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**EXAMINATION OF PRE-SERVICE SCIENCE AND LANGUAGE TEACHERS' CONTENT KNOWLEDGE AND PEDAGOGICAL CONTENT KNOWLEDGE DURING THE TEACHING LEARNING PROCESS: EXAMPLES OF NEW STRATEGIES AND APPROACHES IN OSUN STATE**

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**Abstract**

*The competency profile of a teacher is fundamental to the development of professional standards of pre-service teachers through exposure to teaching practice exercise. This requires being knowledgeable in both content knowledge and pedagogical content knowledge. This paper assessed pre-service Chemistry and English language teachers' content knowledge and pedagogical content knowledge in electrolysis transformation and tenses in English in Osun State respectively with a view to diagnosing, remediating and improving pre-service training strategies. The study adopted the survey strategy of enquiry of triangulation type. The population for the sample comprised Chemistry and English language pre-service teachers in Colleges of Education in Osun State that participated in the 2019 teaching practice exercise. The study sample consisted of 42 Chemistry and 64 English language pre-service teachers totalling 106 selected using convenience sampling technique. Three instruments used for data collection are titled: Pre-service Chemistry Teachers' Achievement Test (PCTAT) and Pre-service English Language Teachers' Achievement Test (PELTAT) to explore the content knowledge, Pre-service teachers' lesson plan and observational checklist titled: Pre-service Teachers' Observation Checklist (PTOC) for pedagogical content knowledge. The reliability of PCTAT and PELTAT through test-retest method with a co-efficient of 0.79. PTOC was based on introduction of the lesson, lesson development and lesson evaluation and categorized into Highly Knowledgeable (HK),*

*Knowledgeable (K), Low Knowledgeable (LK) and Very Low Knowledgeable (VLK). The results showed that pre-service teachers have sufficient content knowledge in their respective subject areas. While about 81% of the samples for pre-service Chemistry teachers had sufficient content knowledge in electrolysis transformation, about 78.1% of their counterpart in English language had sufficient content knowledge in tenses transformation. The result further revealed that both pre-service Chemistry and English language teachers do not have sufficient pedagogical content knowledge in their introductory lesson delivery with the ground means  $\bar{X} = 2.32$ ,  $\bar{X} = 2.34$  for lesson development and  $\bar{X} = 2.26$  for lesson evaluation. The study recommends that lectures in the school of education should try to improve on current pedagogy in Colleges of Education, authorities of Colleges of Education should recommend to the government for employing more teaching staff, while the government should accede to employing more lecturers in the schools of education in the colleges, and organize seminars for pre-service teachers before going for teaching practice.*

**Keywords:** *Content Knowledge, Pedagogical Content Knowledge, Pre-service teachers, Knowledgeable and transformation.*

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## **Introduction**

The competency profile of a teacher could be said to be the foundation for the development of professional standard of the individual categories of teaching staff, be it pre-service teachers, primary or secondary school teachers. The competency profile could therefore be based on conceptual starting point received when in teacher training colleges and proficiency demonstrated when pre-service teachers are deployed for their mandatory teaching practice exercise. A teacher was traditionally considered to be the main subject of education providing knowledge transfer to pupils in the process of education. Teachers co-create an educational environment and atmosphere in the class, organize and co-ordinate the activity of pupils and manage and evaluate the learning process. It is imperative therefore, for pre-service teachers to be trained along the afore mentioned tasks for effective lesson delivery. Again, teacher education programme is related to the development of teacher proficiency and

competence that will enable and empower the pre-service teachers to meet the requirements of the profession and face challenges therein (Abinobi & Abinobi, 2017). According to the National Policy on Education (NPE) (2013), in recognition of the pivotal role of quality teachers in the provision of quality education at all levels, teacher education shall continue to be emphasized in educational planning and development. A pre-service teacher is a student teacher in training to become a teacher. Pre-service teacher education is a program designed that systematically mentors the students into the teaching role either in primary or secondary schools level. These set of students therefore need to acquire the skills and requisite knowledge to impact for conceptual understanding and meaningful delivery of lesson of primary school and secondary school students.

