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Perceived Pedagogical-Content Knowledge of Teachers: Classroom Practices of as Correlates of College of Teachers Education Students' Academic Result

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Abstract

Teachers' pedagogical content knowledge competence is seen as a combination of something one has(knowledge), what one does in the classroom (abilities) and which values one bases teaching on (attitudes), to perform his/her functions satisfactorily. The study investigated the awareness's of teachers and students about teachers' in-depth pedagogical content knowledge, teachers' practices of PCK, and correlates of practicing PCK with academic result of students.The researcher used mixed design(descriptive survey & co-relational) and quantitative research approach. The study sample consisted of 257 who were selected by proportionate stratified sampling,74 comprehensively selected teachers and 6 department heads. The questionnaire developed consisted of 21 statements on teachers' in-depth pedagogical content knowledge and 21 statements on teachers classroom practices of PCK and both teachers and students were asked to rate the statements on a five likert scale. And department heads and the researcher rate teachers' classroom practices of teachers using rubric developed for classroom observation in line with statements included in the questionnaire which asked teachers classroom practices of PCK. Standard deviations, arithmetic Means; one sample t-test, independent t-test, Pearson correlation coefficient, and regression coefficient were used for data analysis.Then the result from the process revealed that teachers perceived that they had adequate pedagogical content knowledge (PCK) but not to the maximum level intended to be per the scale (3.90 from the possible mean score of 5.00). It was also found that there was no statistically significant mean difference between teachers self-rating and students rating on teachers classroom practices of their PCK (3.2 and 3.04 respectively, from the maximum mean score 5.00); all the constructs of PCK practices and students cumulative grade point average have statistically significant relationships in that perceived practices of pedagogical knowledge with the magnitude of (r=.483); perceived practices of subject matter knowledge with the magnitude of(r=.663) and Perceived practices of knowledge of students learning characteristics coefficient of correlation(r=0.504) all at P<0.01 and in similar directions. And last the cumulative effect of classroom practices of PCK was found to be with R-square=22.9 which accounts 22.9% effect for students' academic result.To conclude both teachers and students rated similarly rate that the status of applying PCK in classroom teaching was less than adequate level.

Keywords: Pedagogical Content Knowledge, Academic Result, Pedagogical Knowledge, Content Knowledge, Classroom Practices

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Introduction

Quality education for all has emerged as one of the most desirable goals throughout the world. One of the six goals, outlined by the World Education-Dakar- Framework for Action (2000), is related to the improvement of "all aspects of quality education" in order to achieve the identified learning outcomes (UNESCO, 2000). As various factors including curriculum, delivery of content, learning environment, supervision, and administration of academic facilities contribute to the quality of education, the central importance of the teacher "cannot be denied". The competence and enthusiasm of teachers determine the heights to which an educational system can rise (Iqbal, 1996, as cited in Paliakoff and Schwartzbeck, 2001).

Research on children's thinking and problem solving has documented that children bring a great deal of knowledge to almost any learning situation, which significantly influences what they learn from instruction (Peterson, 1988).This evidence suggests that teachers' knowledge of students' concepts and misconceptions could seriously influence their instruction.

The student learns more effectively when the teacher structures new information, relating it to prior knowledge of the learner, monitoring the learning and providing effective feedback (Peterson, 1988).Fargusan(1999) , as cited in Paliakoff and Schwartzbeck (2001), observes that quality of teachers is the most critical aspect of schooling and that it has a direct impact on student learning.

A number of empirical studies highlight characteristics of quality teachers (Hayes & Chamberlain, 1998). Common to all these studies and commentaries are: having a broad understanding of curriculum aims and objectives; having a wide range of pedagogical strategies; having high expectations of all students; knowing their students well; providing effective feedback; recognizing student success; having sound content knowledge of the subject and understanding what it means to progress(Harlen and James, 1997). These researchers comment that teachers "cannot" provide experiences and activities that guide student progress towards understanding ideas if they themselves do not know what the ideas are. If teachers have generally sound pedagogical skills they rely on them to carry through difficult aspects of the subjects they teach but total dependence on pedagogical knowledge can limit student learning in the subject area.

The skills and knowledge of an effective teacher are summarized by Bransford et al. (2000:188) as follows:

> Expert teachers have a firm understanding of their respective disciplines, knowledge of the conceptual barriers that students face in learning about the discipline, and knowledge of effective strategies for working with students. Teachers' knowledge of their disciplines provides a cognitive roadmap to guide their assignments to students, to gauge student progress, and to support the questions students ask. The teachers focus on understanding rather than memorization and routine procedures to follow, and they engage students in activities that help students reflect on their own learning and understanding.

The above explanation indicates that in complimentary to expert pedagogical knowledge, subject matter knowledge is also an instrument for effective teaching. However, recent research evidences are increasing that teaching a subject requires content knowledge that goes substantially beyond what is typically taught and learned in college and university classes. This form of content knowledge is most commonly referred to as "pedagogical content knowledge or simply PCK (Wineburg & Wilson, 1991).

Many researchers coined that the sole subject matter knowledge and pedagogical knowledge separately didn't brought the lesson to the affordable manner to maximize learning among students Lee Shulman (1987). The term PCK was original coined by Lee Shulman(1987) and was defined as "the most useful forms of representation … the most powerful analogies, illustrations, examples, explanations, and demonstrations—in a word, the most useful ways of representing and formulating the subject that make it comprehensible to others"(Shulman,1986:7).

