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## NOTES ON CONTRIBUTORS

**Abdul, A. Ph.D.** Department of Educational Management, University of Ilorin, Ilorin, Nigeria

**Abdulhafiz, A. I.** is a Lecturer, Department of Islamic Studies, College of Education, Ilorin, Nigeria.

**Abdulkadir, O. R. Ph.D.** is a Lecturer, Educational Foundations Department, Faculty of Education, Federal University Dutsin-MA, Katsina, Nigeria

**Abdullahi, M. A. Ph.D.** is a Chief Lecturer, Department of Education, College of Arabic and Islamic Legal Studies Ilorin, Nigeria

**Abdulraheem, I. O.** Ilorin, Kwara

**Abdulraheem, M.** is a Lecturer, Department of Marketing, Faculty of Management Sciences, University of Ilorin, Ilorin

**Abdulraheem, Y. O.** is a Lecturer, Department of Human Kinetics Education, Faculty of Education, University of Ilorin

**Abdussalam, O. I.** is a Lecturer, Kwara State College of Education, (COED) Ilorin,

**Abimbola, I. O. Ph.D.** is a Lecturer, Department of Science Education, University of Ilorin, Ilorin, Nigeria

**Abubakar, M. S.** is a Lecturer, Department of Educational Psychology, School of Education, Department of Educational Psychology, School of Education

**Adegunna, A. D.** is a Research Student (Mathematics Education) Department of Science Education, Federal University of Technology, Minna, Nigeria

**Adeyemi, W. A.** is a Lecturer, Department of Arts and Social Sciences Education, Al-Hikmah University, Ilorin, Kwara

**Agbonlahor A. A.** is a Lecturer, Department of Educational Foundations & Management, School of Education, Federal College of Education, Abeokuta, Ogun State

**Ahmed, M. A. Ph.D.** is a Lecturer, Department of Science Education, University of Ilorin, Ilorin, Nigeria

**Ajagbe, F. N. Ph.D.** c/o. Mr. Ibrahim Oyedele Ajagbe, Michael Imohoudu National Institute for labour Studies, P.M.B. 1524, Ilorin, Kwara State, Nigeria.

**Ajayi, I. G.** is a Doctoral Student, Department of Educational Management, University of Ilorin, Kwara State

**Ajeigbe, Y. I.** is a Lecturer, Department of Human Kinectics, Health Education and Sports Administraction, Kwara State University Malete

**Akanmu, M. A. Ph.D.** is a Lecturer, Department of Science Education, University of Ilorin, Ilorin, Nigeria

## NOTES ON CONTRIBUTORS

**Akanni, L. F.** is a Lecturer, Business Education Department, Kwara State College of Education, Ilorin

**Akinnubi, O. P. Ph.D.** is a Senior Lecturer, Department of Educational Management and Counselling, College of Education, Al-Hikmah University, Ilorin, Kwara State

**Alabi, D. O.** is a Lecturer, Religious Department, Faculty of Arts, Ekiti State University, Ado-Ekiti

**Ambali, R.** is a Lecturer, Political Science Department, Kwara State College of Education, Ilorin

**Ayinla, S. O.** is a Lecturer, Department of Science and Technical Education, College of Education, Igbaja Campus,

**Bello, A. A. Ph.D.** is a Lecturer, Department of Science Education, University of Ilorin, Ilorin, Nigeria

**Bello, A. Y. Ph.D.** is a Senior Lecturer, Department of Science Education, College of Education, Al-Hikmah University Igbaja Campus.

**Braimah, O. J.** is a Lecturer, *Department of Statistics, University of Ilorin, PMB 1515, Ilorin, Kwara State, Nigeria.*

**Braimah, O. J.** is a Lecturer, *Department of Statistics, University of Ilorin, PMB 1515, Ilorin, Kwara State, Nigeria*

**Busari, K. K. Ph.D.** is a Lecturer, Osun State College of Education, Ilesa, Nigeria

**Chukwujekwu, O. N.** is a Lecturer, Department of Educational Management and Policy, School of Education, Federal College of Education (Technical), Umunze, Anambra State

**Cobbinah, A.** is a Lecturer, Department of Educational Foundations, University of Cape Coast-Ghana

**Daramola, D. S. Ph.D.** is a Lecturer, Department of Social Sciences Education, Faculty of Education, University of Ilorin, Ilorin.

