the normal course of development it passes through a series of states in early childhood, reaching a relatively stable steady state that undergoes little subsequent change, apart from the lexicon. To a good first approximation, the initial state appears to be uniform for the species. Adapting traditional terms to a special usage, we call the theory of the state attained its grammar and the theory of the initial state Universal Grammar (UG) (Chomsky, 1995, p14, as cited in Barman, 2012).

According to Chomsky's nativism, humans are born with a set of linguistic norms known as UG, making language an intrinsic talent. The UG is the foundation upon which all human languages are built (Barman, 2012).

More importantly, Chomsky distinguishes between linguistic competence and linguistic performance (Newby, 2011). He argued that competence is the knowledge of language – an implicit understanding of the structural properties of all the sentences of a language. Performance, on the other hand, involves actual real-time use of the language and may deviate significantly from the underlying competence due to environmental disturbances and memory limitations (Barman, 2012). That is, linguistic competence enables individuals to construct all possible grammatical sentences while performance is how this competence is translated into everyday speech (Schank, 1969). Chomsky suggested that linguistic theory ought to describe the mental processes that underlie language usage. That is, the focus of linguistics will be competence, not performance (Barman, 2012).

METHODOLOGY

A hybrid of ex-post facto and correlational designs were employed for this study. The designs were deemed appropriate since the researcher had no direct control over the independent variable because its manifestation had already occurred. Only its link to the dependent variable was investigated retrospectively (Fakeye&Ogunsiji, 2009). The choice of these designs was influenced by the nature of assumption at hand. Secondly, the fact that correlational design analyses relationships between two or more variables gave it primary importance (Aina, 2013). The study targeted Senior High School science students from Western and Central Regions of Ghana. The cluster sampling technique was employed to randomly select two Senior High Schools (SHS) each from the Central and Western Regions. They were given Pseudonyms: School A, School B, School C and School D. Prior to data collection, the researchers visited the schools for familiarisation, established rapport and had oral discussions with the headmasters and teachers in the schools for their consent and willingness to support in the data collection process. Secondary data in the form of terminal examination scores (results) in English language and Biology were systematically sampled from academic files of continuing science students and recorded. The 2019 WASSCE results in English Language and Biology for the immediate past students were also sampled systematically and recorded. In all 157 individual results in Biology and English language were collected from the four selected schools for analysis. To assess the degree of correlation between English language proficiency and academic accomplishment in Biology, the data (test scores) were analysed using Pearson Product Moment Correlation Analysis. This statistical analysis is suitable because Pearson Product Moment Correlation is used to determine the degree of relationship between two sets of variables (Okoro*et al.*, 2022; Owie, 1996).

FINDINGS AND DISCUSSION

Table 1:Correlation between English Language and Biology (Terminal Examination scores at School A)

		English language	Biology
English language	Pearson Correlation	1	0.479
	Sig. (2-tailed)		0.060
	N	16	16
Biology	Pearson Correlation	0.479	1
	Sig. (2-tailed)	0.060	
	N	16	16

Source: Field data (2019)

In Table 1, the correlation coefficient (r) calculated was 0.479. This depicts a moderate (mild) positive correlation between students' academic performance in English language and Biology in the terminal examination.

Table 2: Correlation between English language and Biology (WASSCE scores at School A)

		English language	Biology
English language	Pearson Correlation	1	0.504**
	Sig. (2-tailed)		0.003
	N	32	32
Biology	Pearson Correlation	0.504**	1
	Sig. (2-tailed)	0.003	
	N	32	32

Source: Field data (2019)

Table 2 reveals that there is a significant positive correlation between English achievement scores and Biology in the WASSCE as the coefficient index (r) was 0.504. The relationship between the two variables was moderate (mild).

Table 3: Correlation between English language and Biology (Terminal Examination scores at School B)

		English language	Biology
English language	Pearson Correlation	1	0.443*
Sig. (2-tailed)		0.044	
N	21	21	
Biology	Pearson Correlation	0.443*	1
	Sig. (2-tailed)	0.044	

Source: Field data (2019)

In Table 3, students' academic performance in English language and Biology correlates by the index 0.443 in the terminal examination. This represents a low (weak) positive relationship.

Table 4: Correlation between English language and Biology (WASSCE scores at School B)

		English language	Biology
English language	Pearson Correlation	1	0.719
	Sig. (2-tailed)		0.107
	N	6	6
Biology	Pearson Correlation	0.719	1
	Sig. (2-tailed)	0.107	
	N	6	6

Source: Field data (2019)

Table 4 observed a correlation coefficient (r) = 0.719. This value represents a high (strong) positive relationship between students' academic performance in English language and Biology in the WASSCE.