According to Gess-Newsome and Lederman (1999) again, pedagogical content knowledge includes knowledge of the conceptual and procedural knowledge that students bring to the learning of a topic,

the misconceptions about the topic that they may have developed, and the stages of understanding that they are likely to pass through in moving from a state of having little understanding of the topic to mastery of it. To these authors, it also includes knowledge of techniques for assessing students' understanding and diagnosing their misconceptions, knowledge of instructional strategies that can be used to enable students to connect what they are learning to the knowledge they already possess, and knowledge of instructional strategies to eliminate the misconceptions they may have developed.

Policy documents stress the importance of teachers for promoting learning; the emphasis on improving teacher quality is most prominent in the 2005 Education Sector Development Programme of Ethiopia (MoE, 2005). In order to prepare effective teachers, a teacher training program must focus on all three types of knowledge: content knowledge, pedagogical knowledge, and pedagogical-content knowledge and skills.

Many student teachers are enrolled in ten colleges of Amhara Region; many novel diploma teachers were graduated as well. As indicated in Amhara regional Education bureau score analysis report among all colleges of the region, however, typical of 2007 year graduate COC scores vividly showed some missing point has been there in that most student-teachers score in pedagogy and content knowledge were below the pass mark(50%) (Edu Bureau, 2015, sees appendix-E).

The score analysis report includes ranks of the colleges depending in their perspective student-teachers score, and the summary indicated that Woldia college of Education as well was with below average in both modalities programs and departments (linear and cluster). If it goes without paying critical attention on this issue, there will be challenging phenomenon that could have the potential to impede quality education in local areas. This was the turning point that triggered the researcher to an enquiry of teachers PCK level and classroom practices in this particular institution. And this research will fill some gaps related with competence of pedagogical content knowledge and classroom practices of PCK of teachers.

Coining other research results and paying attentions to this local situation, instructional process was given due attention as relevant research has found that PCK is essential for effective instruction and positively related to students' learning outcomes (Dapaepe, et al., 2013). Therefore, in this study, teachers' competence in pedagogical content knowledge and classroom application statuses was seen. This status was again assessed if it would predict students' academic achievement. What was the problem?

Woldia College of teachers' education has been making efforts in producing teachers of primary schools at least with optimum competence in both pedagogy and content areas but table1 below clearly indicated the COC result which has shown students scored much below half percent in most departments both in competence of the subject matter and pedagogy. For instance, in aesthetics: students mean score was 36.66 in the subject matter, and 9.36 in pedagogy which in sum was 46.02, this is below 50%, meaning it is under satisfactory. In mathematics: students mean score was 27.91; in the subject matter, 15.66 in pedagogy which in sum was 43.57, again below 50%, i.e. meaning it was under satisfactory. In sum, in all departments except social science all students mean scores were below satisfactory, even in natural science, they scored below 40% which was failure. This is a critical problem that everyone would ask 'why'? Therefore the researcher of this study has developed an inquiry to see the competence of teachers in both status PCK and delivering PCK of teacher.

Table 1. Cluster result analysis by Content & pedagogy

subject		Number	Average	Difference
Aesthetics	Content	517	36.66	9.87
	Pedagogy	517	9.36	4.80
	Total	517	46.02	12.35
Language	Content	1492	37.03	9.42
	Pedagogy	1492	10.47	4.45
	Total	1492	47.50	12.11
Mathematics	Content	1418	27.91	9.33

	Pedagogy	1418	15.66	3.49
	Total	1418	43.57	11.18
N/science	Content	1239	25.65	8.08
	Pedagogy	1239	13.13	3.40
	Total	1239	38.78	10.10
S/science	Content	856	40.03	8.86
	Pedagogy	856	15.49	5.12
	Total	856	55.52	11.52

Source: Woldia College of Teachers Education Registrar Office (2016)

The researcher has got an experience in teaching education courses and developed belief that regardless of many other factors; a teacher in his/her subject can bring enormous changes on students' cognition and skills. This is another questioning that the researcher seeks to know what happened to students' scores if teachers were equipped with the necessary pedagogy and content knowledge which now a day's coined as pedagogical-content knowledge.

Local studies like Genet Gelana and Haftu Hindeya(2014) conducted a study on correctional education teachers' teaching competence in which pedagogical content knowledge was one dimension of their study ; they indicated that teachers were particularly found to be short of pedagogical content knowledge (PCK) which was found to be an obtained mean score 2.082 and standard deviation is =2.78 in which 3 was expected mean and the mean difference was found statically significant at $P<0.01$; however, participants of their study were different in that their participants were not professionals in teaching.

Other local researches were conducted by Dawit Mekonnen and Alemayehu Bishaw(2001) entitled with "….and the efficacy of subject methodology courses in developing pedagogical content knowledge." To the researcher's reading effort, local researches haven't been found in addressing level of perceived PCK and classroom practices of PCK.

In country level, improving the learning outcomes of all students regardless of their socioeconomic background or geographic location is the Ethiopian Government's key objective for education (Ministry of Education, 1994). Teachers in the present Ethiopia are expected to be reflective and change-oriented to meet the government and public demand for quality education. They are expected to consider the dynamic nature of the learners and the society. This situation signifies the importance of pedagogical content knowledge aiming at improving the instructional process thereby improving quality of education. Teachers are expected to employ interactive and contextual methods of teaching to help students learn better. However, ministry of education (2008) has got that teachers in higher educational level are not to level expected in their overall teaching-learning.

This is also evident in students' poor results in school tests/ examinations and public examinations in Africa like the Botswana junior certificate examinations was associated with low competence of teachers instruction (Adedoyin, O.O., 2011).In many studies in word wide also depicted that it was found that majority of classroom teachers lack substantial subject matter knowledge, the knowledge of what to teach, and how to teach the subject matter effectively (competence of Pedagogical content knowledge) (Mushashu, 1997). Because of pedagogical content knowledge problems of classroom teachers, students are underachieving or not performing well in subjects they learn (Sichizya, 1997).

