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EDITORIAL

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We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Patrick C. Igbojinwaekwu
Editor-in-Chief

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TEACHING EXPERIENCE AND ACADEMIC QUALIFICATIONS AS CORRELATES OF PEDAGOGICAL CONTENT KNOWLEDGE OF BIOLOGY TEACHERS IN ANAMBRA STATE

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Abstract

This study investigated teaching experience and academic qualification as correlates of pedagogical content knowledge of secondary school biology teachers in Anambra state. Two research questions guided the study and two null hypotheses were tested at 0.5 level of significance. The study adopted a correlational research design specifically. The population of the study comprised of six hundred and forty-two biology teachers in Anambra State. A sample of 309 biology teachers was selected using a multi- stage sampling procedure. Data was collected using Biology Teachers' Pedagogical Content Knowledge Questionnaire (BTPCKQ), validated by two experts in the in the Department of Science Education, Nnamdi Azikiwe University, Awka. The reliability of the BTPCKQ was established using Kuder Richardson 20- formula (KR-20), yielding a reliability coefficient of 0.81. Data were gathered with the assistance of three trained research assistants. Pearson Product -Moment Correlation was used to answer the research questions and regression analyses were employed to test the null hypotheses at 0.5 levels of significance. The result revealed that there is a positive relationship between secondary school biology teachers' teaching experience, academic qualification and their pedagogical content knowledge in biology. It also revealed that teaching experience and academic qualification were significant correlators of pedagogical content knowledge of biology teachers. Based on the findings, it was recommended that among others that, training programme for pre-service teachers and new teachers should be made to be experiential. This involves giving them ample opportunities for classroom teaching environment.

Keywords: Teaching experience, Academic, Qualifications, Pedagogical Content Knowledge.

Introduction

Education is the structured process through which individuals acquire the knowledge, skills, values, and competencies needed for personal development and national progress (UNESCO, 2022; Okeke, 2020). Beyond the transmission of knowledge, education promotes critical thinking, problem-solving, and lifelong learning, making it a key driver of sustainable development (UNESCO, 2021; OECD, 2018). Within this broad framework, science education occupies a central position because it equips learners with scientific literacy, inquiry skills, and the ability to understand and solve real-life problems (Aina & Akintunde, 2017; Uche & Chukwu, 2021). However, the effectiveness of science education in Nigeria continues to be constrained by challenges such as inadequate instructional resources, limited teacher professional development, overcrowded classrooms, and outdated teaching methods, which negatively affect students' learning outcomes (Adeuya, 2020; Abidoye & Ogunlowo, 2021).

Science education is the discipline concerned with the teaching, learning, and assessment of scientific knowledge, processes, and the nature of science (Obialor, 2018). It plays a vital role in developing scientific and technological manpower through effective curriculum, teaching methods, and educational research. Within science education, biology is particularly important because it equips students with knowledge and skills relevant to health, agriculture, environmental conservation, biotechnology, and sustainable development. Igbokwe (2019) emphasized that effective biology education is essential for improving academic achievement and preparing learners for STEM careers and informed citizenship. However, despite its importance, students' achievement in biology in many Nigerian secondary schools

remains poor, largely due to teacher-centred instructional methods and inadequate practical activities (Udeinya & Okonkwo, 2020).

Biology is the branch of science that studies living organisms, their structure, functions, growth, evolution, and interactions with one another and their environment (Umar, 2021). As a core science subject, biology contributes significantly to medicine, agriculture, environmental conservation, and biotechnology. According to Abimbola (2017), biology teaching should enable students to acquire scientific knowledge, practical skills, problem-solving abilities, and appropriate scientific attitudes. Since biology is broad and conceptually demanding, biology teachers are expected to employ diverse instructional strategies that promote meaningful learning, practical competence, and the application of scientific knowledge to real-life situations (Samuel, Okonkwo & Egolum, 2022). Therefore, the effectiveness of biology teaching largely depends on the pedagogical approaches adopted by biology teachers.