In recent times, most pre-service teachers that are posted to secondary schools in Osun State face challenges rejection by school administrators. The issue of constant rejection has contributed to administrative bottlenecks for the college authorities in addition to lowering the morale of the concerned pre-service teachers. The reason that could be adduced to constant rejection of pre-service teachers by secondary school principals may be due to among others: complaint of poor content knowledge and pedagogical content knowledge of the pre-service teachers in science based courses as well as arts subjects. More often than not, experience showed that the most rejected pre-service teachers are Chemistry and English language teachers. Chemistry teaching and learning is central to all sciences, likewise English in the field of arts. This seems to be a very serious issue in the process of effective lesson delivery in secondary school setting and need remediation. In view of aforementioned problem, it is imperative to assess the pre-service Chemistry and English language teachers' content knowledge and pedagogical content knowledge in electrolysis transformation and tenses in English Language in Osun State.

Shulman(1986, 1987) differentiated CK & PCK content knowledge as “the concepts, principles, relationships, process and applications a student should know within a given academic subject, appropriate for his/her and organization of knowledge” while Pedagogical Content Knowledge is teachers' way of presenting and formatting the subject matter knowledge in the content of facilitating students learning. Studies such as (Kaya, 2008, Oduolowu, 2009 and

Abinobi & Abinobi, 2017) reported that prominent tension of pre-service teachers to a large extent centers on content knowledge and pedagogical content knowledge in the process of pre-service teachers' teaching practice exercise. In Nigeria for example, Oduolowo (2009; Abinobi & Abinobi, 2017 and Eyengho, 2018) reported low level of pre-service teachers on both content knowledge and pedagogical content knowledge. Jegede (2000) opined that content knowledge (CK) is a model for describing how teachers acquire new understanding of the content that they teach and how these understanding influence their teaching. Pedagogical Content Knowledge (PCK) on the other hand according to Oduolowo (2009) is knowledge for teaching. This includes the knowledge of approaches to school subject topics, teachers' knowledge of teaching procedures and motivational techniques, thus, different ways of presenting subject topics.

There are a substantial number of studies in research literature, which have sought to identify the pre-service teachers' content knowledge (CK) and Pedagogical Content Knowledge (PCK). Hashewh (1987) remarked that student-teachers' have inaccurate and inadequate knowledge in chemistry topic of chemical bonding. According to him, the student-teachers might transfer their own misconceptions to their students thereby add to students' conceptual difficulties. Kaya (2008) reported that there was a significant inter-relationship between the content knowledge and Pedagogical Content Knowledge and the pre-service science teachers. Halim and Meerah (2002), Van Dreil, DeJong and Verloop (2002) concluded that content knowledge had influence on Pedagogical Content Knowledge. This result is contrary to Mapolelo (1999) who find out that content knowledge had no effect on Pedagogical Content Knowledge. DeJong & Van Dreil (2004) concluded that macro, micro and symbolic meanings related to Chemistry topics developed 8 chemistry student teachers Pedagogical Content Knowledge. He also claimed that transferring learning from teaching developed and increased the student teachers' (PCK) in an experimental course in chemistry.

Magnusm, Krajck and Borko(1999) claimed than contents knowledge centers on the subject content while pedagogical content knowledge possess five components. The components are knowledge of science curriculum, knowledge of students understanding, knowledge of instructional methods, and orientation

towards science teaching and knowledge of science assessment. These were the focus of this study. Subject matter knowledge deals with prerequisite concepts or topics and knowledge of electrolysis content know by the pre-service teachers. Knowledge of pre-service teachers' curriculum knowledge centers on sequential or logical arrangement of topics in electrolysis to enhance conceptual understanding. Knowledge of students' understanding centers on the learner's prior knowledge and difficulties in relation to application of electrolysis to everyday life. This will reduce misconception of students on electrolysis. In the dimension of teaching methods or strategies, pre-service teachers need to use instructional materials that will facilitate learning for conceptual understanding to spur self-reliance. Pictures, drawings, relevant examples, models, video and analogies which can help students to understand specific concept (Meerah, 2002). In the dimension of knowledge of science assessment, pre-service teachers hat to possess knowledge of teaching method to assess students' learning within a specific topic (Magnusson, etc. 1999).