**Dimowo, R. A.** is a Doctoral Student, Department of Educational Management, University of Ilorin, Kwara State

**Enijuni, A. T.** is a Lecturer, Business Education Department, College of Education, Ikere Ekiti, Ekiti State

**Etejere, P. A. O. Ph.D.** is a Senior Lecturer, Department of Educational Management, Faculty of Education, University of Ilorin, Ilorin, Nigeria.

**Falode, O. C.** is a Lecturer II (Educational Technology) Department of Science Education, Federal University of Technology, Minna, Nigeria

**Fawale, A. A.** is a Lecturer, Department of Educational Management and Counselling, College of Education, Al-Hikmah University, Ilorin, Nigeria

## NOTES ON CONTRIBUTORS

**Gambari, A. Ph.D.** is an Associate Professor (Educational Technology) Department of Science Education, Federal University of Technology, Minna, Nigeria

**Idris, S. M. Ph.D.** is a Lecturer, Department of Islamic Studies, Federal College of Education, Zaria

**Iliyas, R. A. Ph.D.** is a Lecturer, *Department of Educational Foundation, Federal University Dutsinma, Katsina State, Nigeria.*

**Isiaka, G.** is a Doctoral Student Department of Counsellor Education, Faculty of Education, JA'AFAR, A. A. Ph.D. is a Lecturer, Department of Islamic Studies, FCT College of Education, Zuba-Abuja

**Joan, A. P.** is a Lecturer, Department of Curriculum and Instruction, Faculty of Education, Ambrose Alli University, Ekpoma

**Kolawole, L. A.** is a Lecturer, *Chemistry Laboratory Unit, AbdulRaheem College of Advanced Studies, Igbaja (An Affiliate of Al-Hikmah University, PMB 1601, Ilorin, Kwara State, Nigeria)*

**Kurfi, R. A. Ph.D.** is a Lecturer, Educational Foundations Department, Faculty of Education, Federal University Dutsin-MA, Kastina, Nigeria

**Lasisi, A. K. Ph.D.** is a Lecturer, Al-Hikmah University Ilorin

**Lawal, S.** is a Lecturer, Languages Department, Kaduna Polytechnic, Kaduna

**Muhammad-Jamiu I.** Department of Arts Education, University of Ilorin, Ilorin, Nigeria

**Muraina, M. B.** is a Lecturer and Sub-Dean, College of Education, Al-Hikmah University, Ilorin, Kwara State.

**Nuhu, M. A. Ph.D.** is a Lecturer, Department of Social Sciences Education, Faculty of Education, University of Ilorin, Ilorin, Nigeria

**Odetokun, A. A. Ph.D.** is a Lecturer, Department of Arts and Social Sciences Education, Al-Hikmah University, Ilorin, Kwara State

**Ogundele, M. O. Ph.D.** is a Lecturer, Department of Educational Foundations, Faculty of Education, University of Jos, Jos, Nigeria.

**Oguntunde, A. D. Ph.D.** is a Deputy Director, Department of Continuing Education, Ministry of Tertiary Education, Science and Technology, Ilorin, Kwara State, Nigeria.

**Okafor, I. P. Ph.D.** is a Lecturer, Department of Social Sciences Education, Faculty of Education, University of Ilorin, Ilorin, Nigeria.

**Okeshola, T. A.** is a Doctoral Student, Department of History and International Studies, Ekiti State University, Ado-Ekiti

## NOTES ON CONTRIBUTORS

**Olutola, A. T. Ph.D.** is a Lecturer, Department of Educational Foundations, Faculty of Education, Federal University Dutsin-Ma, Katsina State.