Teachers play a vital role in achieving educational goals by translating educational policies into effective classroom practices and using innovative instructional strategies to enhance students' learning and attitudes (Bilesanmi-Awoderu, 2022). A biology teacher is a specialist who teaches biological concepts through both theoretical and practical approaches, fostering scientific inquiry, critical thinking, and scientific literacy (National Research Council [NRC], 2017; Bybee, 2018; UNESCO, 2020). Research has shown that biology teachers significantly influence students' academic achievement (Abidoye & Ogunlowo, 2021; Abidoye, 2015). Consequently, attention has shifted from teachers' qualifications alone to their Pedagogical Content Knowledge (PCK), which integrates subject matter knowledge with effective

teaching strategies to make biology concepts understandable and meaningful to diverse learners.

Pedagogical Content Knowledge (PCK) is the specialized knowledge that enables teachers to combine subject-matter expertise with effective teaching strategies to make learning meaningful and understandable for students (Shulman, 2017; Gess-Newsome, 2018). It includes selecting appropriate instructional methods, addressing students' misconceptions, and designing suitable assessments (Hume & Berry, 2019). PCK develops through teaching experience and professional learning (Chan & Hume, 2019) and has been shown to significantly influence students' academic achievement in biology (Onipede, Alade & Ogunniyi, 2025). Since PCK is shaped by several teacher-related factors, academic qualifications are considered an important characteristic that may enhance teachers' pedagogical and content knowledge.

Academic qualifications refer to the formal educational credentials and professional certifications acquired by teachers, such as degrees in Biology, Biology Education, or related fields. These qualifications provide teachers with subject-matter knowledge and pedagogical training that contribute to the development of their Pedagogical Content Knowledge (PCK) (Carvalho & Santiago, 2019; Abidoye, Adeoya & Salami, 2018; Helen, Okoro & Nwosu, 2025). However, beyond formal qualifications, teaching experience is also considered an important factor that enhances teachers' PCK through continuous classroom practice and professional growth.

Teaching experience refers to the number of years a teacher has spent teaching a subject, during which practical knowledge and instructional skills are developed through classroom practice (Darling-Hammond, Hyler & Gardner, 2017). It enables

teachers to improve classroom management, adapt instructional strategies, address students' misconceptions, and strengthen their Pedagogical Content Knowledge (PCK) through continuous reflection and experience (Ingersoll & Collins, 2018; Gess-Newsome, 2018). Studies have shown that experienced teachers generally demonstrate higher instructional effectiveness and contribute to improved student learning outcomes, particularly when experience is combined with continuous professional development (Ronfeldt, Loeb & Wyckoff, 2018; OECD, 2019). However, findings from Nigeria remain inconsistent, with some studies reporting a significant relationship between teaching experience and instructional quality, while others found no significant relationship (Ebek, Okafor & Nwafor, 2018; Abidoye & Ogunlowo, 2021). Beyond teacher characteristics, the availability of instructional resources also influences effective biology teaching. Inadequate laboratories, teaching aids, and ICT facilities often limit teachers' ability to apply their PCK effectively in the classroom (Abidoye, Adeoya & Salami, 2018).Without adequate resources, even teachers with high qualifications or long experience may struggle to translate their PCK into effective classroom practice. In this case, teachers rely on ‘theoretical teaching’ because the instructional resources for effective instructional delivery of biology curriculum are lacking. However, literature available to the researcher shows no evidence that there has been such a study to find out how teaching experience and academic qualification contribute to teachers’ development of pedagogical content knowledge in biology. This study therefore will be carried out to investigate how teaching experience and academic qualification correlate the pedagogical content knowledge among biology teachers in Anambra State.