Other studies like Howie (2002) and Dobe (2012), on the causes of poor performance of students show that one of the main factors attributed to students' performance is the teachers. Other factors like interest of learners, effort, school environment, etc. may also be taken as considerable causes for poor performances of learners (Howie, 2002).

As Ball, Hill and Bass (2005) argue, "little improvement is possible without direct attention to the practice of teaching … how well teachers know and deliver the subject matter knowledge is central" (p. 14). Conceivably, this explains why recently there has been considerable discussion and research on teachers' subject-matter knowledge, pedagogical content knowledge, and pedagogical knowledge for teaching.

Having these problem statements, this study tried to assess college perceived teachers' pedagogical content knowledge and perceived practices of PCK in relation to students' academic performance / result/ of students being guided by research questions list here under:

- To what extent do teachers perceive their level of pedagogical content knowledge (PCK) and classroom use of their PCK?
- To what extent do students rate teachers' level of applying PCK in classroom teaching?
- Is there statistically significant mean difference between teachers and students in rating
- Classroom practices of Pedagogical content knowledge?
- Are perceived teachers' classroom practices of constructs of pedagogical content knowledge (PCK) predictors of Students' academic result?

Method

Research Design

The purposes of this study were to assess statues of teachers' pedagogical content knowledge (PCK), practices of PCK and check if applying PCK in classroom teaching of college teachers are predictors of students' results; therefore, this research study was conducted based on descriptive survey and co relational designs. Here, since the research process assessed the existing situation depending on previous literatures and models, descriptive survey design was preferred. A survey design was chosen to ensure collection of information which precisely describes the nature of prevailing conditions at a specific point in time (Kang'ahi et al., 2012).

In this study again, relationship among variables will be tested through Pearson Product coefficient of correlation so that co-relational design was followed. Co-relational designs again provide an opportunity for you to predict scores and explain the relationship among variables. In co-relational research designs, investigators use the correlation statistical test to describe and measure the degree of association (or relationship) between two or more variables or sets of scores (Cresswell, 2012).

As it involves the collection of quantitative data through closed-ended questionnaire with rating scale, rubric of ranked values and students' CGPA from rosters in the attempt to answer leading questions, quantitative research approach was preferred to qualitative one.

Participants

In this study both probability and non-probability sampling of subjects were used. In this study, researcher included all college teachers of Woldia College of Teacher Education. Second and third year students, and department heads who were co-researchers were population of the study in this study. First year students were not included here as they didn't have academic result during the data collection periods. Hence, data sources are both primary and secondary ones as the data were sought from teachers and students directly, and rosters from the document analysis.

Sampling Techniques

The initial sampling frame for self-completed questionnaires is defined as all college teachers in Woldia College of Teacher Education.. Teachers in Woldia College of Teacher Education. were 74 in number, which was manageable to take all lecturers. For its manageability and its importance in getting adequate information for the study, all lecturers were selected comprehensively; for the same reason, all department heads were considered totally.

However, student-teachers were selected using stratified sampling technique. Strata may be formed in order to employ different sample designs within strata, or because the subpopulations defined by the strata are designated as separate 'domains of study' (Kish, 1987, p. 34). Variables used to stratify populations in education generally describe demographic aspects concerning schools (for example, location, size, and program) and students (for example, age, sex, grade level, and socio-economic status) (Kish, 1987) as cited in Kenneth N. Ross (2005).

Accordingly, first both levels of the program (second and third year), departments and sections were considered comprehensively, but the number of students from each section were selected using

proportionate stratified sampling where there strata were departments, level of the program and sections: first year students were not included in study as they didn't have grade pont average during data collection for the study. Finally individual students were selected by systematic sampling technique as complete list of students was taken from registrar office. The rationale of this selection procedure was, for one thing; to get representative students who got equal chance to participate as all students are getting similar training context from their teachers' similarly is similar classroom and learning materials; and the other end was to see the relationship between their grade results and perceived classroom practices of teachers' pedagogical content knowledge.

Yamane (1967:886) provides a simplified formula to calculate sample sizes and calculate proportion from each stratum. This formula was used to calculate the sample sizes in Tables 1 and is shown below. A 95% confidence level and P = .05 are assumed for this Equation :

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size, and e is the level of precision. When this formula is applied to the above sample

n = 1025/1+1025(0.05)^2 n = 288

Then to get the sample size from each department and year, proportional index was calculated

By dividing the sample size to the total population (proportional index=Total sample size/Total population =288/1025=.28). Following this, sample size from each department and both years were determined by multiplying the population of each stratum by 0.28. This was summarized in the following table (table-3).

Table-2 Summary of Sample Size

No.	**Department**	**Year, population , percentage of each sample from total sample and sample size**						**Total Population In each department**	**Total Sample**	**Total % from total sample**
		2nd year			3rd year					
		N	Sample	%	N	sample	%			
1.	Amharic specialist	83	24	8	30	9	3	113	33	11
1.	English specialist	73	21	7	39	11	4	112	32	11
2.	Maths specialist	51	14	5	51	14	5	102	28	10
3.	Maths generalist	79	22	8	25	7	2	114	29	10
4.	Integrated N/science	83	23	8	43	12	4	126	35	12
5.	Integrated S/science	44	12	4	31	9	3	75	21	7
6.	Civics & ethical education	45	13	5	44	13	5	89	26	10
7.	Art	65	18	6	41	11	4	106	29	10
8.	Music	70	20	7	42	11	4	112	31	11
9.	Sport and physical Education	43	12	4	43	12	4	86	24	8
10.	Total of total	636	179	62	389	109	38	1025	288	100%

Source: Woldia College of teachers Education Registrar office, 2015/2016.

