

# Transforming Teacher Education and Learning in Ghana: The Impact of a Continuous Professional Development on Physics Teaching at the Colleges of Education

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**Abstract - The colleges of education in Ghana have been involved in a continuous professional development for over four years with support of Transforming Teacher Education and Learning (T-TEL). The main purpose of this research was to assess the perceived impact of the continuous professional programme on physics teaching at the colleges of education. Descriptive cross sectional survey was used for the study. An online survey was conducted which was completed by 85 physics tutors. The survey data were analysed using means and standard deviations and ANOVA. It was found that the professional development is perceived by the physics tutors to have great impact on their teaching practice. It was also found out that there was no statistical significant difference in the perceived impact of the professional development based on tutors' experience. It was concluded that if the student teachers who are being trained by these tutors will learn these ideas from their tutors and practice them, teaching at the basic schools will be more interactive, students-centered and gender responsive.**

**Key words: Professional development, Physics, Impact, Teacher education.**

## I. INTRODUCTION

With the changes in the educational sector brought about largely by technology coupled with government reforms, all teachers will require some new knowledge and skills which comes in a form professional development. This applies to both experience and beginning teachers [1]. Teachers' ability to teach the 21<sup>st</sup> century skills needed by students, will depend on a more effective professional development which is sustainable, job-embedded and collaborative [2]. [3] posit that professional development is an on-going learning experience which begins and end with the teachers' career.

Reforms in education are done with believe that changes in curriculum would lead to changes in teaching practice. This calls for new ways of teaching with professional development as key driver of such reforms [4] that sets school improvement in motion [5]. It is generally recognised that professional development is essential when it comes to introducing educational reforms ([5], [6], [4]) with [7] asserting that teacher learning and for that matter professional development is an essential focus when it comes to

educational reforms. This is because educational innovations and reforms demands changes in classroom practices. It therefore stands to reason that attempts to bring innovation and reforms in education are accompanied by professional development programmes [6]. Teachers will need a great deal of learning which mostly come in a form of professional development to be able meet demands expected of them during such reforms.

Professional development can provide a lot of benefits to the teachers in terms of boosting their confidence, providing opportunity for them to experience and apply some new skills, and improving their content and pedagogical knowledge. [8] assert that professional development is considered as an important process to reforms in teaching and learning. Professional development enhances effectiveness of teachers bringing about improvement in teacher quality thereby improving educational outcome. [9] maintain that teacher professional development can influence teachers' learning, instructional practice and students learning. Teacher professional development is very essential for school improvement [10]. Most researchers believe that the fundamental purposes of organizing professional development are to improve the knowledge of teachers and their classroom practices which will lead to improvement in students learning outcome ([11],[3],[6]).

Many researchers accept the fact that professional development can bring about improvement in teachers' instructional practices ([11],[3],[60]). [12] asserts that there is now a general recognition about the need to assess how participants apply the knowledge and skills they acquire during professional development programme. [12] points out that gathering and analysing data about the use or otherwise of professional development knowledge and how effective they are being applied are important in evaluating professional development programmes. However, it appears the attention of researchers has not focused on it as reviews indicates that few researches have looked at the impact of professional development on teachers' classroom practices ([1], [6]). "Professional development is a key to reforms in teaching and

learning, making it essential that we use the best practice to measure its effects [on teachers' instruction] ([7], p.192)".

Of great value to policy maker, organizers and researchers of professional development is the impact or the effectiveness of the professional development programmes on teachers and students [12]. But for many years, research works on professional development have concentrated on teachers' satisfaction, attitude to change or commitment to innovation to the neglect of the impact of professional development [13]. There is a belief that the more professional development sessions one attends the more efficient he/she becomes. However, the key question that we must ask is how effective is the professional development or what impact did it make? [14].