Statement of the Problem

Despite the critical role biology education plays in equipping students with scientific understanding and inquiry skills, in biology at the secondary school level in Anambra State remains below expectation. Examination results from national and state-level assessments indicate that many students have difficulty grasping core biology concepts, particularly in areas that require practical understanding and application. This shortfall has been linked to inadequate pedagogical practices, which in turn may be influenced by the teacher's academic background and experience. Although many biology teachers in Anambra State hold formal qualifications, there is evidence suggesting a disconnect between their content knowledge and their ability to effectively deliver instruction using learner-centered pedagogies Furthermore, the influence of teaching experience on PCK has yielded inconsistent findings in various states, suggesting that years of service alone may not translate to improved instructional competence. In Anambra State, there is a paucity of recent empirical studies that specifically examine how biology teachers' academic qualifications and teaching experience correlate with their PCK.In light of the premise, the current study investigated how these two key teacher characteristics: academic qualification and teaching experience are associated with biology teachers' PCK in Anambra State. The findings will help clarify the factors that contribute to effective biology teaching and inform teacher recruitment, training, and deployment policies.

Purpose of the Study

The purpose of the study was to examine the relationship between in secondary school biology teachers' academic qualifications, teaching experience, and their

pedagogical content knowledge (PCK) in Biology in Anambra State. Specifically, the study sought to determine the:

1. Relationship between secondary school biology teachers' academic qualifications and their pedagogical content knowledge in Biology.
2. Relationship between secondary school biology teachers' teaching experience and their pedagogical content knowledge in Biology.

Research Questions

The study was guided by the following research questions.

1. What is the relationship between secondary school Biology teachers' academic qualifications and their pedagogical content knowledge in Biology?
2. What is the relationship between secondary school Biology teachers' teaching experience and their pedagogical content knowledge in Biology?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

1. There is no significant relationship between biology teachers' academic qualifications and their pedagogical content knowledge.
2. There is no significant relationship between biology teachers' teaching experience and their pedagogical content knowledge.

Methods

The study adopted a correlational survey research design. The study was carried out in Anambra State, Nigeria. Anambra State is located in the southeastern geopolitical zone of Nigeria, the study was conducted in three education zones namely: Awka Education Zone comprising five local government: Anaocha, Awka North, Awka South, Dunkofia, and Njikoka with a total of 66 public schools; Ogidi Education

Zone with three local government area: Idemili North, Idemili South and Oyi with 40 public secondary schools, and; Otuocha Education Zone with three local governments: Anambra East, Anambra West and Anyamelum with 28 public secondary schools. These zones are part of the six education zones in the state. The population of the study comprised the 642 teachers currently teaching biology in the 274-government owned secondary schools in Anambra State. The sample of the study comprised of 309 biology teachers drawn from the population using multi-stage sampling procedure, employed as follows. Firstly, simple random sampling technique, sampling without replacement, was used to draw out three (Awka, Ogidi and Otuocha) out of the six education zones in the state. Simple random sampling technique was employed to give all the six zones an equal chance of being selected, to ensure representativeness across the three sampled education zones were chosen to participate in the study. This was done to ensure proportional representation and also, because the population of Biology teachers in the schools, in the zone, were not too many. Finally, all the 157 biology teachers in Awka Education zone, 108 in Ogidi education zone and 44 in Otuocha education zones, were all chosen to participate in the study, since they were not considered too many. The instrument was subjected to face and content validation by three experts. Two of the experts were from the Department of Science Education, while one from Measurement and Evaluation of the Department of Educational Foundations all from Nnamdi Azikiwe University, Awka. To ascertain the consistency at which the instrument measures what it is supposed to measure, its internal consistency was measured using Kuder Richardson 20- formula because the items in the BTPCKQ were dichotomously scored (that is, for each item its either one passes or fails it). The reliability test yielded a reliability

coefficient of 0.81. Data were collected through direct administration of the questionnaire to the selected respondents, by the researcher, with the help of three trained research assistants. That is, the questionnaires were distributed and the completed copies collected on the spot. Data collected from respondents were analyzed using Pearson Product moment coefficient and regression analysis. In answering the research questions, Pearson Product-Moment Correlation was used while in testing all the hypotheses, at the 0.05 level of significance, simple and multiple regression analyses were employed. To ascertain the relationship between the variables relating to research questions, the following guidelines was used; 0.80 and above (very high relationship), 0.60-0.79 (high relationship), 0.30-0.59 (low relationship), and 0.01-0.29 (very low relationship), 0.00 (no relationship). The decision rule for testing the hypotheses was reject the null hypotheses if the probability value (P-value) is less than the 0.05 alpha level, but if otherwise ($p>0.05$) do not reject.