**Omosidi, A. S. Ph.D.** is a Lecturer, Department of Educational Management University of Ilorin, Nigeria,

**Owolabi, H. O. Ph.D.** is a Lecturer, Department of Adult and Primary Education, Faculty of Education, University of Ilorin, Ilorin.

**Oyelakin, A.M.** is a Lecturer, Department of Science Education, Al-Hikmah University, Ilorin, Nigeria

**Ozurumba. N.** is a Lecturer, Bell University of Technology, Otta

**Rabi, A. D.** is a Lecturer, Department of Educational Foundations, Faculty of Education, Federal University, Dutsin-Ma, Katsina State, Nigeria.

**Raji, K. M.** is a Lecturer, Kwara State College of Education (Technical) Lafiagi

**Salami, S. S.** is a Lecturer, Department of Educational Management and Counselling, College of Education, Al-Hikmah University, Ilorin

**Salau, K. K. Ph.D.** is a Lecturer, Department of Educational Foundation, Kwara State College of Education, Ilorin

**Salau-Ibrahim T.T.** *Department of Physical Sciences, Al-Hikmah University, PMB 1601, Ilorin, Kwara State, Nigeria*

**Salihu, T. A.** ARMTI SSQ Agricultural and Rural Management Training Institute, Ilorin, Kwara State.

**Saliu, K. A.** is a Lecturer, Department of Educational Foundations & Management, School of Education, Federal College of Education, Abeokuta, Ogun State

**Shittu, A. T.** is a Lecturer I (Educational Technology) Department of Science Education, Federal University of Technology, Minna, Nigeria

**Sule, A. O. Ph.D.** is a Reader, *Department of Statistics, University of Ilorin, PMB 1515, Ilorin, Kwara State, Nigeria.*

**Toki, O. T.** is a Lecturer, School of Basic and Remedial Studies, Kwara State College of Education, Ilorin

**Torpev, T. F. Ph.D.** is a Lecturer, Department of Educational Foundations, Faculty of Education, Federal University, Dutsin-Ma, Katsina State, Nigeria.

**Udechukwu, J. A. Ph.D.** is a Lecturer, Department of Educational Psychology, School of Education, Department of Educational Psychology, School of Education, University of Ilorin, Nigeria

**Uyanne. E. O.** is a Lecturer, Department of Social Sciences Education, Faculty of Education, University of Ilorin, Ilorin, Nigeria



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# ASSESSMENT OF PEDAGOGICAL CONTENT KNOWLEDGE OF BIOLOGY TEACHERS IN SENIOR SECONDARY SCHOOLS IN ILORIN, KWARA STATE, NIGERIA

A.A. Bello, I.O. Abimbola & M.A. Ahmed

## Abstract

Most observers agree that successful teachers draw on specialized knowledge in their instructional work with students, but specifying and measuring this knowledge has proven elusive and controversial in the Nigerian educational system. This study therefore, assessed the pedagogical content knowledge of biology teachers in Senior Secondary Schools in Ilorin, Kwara State, Nigeria. It examined the influence of teaching experience on pedagogical content knowledge of biology teachers. The study was a descriptive one using the survey method in which 270 biology teachers from 90 secondary schools from the five L.G.A in Ilorin, Kwara State, Nigeria were involved. A researcher-designed questionnaire was used in collecting teachers' data on their pedagogical content knowledge. A simple random sampling technique was employed to select the schools. Analysis of Variance (ANOVA) was used to test the two hypotheses. The result revealed that there was no significant difference in the level of knowledge of biology topics between experienced, moderately experienced and less experienced biology teachers ( $F_{(2,264)} = 4.521; .012$ ). There was no statistically significant difference in the level of pedagogical content knowledge of biology teachers based on teaching experience ( $F_{(3,263)} = 1.308; .272$ ). Based on the findings, it was recommended that teachers should intensify more efforts on developing themselves on their subject matter knowledge as it goes a long way in making teaching and learning easy for them and their students. Stakeholders in the education sector should realize that teaching is a profession and that whoever must be chosen to go to class must go through teacher training as this goes a long way in enhancing their experience before going to class to teach.