Then the individual respondents were chosen by using systematic sampling as the complete list of respondents was taken from roster sheet in the registrar office of the college. This was done in the following way: First, number subjects was decided as in table above in the sample (*n*). Because the total number of members in the population (N)was known, N was simply divided by *n* and the sampling interval (*K*) was determined to apply to the list (k=N/n). The first member was randomly selected from the first *K* members of the list. In this case k= 1025/288≈ 4; the first respondent was selected randomly from the top of the first four members in the complete list and then every K^{th} member was selected from the population up to the sample size. To avoid some unique characteristics of the sample, the complete list was prepared without alphabetical order as some names may create one unique characteristic like similar sex, academic achievement, competence of responding. To estimate performance level of teachers in exercising PCK, 25 sessions were observed (meaning 25 teachers were observed) using convenient sampling.

Instruments

I. Questionnaire

It was the main instrument of the study. The instrument was used here after adaptation of the research instrument used to portray the PCK of chemistry education (Loughran *et al.*, 2001) and programming education (Saeli *et al.*, 2011a) in USA, and items designed to measure teachers' "pedagogical content knowledge" within the context of a multi-purpose survey being conducted in elementary schools participating in three of America's largest comprehensive schools reform programs. The instrument used by these researchers was with 40items and with reliability coefficient of(r=.87 and r=.954 respectively) as cited in O.O Adedoyin (2011). The adapted questionnaire has two categories of respondents: for teachers and one for students.

A) Teachers questionnaire

An adapted questionnaire was administered for the respondents, having of42 statements on teachers' perceived in-depth pedagogical content knowledge and classroom implementation of PCK; 21 of items contain actions teacher educators' are expected to demonstrate in classrooms.

The questionnaire consists two sections, section A is on the background information of the students and section B consisted 21 items about in-depth level of teachers pedagogical content knowledge and another (21) items on the practices of teachers pedagogical content knowledge in relation to classroom and students learning contexts on a five likert rating scale with numbers (strongly disagree (SD) disagree (D) partially agree (PA) agree (A) strongly agree (SA).

B) Students' questionnaire

Having similar content, number of items(21) and rating scales, another closed ended questionnaire was adapted from teachers' questionnaire by changing the subject of the respondents (teachers to students) and administered for them to assess the extent of students' perceived rating about teachers' level of practicing their PCK in daily classroom teaching.

II. Document

The second instrument applied in getting the necessary data was students' roster which was taken from registrar. From this document, Cumulative grade point average (CGPA) of systematically selected students was taken to see its relationship with teachers' classroom practices of PCK.

III. Rubrics

To triangulate teachers and students rating on teachers' performance in exercising PCK, criterion based rubrics was developed depending on the constructs of executing PCK. Here the department heads were invited to observe (rate) their perspective teachers as co-researchers, because the researcher felt that he lack some sort of knowledge in rating teachers in different departments. This was done in one session of heads classroom supervision. This was done depending on literature which revealed that rubrics can offer a way to provide the desired validity in assessing complex competences,

without sacrificing the need for reliability (Morrison & Ross, 1998) and believing that exercising PCK is non-conditional.

Reliability and validity of the instruments

Both questionnaires were piloted by administering for 15 teachers and 25 students whom were randomly selected from their perspective populations. Then, Cronbach's Alpha of reliability coefficient was calculated and found to be (r=.91) for teachers questionnaire, and (r=.84) for students questionnaire. The questionnaires were translated in to Amharic language to minimize ambiguities, enhance clarity and checking internal reliability.

To enhance validity, first the instrument was given for three teachers in professional studies and research committee at least to check face validity and content validity against leading questions. Furthermore, the instruments were administered for perspective respondents for pilot testing so that the validity of the instrument like ambiguities in the phrasing of questions, excessive complexity in the language that has been used were found and revised; inappropriate response categories for some questions were realized and some questions were found redundant so that all the cases were revised.

Ethical Issues

These were well considered to make the research findings trustworthy as the research sought to get institutional information. Particularly, the researcher maintained informed consent by making the research objectives clear to the participants and colleges' administrators before collecting data. In addition in using documents from the registrar office, the researcher has got formal letter from the higher management body of the college as students results are forbidden to be exploited for any purpose regardless of authorized permission. In completing the rubrics (measuring teachers performance in exercising their PCK), teachers were asked permission personally to be observed in their classroom teaching.

Data Analysis

a) Data analysis procedure: The nature of data obtained from this study was quantitative. Quantitative data, which were mainly from self-completed questionnaires, were analyzed using Statistical Package for Social Sciences (SPSS-20). To do this, first the questionnaire was collected timely and the data sorting was taken place in excel Microsoft and the summation data and coding of variables were done. Then the data were taken to data view after the variable view was completed by the coded variables, labels and values .etc.

b) Data analysis Techniques: Here mean and standard deviation were used to see the status of perceived Pedagogical content knowledge and practices of teachers.

Pearson's correlation coefficient was used to checkout if teachers perceived PCK issignificant predictor of their classroom teaching; if practices of teachers, as perceived by students, predicts students' academic result and at last to checkout if dimensions of PCK do correlate one another.

One sample t-test was used to see if there is statistical significant difference between obtained means and expected mean; and independent sample t-test were used as analyzing techniques to test of there is statistically significant mean difference between students and teachers perception on classroom practices of PCK by teachers. Outputs from the SPSS were presented in tabular and graphic forms.

Results

The purposes of this study were to assess statues of teachers' pedagogical content knowledge (PCK), practices of PCK and check if applying PCK in classroom teaching of college teachers are predictors of students' results. To get these purposes, collecting data was made from 288 randomly selected regular students and most teachers (74), who were compressively considered from Woldia Teachers College of Education.