### **Differences between “Content Knowledge” and “Pedagogical Content Knowledge”**

Teachers' knowledge is a key factor to students' academic success in today's classrooms. Understanding the difference or relation between Content Knowledge” and “Pedagogical Content Knowledge is very imperative. In the 1980's, Lee Shulman and his colleagues popularized the concept of “pedagogical content knowledge” and introduced a new way of thinking about the nature and role of the teacher's knowledge needed for high academic success of students Shulman (1986). In 1987, Shulman distinguished teacher's knowledge in seven categories: content knowledge; curricular knowledge; pedagogical content knowledge; general pedagogical knowledge; knowledge of learners and their characteristics; knowledge of educational contexts and knowledge of educational ends, purposes and values. Ever since Shulman established these categories, many researchers have come to believe that pedagogical content knowledge is an important topic in teaching-learning process and that high levels of pedagogical content knowledge will predict high levels of student achievement and this believe has further grounded the platform

for discussion to which one is most important content knowledge or pedagogical content knowledge.

Ball's studies (1990) showed that effective subject teaching is linked to both teachers' subject matter content knowledge as well as their pedagogical content knowledge. Pedagogical content knowledge is the knowledge of how to transform formal content knowledge into meaningful learning outcomes for students and it involves an understanding of a particular topic and the ways a teacher explains the topic or concepts to make sense to the students in the classroom. Teachers are always expected to exhibit a basic set of pedagogical knowledge and skills in the classroom, which involves a good knowledge of specialized area, teaching methods, skills and knowledge of child development etc. This is emphasized by (Hill et al 2004) that "In performing the process of teaching and learning, teachers bring along with them the knowledge components, contents knowledge, good knowledge about the students and the various ways of using content knowledge in a classroom's teaching and learning process indeed play a role". Moreover, the integration of all these knowledge is recognized as pedagogical content knowledge.

Pedagogical content knowledge includes "...understanding of how particular topics, problems, or issues are organized, presented, and adapted to the diverse interests and abilities of learners" and the "...most useful forms of representation of these ideas, most powerful analogies, illustrations, examples, explanations, and demonstrations" and "...the ways of representing and formulating the subject that make it comprehensible to others" (Shulman, 1987). The relation and difference between different subjects content knowledge and pedagogical content knowledge can be better understood from the following table:

### Content knowledge against Pedagogical Content knowledge

Dimensions of Content Knowledge	Content Knowledge	Pedagogical Content Knowledge
Field of Knowledge	Chemistry and English	Chemistry and English Education
Output of Knowledge	Enables to be skilled and competent	Enables to be skilled and competent

	Chemistry/English student/s	Chemistry/English teacher/s
<b>Knowledge is Mastered by</b>	The learner/student	The teacher
<b>Objective of Getting Knowledge</b>	To master the rules, principles, formulae etc. of Chemistry/English to solve the problems based on them	To transform mathematical knowledge into meaningful learning outcomes for students to make them understand the rules, principles, formulae etc. of Chemistry/English
<b>Basic Requirements for Knowledge</b>	The will to learn Chemistry/English Attitude towards learning Chemistry/English	· The will to teach Chemistry/English · Aptitude for teaching Chemistry/English
<b>Areas of Study of Knowledge</b>	<ul style="list-style-type: none"> <li>· The concepts and sub-concepts of Chemistry/English</li> <li>· The relation within and between the branches of Mathematics</li> <li>· Solution of Mathematical problems related to the concepts of arithmetic, algebra, geometry, statistics, trigonometry, the relationship among the types of tenses in English Language etc.</li> </ul>	<ul style="list-style-type: none"> <li>· Teaching of Chemistry/English</li> <li>· The content knowledge</li> <li>· Content analysis</li> <li>· Pedagogical analysis</li> <li>· Psychology of teaching and learning</li> <li>· Learner and her/his characteristics</li> <li>· Methods of evaluation etc.</li> </ul>
<b>Knowledge is Mastered Through</b>	Drill work techniques and practice while learning	Training and practice during teaching

<b>Basis for Knowledge</b>	Pure Chemistry and English	Behavioural Sciences
<b>Relation</b>	Without pedagogical content knowledge a teacher will not be teach effectively in the class. less effective teaching results in less effective content knowledge	Without mastery of content knowledge, teacher cannot master the pedagogical content knowledge.