Results

Research Question 1: What is the relationship between secondary school Biology teachers' academic qualifications and their pedagogical content knowledge in Biology?

Table 1: Pearson r on Relationship Between Biology Teachers' Academic Qualifications and their Pedagogical Content Knowledge in Biology

Source of variation	**N**	**R**	**r^2**	**(%) contribution**	**Remark**
Academic Qualification	309	0.32[a]	0.10	10%	Low positive r/ship
Pedagogical Content Knowledge	309				

Table 1 reveals a Pearson coefficient (r) value of 0.32 indicating that a low positive relationship exists between Biology teachers' academic qualification and their pedagogical content knowledge in biology. In addition, the finding showed that Biology teachers academic qualifications accounted for 10% of the variance ($\mathbf{r^2}$ = 0.10) in their pedagogical content knowledge in biology. This by implication asserts that the higher a teachers' academic qualification is, the greater their pedagogical content knowledge in biology.

$H0_1$: There is no significant relationship between secondary school biology teachers' academic qualification and their pedagogical content knowledge in Biology

Table 2: Significance of Correlation Between Biology Teachers' Academic Qualifications (AQ) and their Pedagogical Content Knowledge (PCK) in Biology

	Model	Sum of Squares	df	Mean Square	F	Sig.	Decision
1	Regression	671.408	1	671.408	35.051	0.000[b]	Significant
	Residual	5880.631	307	19.155			
	Total	6552.039	308				

a. Dependent Variable: PCK
b. Predictors: (Constant), AQ

Table 2 reveals that at an F-value (df 1 and 307) of 35.051, the P-value is 0.00. Since the P-value is less than 0.05 level of significance, the null hypothesis is rejected. This reveals that a statistically significant positive relationship exists between Biology teachers' academic qualifications and their pedagogical content knowledge in biology.

Research Question 2: What is the relationship between secondary school Biology teachers' teaching experience and their pedagogical content knowledge in Biology?

Table 3: Pearson r on Relationship Between Biology Teachers' Teaching Experience and their Pedagogical Content Knowledge in Biology

Source of variation	N	R	r^2	(%) contribution	Remark
Teaching Experience	309	0.49[a]	0.24	24%	Low positive r/ship
Pedagogical Content Knowledge	309				

Table 3 reveals that a low positive relationship (r = 0.49) exists between Biology teachers' years of teaching and their pedagogical content knowledge in biology. Furthermore, the findings showed that 24% of the variance in teachers' pedagogical content knowledge in biology may be attributed to their years of teaching experience($\mathbf{r^2}$ = 0.10). This by implication opines that the greater the number of years of teaching experience a biology teacher has, the higher their pedagogical content knowledge in biology.

$H0_2$: There is no significant relationship between secondary school biology teachers' teaching experience and their pedagogical content knowledge in Biology

Table 4: Significance of Correlation Between Biology Teachers' Years of Teaching Experience (YTE) and their Pedagogical Content Knowledge (PCK) in Biology

	Model	Sum of Squares	df	Mean Square	F	Sig.	Decision
1	Regression	1587.083	1	1587.083	98.135	.000[b]	Significant
	Residual	4964.956	307	16.172			
	Total	6552.039	308				

a. Dependent Variable: PCK
b. Predictors: (Constant), YTE

Table 4 reveals that at an F-value (df 1 and 307) of 98.135, the P-value is 0.00. Since the P-value is less than 0.05 level of significance, the null hypothesis is rejected. This reveals that a statistically significant positive relationship exists between Biology teachers' years of teaching experience and their pedagogical content knowledge in biology.