Table 5: Correlation between English language and Biology (Terminal Examination scores at School C)

		English language	Biology
English language	Pearson Correlation	1	0.379
	Sig. (2-tailed)		0.121
	N	18	18
Biology	Pearson Correlation	0.379	1
	Sig. (2-tailed)	0.121	
	N	18	18

Source: Field data (2019)

In correlating the two subjects, Table 5 observed that r = 0.376. The value indicates a low (weak) positive relationship between students' academic performance in English language and Biology in the terminal examination.

Table 6: Correlation between English language and Biology (WASSCE scores at School C)

		English language	Biology
English language	Pearson Correlation	1	0.827**
	Sig. (2-tailed)		0
	N	19	19
Biology	Pearson Correlation	0.827**	1
	Sig. (2-tailed)	0	
	N	19	19

Source: Field data (2019)

In Table 6, r = 0.827. The value implies a high (strong) positive relationship between students' academic performance in English language and Biology in the WASSCE.

Table 7: Correlation between English language and Biology (Terminal Examination scores at School D)

		English language	Biology
English language	Pearson Correlation	1	0.345
	Sig. (2-tailed)		0.057
	N	31	31
Biology	Pearson Correlation	0.345	1
	Sig. (2-tailed)	0.057	

Source: Field data (2019)

Table 7 reveals a positive relationship between English language scores and Biology as the correlation coefficient (r) was = 0.345. This relationship was, however, weak.

Table 8: Correlation between English language and Biology (WASSCE scores at School D)

		English language	Biology
English language	Pearson Correlation	1	0.085
	Sig. (2-tailed)		0.772
	N	14	14
Biology	Pearson Correlation	0.085	1
	Sig. (2-tailed)	0.772	

Source: Field data (2019)

In Table 8, the correlation coefficient calculated is 0.085. This value represents a low (weak) relationship between students' academic performance in English language and Biology in the WASSCE.

It could be deduced from the data analysed that proficiency in English language is essential for all science students to perform academically in Biology. From the above analysis, the correlation indices determined between students' academic performance in English language and Biology in the terminal examinations scores for School A, School B, School C and School D were 0.479, 0.443, 0.379 and 0.345 respectively. These values show positive correlation between English language and Biology. This means that students of each group retain the same positions of high scores in both English language and Biology, or low scores in both subjects. This suggests that as English language proficiency increases among students, academic success in Biology also increases and vice versa. This finding is in consonance with the views of researchers that there is a positive correlation between proficiency in the language of instruction and overall academic achievement of learners (Ajibade 1993; Feast 2002; Owu-Ewie, 2012; Aina, Ogundele&Olanipekun, 2013). This implies that students who are proficient in the language of instruction generally perform well insubjects taught in that language and vice versa. However, the correlation coefficients determined aregenerally weak which indicate that academic performance in English language cannot be predicted with avery high degree of accuracy from academic performance in Biology and vice versa.

In the WASSCE scores; 0.504, 0.719, 0.827 and 0.085 were the correlation indices computed by the four selected schools respectively. These indices also represent positive correlation between the two subjects (English language and Biology). The indices; 0.825 and 0.719 denote high or strong correlation between English language proficiency and Biology achievement. This implies that academic performance in English language can be predicted with a very high degree of accuracy from academic performances in Biology and vice versa. That is, good English language proficiency determines good performance of students in Biology or vice versa (any student who is not good in English language may not as well be good in Biology). This study confirms earlier findings by Science scholars that there is significantly stronger positive correlation between English language and science achievement (Aina, Ogundele & Olanipekun, 2013;

Rauchas, Konidaris, Rosman& Sanders 2006).

CONCLUSION

Generally, this study has demonstrated that there is a positive correlation between English language proficiency and academic achievement in Biology. However, a strong significant positive correlation between English language and Biology has been established in the WASSCE results of School B and School C. This evidence is enough to conclude that proficiency in English language is strongly related to science students' academic performance in Biology. Based on this, it can be inferred that students' skills in acquisition of language through reading and writing in English language is helping them to understand, master and perform well in Biology and vice versa because both subjects require ample reading and writing. Hence the call by Martin & Miller (1988) that science students must be taught how to write reports (reports that classify, decompose, describe and list properties), explanations, experimental accounts and expositions which present arguments in favour of a position is very laudable. This finding is also in consonance with what Wellington & Osborne (2001) pointed out that being scientific literate means that students need to learn both how to read and how to write science.

RECOMMENDATIONS

In view of the research findings elaborated on, the following recommendations are made;

1. Since the English language is extensively used in education as the medium of instruction, Biology (Science) teachers must be given ample linguistic training to teach language across the curriculum. That is, they must lay special emphasis on language in their instructions when the need arises.
2. Biology (Science) teachers should focus on contextual proficiency more than on general proficiency in the language of learning and teaching (LOLT). This holds more promise for enhanced learning andachievement in science.
3. Admission of students from the Basic level into Senior High School Science courses should be based on credit pass in English language or such students should have good English language proficiency.

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