From the population of 74 teachers 60 of them were Master's degree, 8 of them were Bachelor degree and 2 of them were diploma holders. Most teachers have above 12 years of teaching experiences and the minimum and maximum years of teaching experiences were 6years and30 years respectively.

From the target population of 1025 students, 288 students were selected through stratified and simple random sampling techniques. From 288 students, 179 respondents were second year and the rest (109) were third year students from different departments as outlined in table-1 in chapter 3.

But for data analysis, 257 student and 58 teacher-respondents were used. The first numbers of participants, in both cases, were reduced to the later ones for similar reasons. Some respondents couldn't bring back the questionnaire as they had taken to their home and the other responses was given with lots of missing and with haphazard completion of the questionnaire so that they were omitted.

Starting from descriptive statistics in measuring perceived status of PCK and applying PCK in its dimensions, it was shown the following table 4.

Variables	Mean	Std. Deviation	N	T	df	Sig. (2-tailed)
1. knowledge of subject matter	3.99	.51	58	13.269	57	.000
2. knowledge of understanding students learning	3.70	.48	58	12.848	57	.000
3. knowledge of pedagogy	3.89	.44	58	13.269	57	.000
4. Applying knowledge of subject matter	3.29	.57	58	3.996	57	.000
5. Applying knowledge of understanding students learning	3.19	.51	58	2.836	57	.016
6. Applying knowledge of pedagogy	3.16	.52	58	2.325	57	.024

Table 4 indicated that teachers rate about their level of knowledge in dimensions of PCK like in subject matter knowledge, their mean score (obtained mean=3.99) with average deviation of respondents(St. Deviation=0.51), which significantly higher than the expected mean(m=3, at P<0.01, with t-value=13.269).

In the same table, it was shown that respondents rate their level of knowledge of understanding students learning with mean score of (obtained mean= 3.7) with average deviation of respondents (St. Deviation=0.48), which significantly higher than the expected mean (m=3, at P<0.01, with t-value=12.848).

In table 4 again, it was depicted that respondents perceived level of knowledge pedagogy with mean score of (obtained mean= 3.89) with average deviation of respondents (St. Deviation=0.44), which has statistically significant mean difference the expected mean (m=3, at P<0.01, with t-value=13.269.848).

From these result, it possible the summarize that teachers level of perceived Knowledge in all dimensions of PCK was higher than the expected mean which is important input for teaching learning process.

In another category of the same table which further contains teachers level of perception about classroom practices of their PCK dimensions, it was shown that teachers rate in their level of practicing or delivering their subject matter knowledge was found to be mean score of (obtained mean=3.29 but with St. Deviation=.57), which was higher than the expected mean (expected mean=3.00) and it was found to be statistically significant P<0.01 as tested by on sample t-test (t=3.996). Here, one can observe that teachers didn't rate themselves similarly about their subject matter knowledge and applying this knowledge in classroom teaching (3.29<3.99, rate of practicing and knowledge respectively).

It was again shown that teachers rate in their level of practicing or delivering their knowledge of understanding students learning was found to be mean score of (obtained mean=3.19 but with St. Deviation=.57), which was higher than the expected mean (expected mean=3.00) and it was not found to be statistically significant P<0.01, as P=0.016 as tested by on sample t-test (t=2.836). Here, one can observe that teachers didn't rate themselves similarly about knowledge of understanding students

learning and applying this knowledge in classroom teaching (3.19<3.7, rate of practicing and knowledge respectively).

Table4 revealed that teachers rate level of practicing or delivering their knowledge of pedagogy was found to be mean score of (obtained mean=3.16 but with St. Deviation=.52), which was higher than the expected mean (expected mean=3.00) and it was not found to be statistically significant P<0.01, as P=0.024 as tested by on sample t-test (t=2.325). It was observed that teachers didn't rate themselves similarly about their knowledge of pedagogy and applying this knowledge in classroom teaching (3.16<3.89, rate of practicing in classroom teaching and knowledge respectively.

Table 5. Summary of Status of PCK and classroom practices of PCK as perceived by Teachers

Variables	**N**	**Expected mean**	**Obtained Mean**	**Std. Deviation**	**One sample t-test**	**df**	**Sig. (2-tailed)**
Level of classroom practices of PCK of teachers	58	3.00	3.23	.50	3.248	57	.02
Level pedagogical knowledge of teachers	58		3.90	.43	15.834	57	.000

As indicated in table 5 teachers revealed that the extent of their own perception about their pedagogical content knowledge is above the expected mean (obtained mean=3.9, and expected mean = 3.00; Std. deviation=0.435); the obtained mean is significantly different with the expected mean as tested by one sample t-test (t=15.834; df=57, and sign at P<0.01). In the same table (5), it was found that the level of teachers perceived classroom practices of their PCK is (obtained mean=3.23). The mean score was again compared with the expected mean, the result was found to be (t=3.248, df=57).it was found to be significant at p<0.05) but there is no significant mean difference at p<0.01.

Table 6. Rate of students about teachers' classroom practices in dimensions and generic of PCK

Variables	**Rated by 257-respondents**					
	Obtained mean	Exp. mean	Std. Deviation	Mean difference	One sample t-test	Sign. (two-tailed)
Perceived practices knowledge of understanding students learning	2.95	3.00	.58	.052	-1.570	.118
Perceived practices of knowledge of Pedagogy	3.06		.48	.062	2.168	.031
Perceived practices knowledge of subject matter	3.12		.57	.12	3.333	.011
Overall Status of classroom practices of PCK of teachers	3.04		.46	.04	2.142	.063

Table 6 above showed that students rate their teachers' classroom practices of knowledge of understandings how students learn with mean score (obtained mean=2.95,St.deviation=0.58) which is less than the expected mean but very much close to it as there was no statistically significant mean difference (t=-1.570, at P<0.01).