Discussion

Relationship Between Secondary School Biology Teachers' Academic Qualification and their Pedagogical Content Knowledge in Biology

The study revealed that there exists a low positive relationship between Biology teachers' academic qualification and their pedagogical content knowledge in Biology, revealing that although low, the higher the academic qualification a teacher has, the higher his/her pedagogical content knowledge in Biology. The finding, when tested, proved statistically significant affirming that although low, Biology teachers' academic qualification plays a statistically significant relative role in their acquisition of pedagogical content knowledge in Biology. This observed significant relationship, generally, could be attributed to the rigorous process involved in acquiring a higher degree during which teachers are exposed to a variety of activities, methodologies, opportunities, contents and experiences deepening their understanding of the intricacies of their subject area. In the process of acquiring a higher degree in most teacher training institutions, teachers are exposed to variety of assignments, seminar presentations, paper writing and publications, examinations as well as project writing, instilling in them the pedagogical skills and content knowledge of their subject areas.

In Biology specifically, additional years involved in the acquisition of a higher degree inculcates in a biology teacher better understanding of; the subject matter, assessment

techniques, techniques for teaching, teaching skills and classroom management strategies, enhancing their pedagogical and content knowledge in Biology. The findings of the study lay credence to the findings of Okeke (2024), Samuel, Okonkwo and Egolum (2022), Amadi (2022) and Ajayi (2017) who reported in their respective studies that teachers' academic qualifications positively and significantly correlated with their pedagogical content knowledge, in their respective investigated subject areas.

Relationship Between Secondary School Biology Teachers' Teaching Experience and their Pedagogical Content Knowledge in Biology

The finding revealed that a low positive relationship exists between Biology teachers' teaching experience and their pedagogical content knowledge in Biology. The finding implies that as biology teachers' years of experience in teaching the subject increases, their pedagogical content knowledge in Biology, also increases although at a low extent. The finding was further affirmed by the test of the null hypothesis, confirming that Biology teachers' years of teaching experience significantly correlated with their pedagogical content knowledge in Biology. Generally, the findings could be attributed to the activities, scenarios, and opportunities gathered by a classroom teacher throughout her years in the teaching profession. With attendance to conferences, symposia and workshops organized by educational stakeholders such as professional bodies, Non-Governmental Organizations (NGOs) as well as the government at all levels of education, teachers are exposed to and trained on variety of new methodologies, assessment strategies and classroom management skills that promote their teaching (pedagogical) and content knowledge of their subject areas.

In the teaching of Biology specifically, the number of years a teacher has spent in the profession notably adds to his or her comprehension of the peculiarities of the subject, especially its principles and guidelines, promoting the effective teaching of biology contents. For instance, external examination bodies such as West African Examinations Council (WAEC) and National Examinations Council (NECO) place significant emphasis on number of years a teacher have given to the teaching profession before assigning him or her as an examiner. The findings of the study concur with that of Okeke (2024), Umeanolue, Okoli, and Obialor (2023), Samuel, Okonkwo and Egolum (2022) and Obialor and Ezenwabuchili (2022) who affirmed in their respective studies that teaching experience of a teacher significantly and positively relates (contributes) to their pedagogical content knowledge in Biology.

Conclusion

Based on the findings of this research, it was concluded that teaching experience and academic qualification correlated biology teachers' pedagogical content knowledge. It was also revealed that there were significant relationships between teaching experience, academic qualification and teachers' pedagogical content knowledge in biology. This shows that teachers' teaching experience and academic qualifications should be considered in the recruitment exercises so as to promote quality pedagogical content knowledge.

Recommendations

On the basis of findings from this study, it is recommended that:

1. Since teaching experience correlates biology teachers' pedagogical content knowledge, training programme for pre-service teachers and new teachers should be made to be experiential. This involves giving them ample opportunities for classroom teaching environment.
2. Biology teachers with lower educational qualifications like NCE should be supported to go for further training to acquire higher degrees. This support could be informed of study leave and financial support by the government. This will enable them develop their pedagogical content knowledge in the subject.

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