**Keywords:** Content Knowledge, Pedagogical Knowledge, Pedagogical Content Knowledge, Teaching Experience, Component

## Introduction

Pedagogical Content Knowledge (PCK) is seen as a concept that has come to represent the knowledge that teachers use in the teaching process (Kind, 2009). In this sense, if you can identify PCK, the understanding of what it means to be a good teacher could be enhanced to facilitate the promotion of PCK development of pre-service teachers.

PCK is the synthesis of the knowledge of teachers' teaching strategies and subject matter. Shulman (1986) was of the opinion that Pedagogical Content Knowledge is the most valuable means of representation of topics, the most powerful analogies.



illustrations, examples, explanations and demonstration.

The PCK is seen as teachers' interpretation and transformation of subject-matter knowledge in the context of facilitating student learning (Shulman, 1987). Shulman later put forward different crucial elements of Pedagogical Content Knowledge:

- (1) Knowledge of representation of subject matter (Content Knowledge)
  - (2) Subject matter conception of student understanding
  - (3) General Pedagogical Knowledge (or teaching strategies)
  - (4) Curriculum Knowledge
  - (5) Knowledge of educational contexts
  - (6) Knowledge of the purpose of education.
- 
- (1) Content Knowledge: this refers to the body of information that teachers teach and that students are expected to learn in a given subject matter or content area (edglossary.org, 2015).
  - (2) Subject matter conception of student understanding: this is the knowledge of how students develop and think about a particular concept and how they learn (Shulman, 1986).
  - (3) General Pedagogical Knowledge (or teaching strategies): The knowledge of how to relate specific content in a way that the particular students can learn it (Shulman, 1986).
  - (4) Curriculum Knowledge: This includes knowledge of how curriculum is designed and for what purpose, as well as how it is delivered and received (Shulman, 1987).
  - (5) Knowledge of educational contexts: This is the type of knowledge related to the educational goals and value development through the experience of education (edglossary.org, 2015).
  - (6) Knowledge of the purpose of education: This is the knowledge that is of the relevance of education and the values that are developed through the experience of education (Edglossary.Org, 2015).

According to Shulman (1986) the PCK elements include first, knowledge of the specific subject matter; second, knowledge of teaching methodology; third, knowledge of learners' conception; and fourth, an understanding of what makes the learning of a particular topic difficult or easy for students. Shulman's (1986) fifth category of teachers' knowledge bases, curriculum knowledge, involve awareness of how items are arranged both within a school year and ways of using curriculum resources such as textbooks to organize a programme for the students.

PCK, being at the core of this study, is an amalgam of teacher's knowledge bases that Yusof and Zakaria (2010) says they include:

- Knowledge of the educational context, curriculum and assessment
- Knowledge of student learning
- Knowledge of teaching methods and representations of Mathematics
- Knowledge of student understanding about concepts in Mathematics

Ever since Shulman (1987) established these categories, several researchers have come to the realization that PCK is a relevant topic in science education. High levels of students achievement will depend largely on the high levels of PCK (Abell, 2007). However, research has not yet produced a consistent method of assessing PCK (Park & Oliver, 2008).

According to Goldston (2004); Loughranm, Mulhall and Berry (2004). PCK is a combination of content and pedagogy that is uniquely constructed by teachers and thus, is a "special" form of an educator's professional knowledge and understanding.

PCK is also referred to as craft knowledge. It includes integrated knowledge representing wisdom gathered by the teachers in relation to their teaching practice (Goldston, 2004; Loughranm et al. 2004 Van Driel, Verloop&Vos, 1998). Archambault and Crippen (2009) submitted that PCK includes knowledge of what makes a subject difficult or easy to learn, as well as knowledge of common misconceptions, and likely opinions the students carry to classroom.