In Table 6 above, it was depicted that students rate their teachers' classroom practices of knowledge of subject matter with mean score (obtained mean=3.12, St. Deviation=0.57) which is greater than the expected mean but much close to it as there was no statistically significant mean difference (t=3.33, at P<0.01).

In in the same table above, it was shown that students rate their teachers' classroom practices of knowledge of pedagogy with mean score (obtained mean=3.06, St. Deviation=0.48) which is greater than the expected mean, yetvery much close to it as there was no statistically significant mean difference between them (t=2.168, at P<0.01).

Generally, in table 6, it was revealed that students were asked to rate their teachers generic practices of PCK and found to be (obtained mean=3.04, with Std. deviation= 0.46). This was compared with the expected mean and it was found to be (one sample t-test value= 2.142, df=257) there was no significant mean difference between students score in rating their teachers with the expected mean at P<0.01, where (P=0.063).

Table 7. Group Statistics: Mean Difference of Respondents on Perceived classroom practices of PCK

Variable	groups	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)	
PPPCK- Perceived Practices of PCK	students	257	3.046	.46111	-2.240	313	.056	Equal variances assumed
	teachers	58	3.21	.50239	-2.122	80.089	.067	Equal variances not assumed

In table 7, an attempted was made to compare if students rate their teachers differently from teachers own perception about classroom practices of PCK.

In the table, it revealed that there was statistically significant mean difference between them as tested by independent t-test (t-=-2.12 and significant level, p=0.067 as unequal variance is assumed because the number of respondents was different) at p<0.05, meaning students and teachers rate similarly about classroom practices of t PCK.

Normally data was collected from department heads to rate teachers of their department to triangulate on perceived level of teachers

Table 8. Summary Rubric results

Dimensions	No of teachers observed	No of heads completed the rubric	department head's rating mean score
SMART lesson planning and alignment of contents, objectives and assessment	25	6	2.56
Student-teacher specific interaction	25	6	2.5
Student-content- teacher and context interaction	25	6	2.2
Student- student-students interaction	25	6	2.5
Methods variability and differentiated instruction	25	6	2
Subject matter mastery	25	6	3.3
Delivery of Assessment-teaching method-content-students alignment	25	6	1.9
Instructional Media appropriateness, ability of representing concepts in media	25	6	1.5

This table clearly indicated that teachers competence in classroom execution of their PCK as rated by department head was found to be only satisfactory as the mean score (rated mean=2.66 which level as satisfactory level of performance where 4.00 = excellent, 3.5 and above is very good; 3 and above is good; 2.5 and above <3.00 is satisfactory which is in line with the students rating and teachers themselves ratings in classroom practices of PCK.

Next, an attempt was made to see if perceived genericPCK of teachers predict one another. Dimensions of PCK were also checked if they correlate with one another as shown

Table 9. Co-relational statistics

		Variables		
Variables	Correlation coefficient tested by	knowledge of subject matter(KS)	knowledge of understanding students learning(KUS)	knowledge of pedagogy (PK)
knowledge of subject matter	Pearson Correlation	1		
knowledge of understanding students learning	Pearson Correlation	.716**	1	
knowledge of pedagogy	Pearson Correlation	.686**	.834**	1

**. Correlation is significant at the 0.01 level (2-tailed).

In table 9, it was shown that all the dimension of PCK correlate with one another in that KS has a statistically significant relationship with KUS with the magnitude of (r=.716) in the same direction at P<0.01 level; KS is again related with KP with the magnitude of(r=.686) in similar direction atP<0.01. Similarly, KP is positively and significantly related with KUS with coefficient of correlation(r=0.834) at P<0.01.

Then, the next question is, does each dimensions of classroom application of PCK predicts students cumulative grade point Average (CGPA)?

Table 10. Summary of relationship among CGPA and dimensions of PCK

Correlations					
		application of KSM			
application of KSM	Pearson Correlation	1	* application of KUS		
	Sig. (2-tailed)				
application of KUS	Pearson Correlation	.784**	1	application of PK*	
	Sig. (2-tailed)	.000			
application of PK	Pearson Correlation	.776**	.898**	1	CGPA*
	Sig. (2-tailed)	.000	.000		
CGPA	Pearson Correlation	.663**	.504**	.483**	1
	Sig. (2-tailed)	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

In table 10, it was shown that all the dimensions of PCK and students cumulative has a statistically significant relationship including perceived practices of pedagogical knowledge with the magnitude of (r=.483) in the same direction at P<0.01 level; perceived practices of subject matter knowledge is again related cumulative grade point average (CGPA) with the magnitude of(r=.663) in similar direction atP<0.01. Similarly, Perceived practices of knowledge of students understanding is positively and significantly related with CGPA with coefficient of correlation(r=0.504) at P<0.01.

In this table (10) , generic relationship between perceived classroom practices of PCK as rated by students with their grade was tested using Pearson's correlation coefficient and found to be (r=.583 which was statically and positively significant at P<0.01). This indicates teachers' level of PCK with optimum strength predicts their classroom use of PCK with the magnitude of(r= 0.583) in similar direction.

Table 11. Cumulative effect of practices PCK dimension on students' academic result

Model Summary			
Model	**R**	**R Square**	**Adjusted R Square**
1	.488[a]	.238	.229

a. Predictors: (Constant), application of pedagogy in context , application of knowledge of subject matter , application of knowledge of understanding students learning

As indicated in table-10, it was found that of many other factors which have either effects of academic result of college students, 22.9% was contributed by PCK dimensions.