### 1.1 The context of the study

A national effort is on-going to transform and upgrade teacher educational programmes in Ghana to produce high quality teachers for the country. The Government of Ghana has aimed at overcoming the poor learning outcomes and identifies teaching both as a hindrance and solution to that progress [15]. It has therefore instituted a four-year programme called Transforming Teacher Education and Learning (T-TEL) with the financial support of £17 million from the UK government which is aimed at transforming the pre-service teacher education in Ghana by improving the quality of teaching and learning in the country.

T-TEL seeks to initiate a reform programme to instigate effective professional learning for college tutors and student teachers with the view to developing professional teachers who are well-equipped with knowledge, skills, and the disposition to learn, and who will guide their pupils to achieve the learning outcomes of the national curriculum in basic education. The intended outcome of the programme is the development of beginning teachers who demonstrate interactive, student-focused instructional methods, who demonstrate gender-sensitive and student-centred instructional strategies, and who know and can apply the school curriculum and assessment ([15], p.9).

In view of the reform of teacher education in Ghana, ongoing professional development sessions have been instituted for the tutors of the colleges of education. The main idea behind the professional development is that an "interventions to improve tutors' teaching skills will lead to changes in the behaviour, performance, and teaching skills of student teachers" ([15], p.10). This implies that as college tutors learn and adopt interactive and student-centred instructional strategies, the pre-service teachers will also teach using these students-centred approaches as they have experienced in their training. T-TEL provides support for the college based professional development of the tutors. This is a weekly professional development session which is organized in every semester to improve teachers teaching practice. The programme which was started in 2015 has been sustained till now. The professional development has focused on classroom

practices -such as Creative Approaches, Questioning, Group Work, Use of Teaching and Learning Materials, Talk for Learning and many more - which are treated thematically for a semester.

Since the inception of the professional development for the tutors of the colleges in Ghana in 2015, it appears no study has been carried out to look at the impact the programme on physics teaching at the college level. This study which looks at the impact of continuous professional development of college tutors will address a research gap in professional development studies as research on professional development have concentrated on teachers at the lower levels (especially the elementary levels) of education to the neglect of higher ones [3]. The main purpose of this study was to exam the perceived impact of the professional development on physics teaching at the colleges of education in Ghana. The study was guided by the following research question and hypothesis.

**Research Question:** What is the perceived impact of the professional development on physics tutors' teaching practice?

**Research Hypotheses:**  $H_0$ : There is no statistically significant difference in the perceived impact of the professional development by the physics teachers based on their experience.

## II. THEORETICAL AND EMPIRICAL REVIEW

Professional development can affect teachers' behaviour which will manifest in their classroom practices [6]. The chance for teachers to study about reforms influence the knowledge and skills of the teachers. This effect is what [16] referred to as "domain of practice". Professional development is regarded as a critical process of changing teachers thinking and increasing their content knowledge which in turn influence and improve their classroom practices ([10],[17]). Professional development thus improves teachers pedagogical content knowledge. Given the major role teacher play in educational reforms, it is very essential that professional development offer the teachers with the needed content and opportunities which can lead to changes in their instructional practice [18]. This is because professional development is regarded as the best bet for effecting change in teachers' practices[19].

It is generally accepted that professional development can bring about improvement in teaching practice [20]. But for that to occur [17] claim that there must be a balance between teachers "pedagogical discontentment" (ie the degree to which teachers are dissatisfied with their teaching practice and want to change) and their self-efficacy. This means that until teachers are dissatisfied with their teaching practice and have the belief that it can be change, there will not be any improvement in their instructional practice. This idea is corroborated by [21] who argued that removing contextual barrier is an essential but not enough condition to bring change in teachers' practices. They further argued that for an

improvement in instructional to occur, there should be existence of pedagogical dissatisfaction. “We must focus on teachers' dissatisfaction with their current practices and their degree of engagement with existing reforms if we are to understand the manner in which they enact reforms” ([21, p.738).