PCK is referred to as a separate category of knowledge with its solitary identifiers (Magnusson, Krajcik, &Borko, 1999). There are several models involved in PCK; these models are called transformative models of PCK (Gess-Newsome, 1999). These models, Pedagogical Content Knowledge can be seen as an important change that occurs from other categories of knowledge (e.g., science curriculum knowledge, understanding of science, teaching strategies and assessment of scientific literacy (Magnusson, et al., 1999). This model accounts for both components of the knowledge based on teachers and the components of PCK within the same model.

Teachers differ from scientists, not necessarily in the quality or quantity of their subject matter knowledge, but also specifically in the way they (Teachers) organized and utilize those knowledge. In other words, an experienced science teacher's knowledge of science is organized from an instructional point of view and is used as a basis for helping students to understand specific concepts. A scientist's knowledge, on the other hand, is organized specifically for research purpose and is used for enhancing knowledge in the field of science. This opinion was filed in Biology by Hauslein, Good, and Cummins (1992), in a comparison of the organization of subject matter knowledge among groups of experienced science teachers, experienced research scientists, novice science teachers, subject area science majors, and pre-service science teachers.

Teachers' professional knowledge may be considered the single most important characteristic in instruction. Elbaz (1983) opined that the solitary most crucial characteristic in instruction was the teachers' professional knowledge. It is the transformation of 1) subject matter knowledge and 2) general pedagogical knowledge that is usually known as PCK. Others argue however that PCK is a distinct class fueled by subject matter as well as pedagogical and educational context knowledge (Magnusson et al., 1999). In spite of the lack of agreement, researchers agree that the unique qualities of PCK are significant in perceiving the intended meaning of science teaching and science education

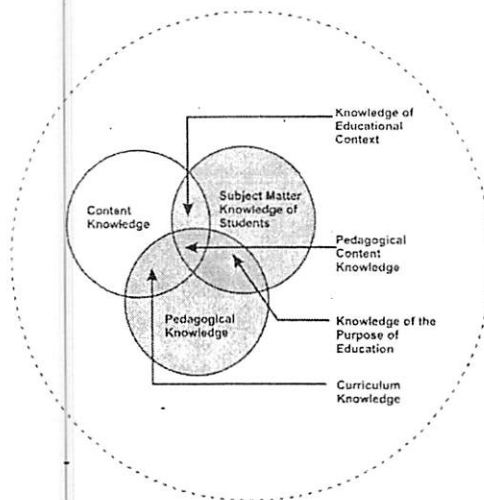


Figure1. Model of the Elements of Pedagogical Content Knowledge Source: *Bello and Abimbola (2015)*.

Do biology teachers' level of knowledge of teaching biology topics differ based on their experience? Are biology teachers' knowledgeable about the appropriate method to teach specific biology topics under (a) ideal situation (b) current prevailing classroom situation? How often do biology teachers apply their knowledge of students' pre and post-conception of biology concepts when teaching biology? To what extent do the teachers of biology possess the Pedagogical Content Knowledge based on the teaching experience? Based on the afore-mentioned questions, the following two research hypotheses were formulated and tested: (i) Biology teachers' level of knowledge of teaching biology topics does not differ significantly based on their experience (ii) There is no significant difference in the level of Pedagogical Content Knowledge of biology teachers based on the teaching experience. Based on these hypotheses, the present study sought to assess the Pedagogical Content Knowledge of biology teachers in Senior Secondary Schools. The study would help biology teachers to identify the major teaching technicality and approach in the field

of science especially biology. This approach, coupled with others would also play a role in reducing the poor academic performance of students in biology.