Discussion

In result, it was found that teachers rate about their extent of PCK up to the mean score of 3.90, which significantly higher than the expected mean (3.00). In here again, teachers rate themselves as they have above average knowledge in the three components of PCK including knowledge of subject matter, understanding students learning and pedagogical strategies, in which they rate with mean score of (3.99, 3.89 & 3.7) and this indicated that teachers perceived their PCK is above average which is significant input for classroom teaching learning process. The necessity of PCK in classroom teaching was described by Shulman that teachers with high PCK have "an understanding of what makes the learning of specific topics easy or difficult" and have developed "ways of representing and formulating the subject that make it comprehensible to others" (1986, p. 9).

To this scholar, the most effective teachers have deep knowledge of the subjects they teach, and when teachers' knowledge falls below a certain level it is a significant impediment to students' learning. As well as a strong understanding of the material being taught, teachers "must" also understand the ways students think about the content, be able to evaluate the thinking behind students' own methods, and identify students' common misconceptions. When considering theme of Shulman, even the result of this study (mean=3.9 of the possible score 5.00) is not the maximum knowledge important for teaching but necessarily it was found adequate as far as expected mean is concerned.

However, when the classroom practice of PCK of teachers was considered, teachers rated themselves that their practices was lower than their knowledge, as it was summarized in table 6 and 7 both in dimensions and generic of PCK practices. They were found to be with mean score of 2.95, 3.06, 3.12, in dimension of PCK, and 3.04 generic practices of PCK. In all cases teachers rating mean score were very much close to the expected mean (3.00). This means teachers competence in delivering appropriate lesson, understanding students learning, and selecting and implementing the right pedagogical strategies were average.

This average performance doesn't guarantee to produce equipped and quality teachers. In line with this, other studies strengthen idea that that teachers' competence in PCK is one of important factor which determine student's achievement. For example, teachers are regarded as the "most imperative" school-based factor that influences students' achievement levels. "Poor" academic performance by numerous students in both higher education and training public and private institutions has gained significant attention by most researchers in the field of educational management (Shulman & Grossman, 1989).

Previous studies on the subject on students' academic performance by Kang'ahi et al (2012) indicated that although there exist several factors that influence students' academic performances, but lecturer competence in PCK remains one of the major determinants of students' academic achievements.

Previous study like a research conducted by Lange, K., Kleickmann, T., & Möller, K. 2012, cited in cited in Allexander Muzenda, 2013) on Teachers' PCK and student achievement showed that teachers' PCK was significantly related to student achievement in elementary science the results revealed a substantial positive effect of the measured PCK on students' gains in science achievement in the domain of "states of matter".

Teachers were expected to be dimensional in classroom teaching like they need to involve highly in

particular students' understanding, students' learning processes Students' common errors and misconceptions, Students' difficulties and confusions which all denote understanding of understanding . in this regard Adunola (2011) claimed that teaching is a collaborative process which encompasses interaction by both learners and the lecturer; they further described that knowing one's own students includes knowing who they are, what they know, and how they view learning the subject that teacher is teaching; the teacher needs to know something of each student's personal and educational background, especially the skills, abilities, and dispositions that the student brings to the lesson; the teacher also needs to be sensitive to the unique ways of learning, thinking about, and doing the subject that the student has developed.

Teachers of this college (respondents) were expected to the higher level in describing rational or lifelong purpose of subject teaching, make connections among topics, deliver concepts clearly, show various ways of solving problems, which all denote delivery of subject matter knowledge, but this was found only average competence, this would have a part in impeding students achievements.

The importance of subject matter knowledge for classroom teaching has been outlined by many scholars and researchers like Grossman et al. (1989) who stated:

> In analyzing video of teaching, it became obvious, especially when teachers lacked common content knowledge, that such knowledge is essential. When a teacher mispronounced terms, made calculation errors, or got stuck trying to solve a problem, instruction suffered and valuable time was lost. In mapping out the mathematical knowledge needed by teachers, it is important not to lose sight of the critical role that a basic understanding of the mathematics in the student curriculum plays in planning and carrying out instruction.

And respondents of this study were expected to higher level in delivering examples, explanations, demonstrations, illustrations , prepare lesson planning and organization; learning activities; student presentations; various teaching styles; real life applications, use of materials, textbooks, and journals which all are manifestation of applications of pedagogical strategies but it was found average though it was near to the expected mean.

And teachers are expecting to understand their students learning. Knowing one's own students includes knowing who they are, what they know, and how they view learning the subject, and themselves. The teacher needs to know something of each student's personal and educational background, especially the mathematical skills, abilities, and dispositions that the student brings to the lesson. The teacher also needs to be sensitive to the unique ways of learning, thinking about, and doing mathematics that the student has developed. Each student can be seen as located on a path through school, equipped with strengths and weaknesses, having developed his or her own approaches to tasks, and capable of contributing to and profiting from each lesson in a distinctive way(Adunola , 2011).

In sum, teachers of this college (respondents of this study) rate themselves to their application of PCK in their classroom teaching was only to the expected mean (3.00) which in the rating scale it was denoted by "I some agree" but there expected at least "I agree"=4.00 and at most "I strongly =5.00". Literature on this regard suggested teachers need to be highly competent in many dimension of teaching in which PCK application is the core dimension. For example, Akiri & Ugborugbo (2009, cited in cited in Allexander Muzenda ,2013), lecturer competence in teaching process is a multidimensional concept that measures numerous interrelated aspects of sharing knowledge with learners which include communication skills, subject matter expertise, lecturer attendance, teaching skills and lecturer attitude. Therefore, consistent evaluation of the aforementioned distinct factors lecturer competence is imperative since in practice, the competence of a lecturer is directly measured by students' academic achievements

Further, Adunola (2011) accentuated that the teaching methods adopted by lecturers " should" be aligned to the subject content and specific outcomes in order to effectively enhance transmission of knowledge and information from the lecturer to the students. According to Chang (2010), each individual learner interprets and responds to questions in a unique way (Chang, 2010), it is therefore crucial for lecturers to regularly review their teaching competences in respect of subject knowledge,

pedagogical strategies which both are constructs of PCK. The research implies that teaching as "the transformation of understanding" relies on the quality and flexibility of content knowledge and on the capacity to generate powerful representations and reflections on that knowledge, which in line with Shulman's & Grossman's (1989) conceptualization of classroom practices of PCK.