Source: Adapted and modified from TRCN, 2010

From the above table it is clear that there is difference between an individual mastering the concept and making others to master the content. The first one refers to the content knowledge and the second one refers to the pedagogical content knowledge. To make students master the Chemistry/English content knowledge, the teacher has to master the content knowledge along with Chemistry/English pedagogical knowledge and contextual knowledge.

A teacher with good Chemistry/English pedagogical content knowledge can break down the subject content knowledge into less polished and abstract forms, thus making it accessible to students who are at different cognitive levels. The teacher can unpack the specialized subjects into its discrete elements and can explain a concept or procedure at a level that includes the steps necessary for the students to make sense of the reasoning. He/she can understand where students may have trouble learning the subject(s) and will be able to concepts for meaningful learning that will give room for understanding and avoid these difficulties. In order to prepare effective teachers in their respective subject areas, a teacher-training program must focus on content knowledge as well as pedagogical content knowledge.

### **Advantages of Content Knowledge**

Content Knowledge is an essential basic component of teaching knowledge impact positively on students' achievements (Ozden, 2008). It implies that a teacher have a deep knowledge about the subject. The advantages of CK among others include:



-It helps teachers to know what kind of prerequisite knowledge is necessary to teach a certain subject: appropriate examples, illustrations and homework that can be applied in a topic

-Help teachers to know the relationship of subject with curricula provided teacher and how they complement each other.

-It provides knowledge about goals and objectives of the curriculum and about special emphasizes in the curriculum.

Advantages of Content Pedagogical Knowledge could be succinctly outlined as:

- Having a deeper understanding of the subject matter;
- Having a deeper understanding of the subject matter;
- Having less misunderstanding of key concepts;
- Developing accessible approaches to specialized content pedagogical knowledge;
- Diversified approach to teaching through motivational approaches;
- A deeper understanding of science and application of scientific knowledge principles; and
- Greater use of authentic assessment approaches.

### **Statement of the Problem**

Content and Pedagogical Content Knowledge are vital in the teaching and learning of different categories of subjects for national development. However, most pre-service teachers show little competency in both content and pedagogical content knowledge with respect to electrolysis aspect of Chemistry as well as tenses in English Language. It seems as if pre-service teachers are ill-prepared in facilitating effective delivery of lesson during their mandatory teaching practice exercise. Most pre-service Chemistry and English Language teachers that are posted to secondary schools in Osun State are being constantly rejected by school administrators for lack of either or both of content and pedagogical content knowledge. Schools of science and languages are responsible for pre-service training in the area of content knowledge while school of education is responsible for pre-service training in the area of pedagogical content knowledge. There is therefore the need to assess the content and pedagogical content knowledge level of pre-service Chemistry and

English Language teachers with a view to diagnosing and remediating the pre-service training strategy, hence, this study.

### **Purpose of the Study**

The aim of this study is to explore the pre-service Chemistry and English Language teachers' knowledge of concepts of electrolysis transformation and Tenses in English in Content knowledge (CK) and Pedagogical Content Knowledge (PCK). The specific objectives of the study are to:

- (i) examine the pre-service Chemistry teachers' Content Knowledge (CK) in electrolysis transformation during their teaching practice exercise;
- (ii) investigate the pre-service English Language teachers' Content Knowledge (CK) in tenses in English during their teaching practice exercise; and
- (iii) assess the pre-service Chemistry and English Language teachers' Pedagogical Content Knowledge (PCK) in electrolysis transformation and tenses in English.

### **Research Questions**

In order to find solutions to the problem of this study, the following research questions were raised:

1. How knowledgeable are pre-service Chemistry teachers in content knowledge in electrolysis transformation?
2. How knowledgeable are pre-service English Language teachers in content knowledge in tenses transformation?
3. How knowledgeable are pre-service Chemistry and English Language pedagogical content knowledge?

### **Research Methodology**

The study was a qualitative research that employed survey strategy of enquiry of triangulation type.