### Research Methodology

This study was a descriptive research of the survey type. The target population consisted of all Senior Secondary one to three biology teachers (SS1-SS3) in Ilorin Kwara State Nigeria. Two hundred and seventy (270) biology teachers from the schools were sampled for the study using simple random sampling. Technique Questionnaires were used to elicit responses from respondents over a period of five weeks. The questionnaire consists of four sections on background information, teachers' content knowledge, teachers' teaching methods and teachers' knowledge of students pre and post-conceptions of biology concepts. Research instrument was validated by experts in the field of science education. The reliability coefficient was determined using Pearson Product Moment Correlation Coefficient for Assessment of Pedagogical Content Knowledge of biology teachers in senior secondary schools in Ilorin and the value was calculated to be  $r=0.71$ . The researcher administered the questionnaire in person, wait for them to be filled and collect them before leaving the sampled schools. Data was analysed by Analysis of Variance using SPSS® version 20.

### Results

Two research hypotheses were tested as presented in Tables 1 and 2.

**HO<sub>1</sub>:** *Biology teachers' level of knowledge of teaching biology topics does not differ significantly based on their experience.*

As shown in Tables 1 and 2 there was a statistically significant difference between groups as determined by one-way ANOVA ( $F_{(2,264)}=4.521$ ,  $p=.012$ ). A Tukey post-hoc test revealed that, there is a statistically significant difference between the moderately experienced biology teacher and experienced biology teachers ( $p=.009$ ). Hence, we reject the null hypothesis.

Table 1  
*Table of One-Way ANOVA to Analyze the Mean Score of Teachers with Experience, Moderately Experience and Less Experience in Teaching Biology Topics.*

Source	sum of square	df	Mean Square	F	sig
Between Group	5.706	2	2.853	4.521	.012
Within Group	166.608	264	.631		
Total	172.315	266			

Table 8

*Table of Post-hoc Test to Analyze the Mean Score of Teachers with Experience, Moderately Experience and Less Experience in Teaching Biology Topics.*

	(I)Teaching Experience	(j) Teaching Experience	mean difference (I-J)	Std. Error	Sig.
Tukey HSD	Less Exp.	Moderately Exp.	-.174		.122
		Exp.	-.198		.114
	Moderately Exp.	Less Exp.	.174		.122
		Exp.	.372		.125
	Exp.	Less Exp.	-.198	.192	
		Moderately Exp.	-.372		.125

**H<sub>02</sub>:** *There is no significant difference in the level of Pedagogical Content Knowledge of biology teachers based on teaching experience.*

Tables 10 and 11 show that there is no statistically significant difference in the level of Pedagogical Content Knowledge of biology teachers based on the teaching experience ( $F_{2,263} = 1.308$ ,  $p = .272$ ), since the p value is higher than the level of significance (0.05), hence we fail to reject the null hypothesis. A Tukey post-hoc test revealed that, there is a statistically significant difference between the less experienced biology teacher and experienced biology teachers ( $p = .002$ )

Table 10

*Table of One-Way ANOVA to Analyze the Mean Score of Pedagogical Content Knowledge of Biology Teachers with Experience, Moderately Experience and Less Experience in Teaching Biology Topics.*

Source	sum of square	df	Mean	f	sig
Square					
Between Group	2.745	2	.915	1.308	.272
Within Group	184.041	263	.700		
Total	186.787	266			



Table 11

*Table of Post-hoc Test to Analyze the Mean Score of Pedagogical Content Knowledge of Biology Teachers with Experience, Moderately Experience and Less Experience in Teaching Biology Topics.*

(I)Teaching Experience	(j) Teaching Experience	mean difference (I-J)	Std. Error	Sig.
Tukey HSD .130	(Less Exp.) (Moderately Exp.)		-.181	.166
	(Exp.) -198	.114	.002	
	(Moderately Exp.) (Less Exp.)	.174	.122	.130
.119	(Exp.)	.372		.125
	(Less Exp.)		-.198	.166
	(Moderately Exp.)		-.372	.125