As indicated in table 9, independent sample t-tested was computed to find out how different teachers and students were in rating teachers exercising of their PCK in classroom teaching. It was found that there was no statistically mean difference between teachers and students in this regard. This means students rate their teachers similarly as teachers' rate themselves on execution of PCK in classroom teaching. Both groups' score was found to be very close the expected mean (3.04= students' obtained mean score, 3.21= teachers' obtained mean score and 3.00= expected mean).

In transformative teaching, learners were expected rate their teachers above the mean score with significant difference, it would have Psychological impact in modeling teachers. In line with this, Glenda A., and Margaret W. (2009) reported that teachers are the single most important resource for developing students' identities in their subject teaching. For example, by attending to the differing needs that derive from home environments, languages, capabilities, and perspectives, teachers allow students to develop a positive attitude towards their learning. A positive attitude raises comfort levels and gives students greater confidence in their capacity to learn and to make sense of their leaning (Brown, 2012).

When we come to relationship among components of PCK, it was indicated that that knowledge of the subject matter (KS) has a statistically significant relationship with knowledge of understanding students (KUS) with the magnitude of (r=.716) . This means if teachers have got high level of KS, they could have similar level of KUS as it was associated with high level of KUS and they have strong and positive correlation. KS has again found statistically significant correlation with KP with the magnitude of(r=.686) in similar direction. Similarly, KP is positively and significantly related with KUS with coefficient of correlation(r=0.834). This study revealed that all the three dimensions correlated each other with strong magnitudes and similar direction. Meaning, if teachers have high level of knowledge in one of the components, those teachers would have similar level knowledge in another and vice versa. These strong relationship depicted that there can be one construct that sum them up called PCK.

The above explanation was described in many studies similarly including Eggen & Kauchak (2002). They reported that there are three dimensions under which a teachers' Pedagogical content knowledge can be measured; namely content knowledge, pedagogical knowledge of content and general knowledge about students .it was continually obvious that pedagogical content knowledge is dynamic (in that he components of pedagogical content knowledge seemed to be subsets of a whole; pedagogical content knowledge could not exist without its various components, and the union of those components constitutes pedagogical content knowledge (Cochran et al., 1994).

In table 9, it was depicted that constructs of PCK are positively associated with students' academic achievement; specifically students cumulative has a statistically significant relationship including perceived practices of pedagogical knowledge with the magnitude of (r=.483) ; perceived practices of subject matter knowledge is again related with cumulative grade point average (CGPA) with the magnitude of(r=.563) in similar direction. This mean if teachers deliver lesson with high level of subject mastery, students results also improved. This has been discussion in many literatures. Education scholars who have begun to conceptualize teachers' knowledge for teaching differently, arguing that teacher effects on student achievement are driven by teachers' ability to understand and use subject matter knowledge to carry out the tasks of teaching (Ball 1990; Shulman, 1986)

In same table (9), it was shown perceived execution helping learning depending on of knowledge of students understanding is positively and significantly related with CGPA with coefficient of correlation(r=0.504). This indicate that if teachers better understand their students learning(learning styles, misconceptions, difficulties, level of understanding, pace), students will have better achievement regardless of other factors.

In this study it was also found that teachers generic classroom practices PCK predicts students achievement with optimum strength of magnitude and in similar direction with Pearson's correlation coefficient(r=0.583). This means when teachers competence in execution of PCK is high, there will be high probability to predict students will achieve better and vice versa. In line with this implicit in Shulman and his associates' work was "the argument that high-quality instruction requires a sophisticated, professional knowledge [PCK] that goes beyond simple rules such as how long to wait for students to respond." Shulman wrote: 'The most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations—in a word, the most useful ways of representing and formulating the subject that makes it comprehensible to others and high understanding of what makes the learning of specific topics easy or difficult, which sum is PCK" is strongly associated with high academic achievement of students (Shulman, 1986: p, 9).

Conclusion and Recommendations

In this study, it was found that teachers perceived their Pedagogical knowledge higher than the expected mean; it was much higher than the satisfactory level: it was adequate but not to the maximum level intended to be per the scale. It was also found that classroom competence of exercising PCK to be satisfactory level; in this case both teachers and students rated the status of applying PCK in classroom teaching was less than adequate level. If teachers' performance was found to be at this status, it could be implied that this may create great impact on students' progress and performance as it found practices of PCK predicts students' academic achievement.

Therefore, if teachers competence both in Pedagogical content knowledge and executing PCK in classroom teaching are not improved more than these background findings by some ways, it will be difficult to get qualified teachers as expected and planned by regional and national government; this in turn could impede quality education to the study area as participants teachers of this study are training student-teachers.

Teachers' pedagogical content knowledge(PCK), applying PCK in classroom teaching are important elements for increase teachers overall teaching competence so that that students(in college case, student-teachers) will be benefited to improve learning , which in turn lead to higher performance in their field of study. Adjustment including achievement levels as well as for improving socio-emotional well-being. Hence: Teaching the ways of knowing, encompasses more than a curriculum and instruction methods course, and clearly, teacher educators cannot do it alone. Professional development experiences should conjoin efforts with in-service teachers as well.

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