The population for the sample comprised final year degree Chemistry and English Language students in Colleges of Education in Osun State, Nigeria that participated in 2019 teaching practice exercise. The sample for the study

consisted of 42 Chemistry and 64 English Language pre-service teachers for the 2019 teaching practice exercise. The pre-service teachers for the study were selected using convenience sampling technique to make up the study sample of one hundred and six. Chemistry and English Language pre-service teachers were assembled, assigned odd and even numbers where those that pick odd numbers formed the study sample.

### **Research Instruments**

Three research instruments were used for the study. The instruments are titled: Pre-service Chemistry Teachers' Achievement Test (PCTAT) and Pre-service English Language Teachers' Achievement Test (PELTAT) to explore the content knowledge. Pre-service teachers' lesson plan and observational checklist titled: Pre-service Teachers' Observation Checklist (PTOC) was used to explore the pedagogical content knowledge of both Chemistry and English Language Pre-service teachers in their respective areas of specialization.

The PCTAT consist two theory questions with sub-sections based on electrolysis transformation and centres mainly on recall, application and evaluation. PELTAT comprised of two theory questions on tenses. PCTAT and PELTAT were categorized into high, moderate and low content knowledge based on their scores (20 marks) expressed in percentage. The PCTAT and PELTAT were adapted from West African Examination Council (WAEC) past questions, hence, a standardized test. The reliability of PCTAT and PELTAT were ensured through test-retest method. The results obtained showed the reliability co-efficient of 0.79 which suggested the instruments were reliable enough for use.

Pre-service teachers' lesson plan in their respective teaching subjects were collected and used along with PTOC. The PTOC was based on introduction of the lesson, lesson development and lesson evaluation. PTOC were categorized into Highly Knowledgeable (HK), Knowledgeable (K), Low Knowledgeable (LK) and Very Low Knowledgeable (VLK).with scores 4, 3, 2 and 1 respectively. Mean rating 2.5 serve as the bench mark for a pre-service teacher to be adjudged having pedagogical content knowledge. The above bench marks were originally used by Magnusson, Krajcik and Borko (1999) as proposed by Shulman (1986). The instrument was validated by experts in experts in Test and

Measurement and Science and Technology in Faculty of Education, Obafemi Awolowo University, Ile-Ife who examined parameters to use for PTOC and the pre-service teachers' lesson plans.

## Results

### Question 1

#### How knowledgeable are pre-service Chemistry teachers in content knowledge in electrolysis transformation?

In answering question 1, scores on Pre-service Chemistry Teachers Achievement Test (PCTAT) was obtained in percentages of the total scores (20 marks). Scores were categorized into high content knowledge (14-20), moderate content knowledge (6-13) and low content knowledge (0-5). The result is presented in Table 1

**Table 1: Pre-service Chemistry Teachers' Achievement in Electrolysis Transformation**

Academic Performance	Frequency	Percentage	Cumulative percentage
Low Content Knowledge	8	20.0	10
Moderate Content Knowledge	22	52.4	37.5
High Content Knowledge	12	28.6	52.5
Total	42	100	100

Table 1 revealed that 8 pre-service Chemistry teachers representing 20.0% of the total sample had low content knowledge, 22 (52.4%) had moderate content knowledge while 12 (28.6%) had high content knowledge. cursory look at the result further showed that about 34 (81%) of the sample had sufficient content knowledge in electrolysis transformation.

### Question 2

#### How knowledgeable are pre-service English Language teachers in content knowledge in tenses transformation?

In order to answer question 2, scores on Pre-service English Teachers Achievement Test (PELTAT) was obtained in percentages of the total scores (20 marks). Scores were categorized into high content knowledge (14-20),

moderate content knowledge (6-13) and low content knowledge (0-5). The result is presented in Table 2

Table 2: Pre-service English Language Teachers' Achievement in Tenses Transformation

Academic Performance	Frequency	Percentage	Cumulative Percentage
Low Content Knowledge	14	21.9	11.3
Moderate Content Knowledge	32	50.0	37.1
High Content Knowledge	18	28.1	51.6
Total	64	100	100

Table 2 showed that 14 pre-service English teachers representing 21.9% of the total sample had low content knowledge, 32 (50.0%) had moderate content knowledge while 18 (28.1%) had high content knowledge. cursory look at the result further revealed that about 50 (78.1%) of the sample had sufficient content knowledge in English language tenses.