## Discussions

The researcher found that there was a significant difference ( $p=.012$ ) in the level of knowledge of biology topics between experienced, moderately experienced and less experienced biology teachers. This might be as a result of the fact that majority of the experienced biology teachers responded based on their experience in teaching and tend to assess themselves with the level of academic achievement of their students in which the less experienced biology teacher might not take cognizance of. Other reason that could lead to this response could be that the Less Experienced biology teachers over rated themselves in the area of competence in teaching biology and based their rating only on some element of PCK without considering the other components of PCK. Similar to the findings of Drechsler and Van Driel (2007) who found that there is a significant difference in the level of knowledge that exists between experienced chemistry teachers and less experienced chemistry teachers. The result shows that the ways the teachers related on their teaching in order to improve differs. Some teachers reflected more on students' difficulties while others showed more concern about their individual performance. To explore further, Trend in International Mathematics and Science Study (2003) revealed that students studying in the group taught by teachers with more than 15 years of experience gained higher achievement score than students studying in group taught by teachers with fewer years of experience.

The study revealed that there is no statistically significant difference ( $p=.272$ ) in the level of Pedagogical Content Knowledge of biology teachers based on teaching experience. It became apparent that, according to the moderately experienced biology teachers, classroom experiences had the strongest impact. In the first place, different activities and events during classroom teaching had affected the moderately experienced biology teachers' knowledge of specific learning

difficulties of students. In the second place, their knowledge of representations and teaching strategies had benefited from experiences during classroom practice. But more importantly the moderately experienced biology teachers are the most suited for teaching being that they are not strange to the classroom practices by staying glue to the contemporary situation in teaching and learning process and rather not too old for the classroom practices, hence being in the best position to understand the classroom better. This strong impact of teaching experience is consistent with the findings of other scholars (e.g Grossman, 1990; Lederman, Gess-Newsome, & Latz; Smith, 1999). Other studies have shown that new teachers have incomplete or superficial levels of Pedagogical Content Knowledge (Carpenter, Fennema, Petersen, & Carey, 1988; Feiman-Nemser & Parker, 1990; Gudmundsdottir & Shulman, 1987; Shulman, 1987). A novice-teacher tends to rely on unmodified subject matter knowledge (most often directly extracted from the curriculum) and may not have a coherent framework or perspective from which to present the information. The novice also tends to make broad pedagogical decisions without assessing students' prior knowledge, ability levels, or learning strategies (Carpenter, et al. 1988). In addition, pre-service teachers have been shown to find it difficult to articulate the relationships between pedagogical ideas and subject matter concepts (Gess-Newsome & Lederman, 1993); and low levels of Pedagogical Content Knowledge have been found to be related to frequent use of factual and simple recall questions (Carlsen, 1987).

### **Conclusion and Recommendations**

The study shows that there was a significant difference in the level of knowledge of biology topics between experienced, moderately experienced and less experienced biology teachers. Better still teachers' experience plays a significant role in teachers' Pedagogical Content Knowledge. Considering the mean of the three components of the Pedagogical Content Knowledge examined in this study, it was concluded that moderately experienced biology teachers displayed higher level of Pedagogical Content Knowledge in Ilorin, Kwara State, Nigeria.

Teachers should intensify more effort on developing themselves on their subject matter knowledge as it goes a long way in making the teaching and learning easy for them and their students, better understanding of their content knowledge allows them to recognize what makes a specific topic easy or difficult to learn by their students. Teachers should desist from the attitude of limiting their knowledge to what they have been taught in school and engage in continuous learning habits such as use of internet, newspapers, use of library and many others as learning never stops. Stakeholders in the educational sector should realize that teaching is a profession and that whoever must be chosen to go to class must go through teacher training as this goes a long way in enhancing their experience before going to class to teach. Thereby setting a standard for teachers to possess a minimum level of Bachelor's degree in Education to qualify to teach.

Teaching experienced should not be a barrier to recruitment into teaching job or a measure for judging the Pedagogical Content Knowledge of biology teachers as research has shown that teaching experience has no significant difference in the level of Pedagogical Content Knowledge of biology teachers.

Further studies can be carried out on other variables like school type and teachers' background could be added to the independent variables to explore the effect on Pedagogical Content Knowledge of teachers. More importantly further studies could look at the academic achievement of students of teachers with high level of Pedagogical Content Knowledge in a larger domain.