### Question 3

#### How knowledgeable are pre-service Chemistry and English Language teachers in pedagogical content knowledge?

In answering question 3, Pre-service teachers' lesson plan in their respective teaching subjects were collected and used along with PTOC, the results of the mean rating are presented in Tables 3, 4 and 5

Table 3: Summary of Pre-Service Teachers' Lesson Introduction

Behaviour Observed	HK	K	LK	VLK	N	X	$\bar{X}$	Remark
<b>A</b> Instructional Objectives								
<b>1</b> Clarity / Relevance	36	150	56	19	106	261	2.50	Knowledgeable
<b>2</b> Measurability	44	210	40	5	106	299	2.82	Knowledgeable
<b>3</b> Comprehensiveness/do the Objectives covers the three educational domains?	20	60	140	11	106	231	2.18	Not Knowledgeable
<b>B</b> Instructional Aids								
<b>4</b> Relevance	32	180	56	10	106	278	2.52	Knowledgeable

5	Clarity/bold enough to seen by all	8	45	130	24	106	207	1.95	Not Knowledgeable	-
6	Skillful//efficient use of aids apparatus	40	54	108	15	106	217	2.05	Not knowledgeable	
7	Motivational effect / attractive	24	66	112	22	106	224	2.11	Not knowledgeable	-
C	Previous learning Experience									
8	Relevance of learning experiences to the topic	72	126	76	8	106	282	2.67	Knowledgeable	
9	Ability to establish relationships Between previous and present Learning experiences	40	66	88	30	106	224	2.11	Not knowledgeable	

Ground Mean Total

$$X = \bar{2.32}$$

Remark:

Not knowledgeable

Table 3 showed that clarity/relevance and measurability behaviours with  $\bar{X}=2.50$  and  $\bar{X}=2.82$  respectively indicated that pre-service Chemistry and English Language teachers are knowledgeable in pedagogical content knowledge. However, with  $\bar{X}=2.18$  that is less than the bench mark  $\bar{X}=2.50$  in comprehension, pre-service teachers do not have sufficient pedagogical content knowledge in spreading the instructional objectives to cover the three educational domains. Also, the pre-service teachers are knowledgeable in terms of relevance of instructional aids used ( $\bar{X}=2.52$ ) but not knowledgeable in the clarity of aids used, skillful use of the aids and motivational effect of the aids:  $\bar{X}=1.95$  and  $\bar{X}=2.05$  and  $\bar{X}=2.05$  respectively. Furthermore, pre-service teachers are knowledgeable in terms of relevance of learning experiences of the topic taught ( $\bar{X}=2.67$ ) but not knowledgeable in their ability to establish relationship between previous and present learning experiences. Finally, the ground mean  $\bar{X}=2.32$  fall short  $\bar{X}=2.50$  required bench mean, therefore, both pre-service Chemistry and English Language teachers do not have sufficient pedagogical content knowledge in their introductory lesson delivery.

**Table 4: Summary of Pre-service Teachers' Lesson Development**

Behaviour Observed	HK	K	LK	VLK	N	X	Remark
10 Mastery of Subject matter	32	180	56	10	106	278	2.52 Knowledgeable
11 Logical and sequential Presentation of subject matter	72	126	76	8	106	282	2.67 Knowledgeable
12 Communication skills	20	60	140	11	106	231	2.18 Not knowledgeable
13 Questioning skills	8	45	130	24	106	207	1.95 Not knowledgeable
14 Pupils' participation / Learner centre approach	40	54	108	15	106	217	2.05 Not Knowledgeable
15 Use of chalk board (neatness Legibility, orderliness)	72	126	76	8	106	282	2.67 Knowledgeable
16 Class management discipline	40	66	88	30	106	224	2.11 Not Knowledgeable
17 Time management	44	210	40	5	106	229	2.82 Knowledgeable
18 Summary and conclusion	24	66	112	22	106	224	2.11 Knowledgeable

Ground Mean Total

$\bar{X} = 2.34$

Remark

Knowledgeable

Table 4 revealed that pre-service teachers have knowledge in mastery of subject matter and logical presentation of subject matter with  $\bar{X} = 2.52$  and  $\bar{X} = 2.67$  respectively and likewise in the use of chalk board and time management  $\bar{X} = 2.67$  and  $\bar{X} = 2.82$  respectively. However, the pre-service teachers do not have sufficient knowledge in communication skill ( $\bar{X} = 2.18$ ), questioning skills ( $\bar{X} = 1.95$ ), pupils' participation ( $\bar{X} = 2.05$ ) class management ( $\bar{X} = 2.11$ ) and in their summary and conclusion ( $\bar{X} = 2.18$ ). The ground mean  $\bar{X} = 2.34$  fall short  $\bar{X} = 2.50$  required bench mean, therefore, both pre-service Chemistry and English Language teachers do not have sufficient pedagogical content knowledge in their lesson development.

**Table 5: Summary of Pre-service Teachers' Lesson Evaluation**

Behaviour Observed	HK	K	LK	VLK	N	X		Remark
19 Relevance of evaluation Techniques to the instructional Objectives	36	150	56	19	106	261	2.50	Knowledgeable
20 Skillful use of evaluation Techniques	24	66	112	22	106	231	2.18	Not knowledgeable
21 Feedback (strength and Weakness areas to be emphasized	20	60	140	11	106	231	2.18	Not knowledgeable

Ground Mean Total

$$X = \bar{2.26}$$

Remark: Not knowledgeable

Table 5 indicated that pre-service teachers are knowledgeable in their lesson evaluation in terms of relevance of evaluation techniques in relation to the stated instructional objectives ( $\bar{X}= 2.50$ ) but do not have sufficient knowledge in the skillful use of the evaluation techniques ( $\bar{X}= 2.11$ ) and also in their feed back to the learners ( $\bar{X}= 2.18$ ). The ground mean  $\bar{X}= 2.26$  is less than  $\bar{X}= 2.50$  required bench mean therefore, both pre-service Chemistry and English Language teachers do not have sufficient pedagogical content knowledge in their lesson evaluation.

### Discussion

Findings from this study indicated that pre-service teachers have sufficient content knowledge in their respective subject areas. While about 81% of the



sample for pre-service Chemistry teachers had sufficient content knowledge in electrolysis transformation, about 78.1% of their counterpart in English Language had sufficient content knowledge in English Language tenses. The high content knowledge of the pre-service teachers might be because they were exposed to enough courses in their respective areas of studies in their undergraduate days which could have contributed to high score of the pre-service teachers' content knowledge. This result corroborates the findings of Festus (2008) which states that if students are taught by teachers of high content knowledge they perform better and this has shown even in the Chemistry and English pre-service teachers' performance in their subject areas. The finding also support the report of Hashewh (1987) who remarked that student-teachers' have inaccurate and inadequate knowledge in Chemistry topic of chemical bonding.

On research question three which states that how knowledgeable are pre-service Chemistry and English language teachers in pedagogical content knowledge? The findings of the result revealed that both pre-service Chemistry and English Language teachers do not have sufficient pedagogical content knowledge in their introductory lesson delivery, lesson development and for lesson evaluation. This does not show a good classroom practice of lesson delivery to pupils in secondary school during teaching practice exercise. The result is similar to the findings of Ball (2003) who reported that mathematical understandings that prospective teachers bring to classroom showed poor pedagogical content knowledge. This may be adduced to preparation pre-service teachers for teaching practice exercise and poor attitude to it.

### **Conclusion**

The study concludes that despite the fact that pre-service teachers have good content knowledge, they do not have sufficient pedagogical content knowledge in introductory lesson delivery, lesson development and for lesson evaluation. It was observed that the pre-service teachers were deficient in their classroom practice; hence, pedagogy has to be taught to empiricism and be improved upon.

### **Recommendations**

Based on the result obtained from this study, the following recommendations were made.

1. School of education should try to improve current pedagogy in Colleges of Education, most especially in micro teaching and education courses such as principles and methods of teaching, instructional approaches and classroom testing.
2. Authorities of Colleges of Education should recommend to the government employment of more teaching staff, while the government should accede to the demand. The college authority should organize seminars for pre-service teachers before going for teaching practice and the pre-service teachers should cultivate a good habit towards teaching practice exercise.
3. Ministry of Education should support the college authorities through the department of quality assurance to encourage the pre-service teachers during their teaching practice exercise.

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