## References

- Abell, S. (2007). Research on science teachers' knowledge. In S. K. Abell, & N. G. Lederman (Eds.), *Handbook of research on science education*, (pp. 1105-1149). Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Archambault, L., & Crippen, K. (2009). Examining TPACK among K-12 online distance educators in the United States. *Contemporary Issues in Technology and Teacher Education*, 9(1), 71-88.
- Anon. (2015). 08-11:3:29pm. *The glossary of education reform*. <http://edglossary.org>
- Carlsen, W. S. (1987). Why do you ask? The effects of science teacher subject-matter knowledge on teacher questioning and classroom discourse. Paper presented at the annual meeting of the American educational research association. (ERIC Document Reproduction Service NO.ED 293 181).
- Carpenter, T. P., Fennema, E., Petersen, P., & Carey, D. (1988). Teachers' pedagogical content knowledge of students' problem solving in elementary arithmetic. *Journal for Research in Mathematics Education*, 19, 385-401.
- Drechsler, M., & Van Driel, J. H. (2007). Experienced Swedish Science Teachers pedagogical knowledge of teaching acids-base chemistry. Publisher ad i: paper presented at ESERA, Malmö, Sweden, Konferensbidrag-referegratkat.
- Elbaz, F. (1983). *Teacher thinking: A study of practical knowledge*. New York: Nichols.

Feiman-Nemser, S., & Parker, M. (1990). Making subject matter part of the conversation in learning to teach. *Journal of Teacher Education*, 41(3) 32-43

Gess-Newsome, J. (1999). Pedagogical content knowledge: An introduction and orientation. In J. Gess-Newsome & N. G. Lederman. *Examining pedagogical content knowledge* (pp. 3-17). Dordrecht: Kluwer.

Goldston, M. (2004). *The highly qualified teacher and pedagogical content knowledge*: 2004 focus group background papers. Arlington, Va.: The National Congress on Science Education.

Gudmundsdottir, S., & Shulman, L. (1987). Pedagogical content knowledge in social studies. *Scandinavian Journal of Educational Research*, 31, 59-70

Hauslein, P.L., Good, R.G., & Cummins, C.L. (1992). Biology content cognitive structure: From science student to science teacher. *Journal of Research in Science Teaching*, 29(9), 939-964

Kind, V. (2009). Pedagogical content knowledge in science education: Perspective and potential for progress. *Studies in Science Education*, 45(2), 169-209

Loughran, J., Mulhall, P., & Berry, A. (2004). In search of pedagogical content knowledge in science: Developing ways of articulating and documenting professional practice. *Journal of Research in Science Teaching* (Australia: Monash University). (41)4, 370-391.

Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources, and development of pedagogical content knowledge for science teachers. In J. Gess-Newsome, & N. G. Lederman (Eds.), *Examining pedagogical content knowledge: The construct and its implications for science education*, (pp. 95-132). Kluwer Academic Publishers: Dordrecht, The Netherlands..

Park, S., & Oliver, S. J. (2008). Revisiting the conceptualisation of pedagogical content knowledge (PCK): *PCK as a conceptual tool to understand teachers as professionals*. *Research in Science Education*, 38, 261-284.

Shulman, L. S. (1986). *Those who understand: Knowledge growth in teaching*. *Educational Researcher*. 15 (2), 4-14.

- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new Reform, *Harvard Educational Review*, 57, 1-22.
- Trend in International Mathematics and Science Study (2003). Teachers' qualification and their impact on student achievement. Tel Aviv, Israel: Centre for science and technology education
- Van Driel, J., Verloop, N., & De Vos, W. (1998). Developing science teachers' pedagogical content knowledge. *Journal of Research in Science Teaching*, 35 (6), 673-695.
- Yusof, Y. M., & Zakaria, E. (2010). Investigating secondary mathematics teachers' pedagogical content knowledge: A case study, *Journal of Education and Sociology*, 5, 32-39