For teachers, carrying out a new idea or practice is finding out how and when to add that idea into their already developed habitual practices [20] Therefore, trying to change the teaching practices of teachers is a very difficult task to achieve because the process requires concerted efforts [22]. [3] therefore suggested that teachers require diverse forms of instructional support to be able to change their instruction. This instructional support require collaboration from peers and educational communities [4]. Changes in teaching practices demand time for ‘adaptation adjustment and refinement’ Better results are obtained for changes in instructional practices during the second year of implementation as there will be refinement and efficiency of effort while the first year will be for experimentation [12]. There are a lot of empirical evidence to support the fact that professional development can influence teachers’ classroom practices.

In an experimental study of science teachers’ professional development programme, involving 125 teachers and 1676 students, [8] found that there was an effect on the teachers in their classroom practices as teachers in the treatment engaged in more interactive teaching than those in the control group. A study was conducted by [23] involving 1180 teachers to examine the relation between professional development and teacher classroom practices. It was found that a positive correlation exists between professional development and teachers’ instruction methods.

A survey was conducted by [15] to assess the impact of T-TEL programmes in the colleges of education in Ghana. Using teachers self-report and observation, it was found that the 65.9% of tutors used in the study demonstrated student-focused teaching methods compared to a previous baseline study of 26.1%. It was concluded that “a growing number of tutors have mastered the use of student-focused teaching methods and gender-responsive instructional strategies” ([15], p.38).

[17] carried out a longitudinal study to look at the change in the thinking and practices of teachers after participating in two professional development using 106 teachers. Using data from questionnaire, interview and observation, it was found that changing teachers’ beliefs about teaching had an indirect influence on their teaching approaches. That is, teachers’ participation in the professional development influenced their belief which in turn affected their instructional methods.

A 7-year longitudinal research involving 48 projects in the National Science Foundation's Local Systemic Change (LSC) was conducted by [24] to investigate the relationship between teacher participation in professional development and

teachers' attitudes, preparedness, and classroom practices in mathematics. The instrument used for the study was questionnaire for both teachers and principals. Using different analytical approaches such as hierarchical linear modelling (HLM) approach and structural equation modelling (SEM) the researchers found that teacher participation in LSC professional development was positively correlated with teacher reported classroom practice. The researchers concluded by re-echoing the need to attend to factors that affect teachers’ ability to change their teaching practice.

[22] investigated how a two-year long professional development impacted on the instruction of six science teacher in the USA. Using observations and interview, it was concluded that the teachers were able to apply the standards-based teachings emphasised in the professional development but in different ways.

A research was carried out to examine the impact of 2-week long professional development involving groups of a secondary school science teachers and two students each on monarchy butterfly ecology by [25]. In all 44 teachers and 86 students took part in the 1-week project. Using a mixed method approach the study found that number of teachers giving opportunities for student enquiry increased significantly after the programme. In a longitudinal study to determine the effects of professional development on instructional practices by [26], it came out that professional development that concentrated on a particular teaching practice (technological, instructional or assessment) improved that instructional approach used by the teachers.

### III. RESEARCH METHODS

Descriptive cross sectional survey was used for the study. The population for the study comprised all colleges of education tutors who teach physics. There was no data on the exact number of physics tutors who are at the colleges of education in Ghana. Concerted efforts was therefore made by the researcher to reach as many college physics tutors as possible. In all 85 physics tutors took part in the online survey. The research instrument used in collecting data for the study was a questionnaire which was designed by the researcher as an online instrument using google. The questionnaire was developed based on the content and aims of the professional development that the tutors have been engaged in. To ensure validity, the instrument was given to one professional development coordinator, and two physics tutors to check whether the items were in line with the objectives of professional development. The questionnaire was converted into an online survey form using google. It was then pilot tested using ten physics tutors. These tutors completed the online survey and their responses were used to establish the reliability of the instrument. The Cronbach Alpha reliability of the instrument was found to be 0.901. Data to answer the research question was analysed using means and standard deviation whereas data to test the hypothesis was analysed using analysis of variance (ANOVA).



## IV. RESULTS

### 4.1 Research question

What is the perceived impact of the professional development on physics tutors' teaching practice?

The responses to the items on the questionnaire were in a four point Likert format ranging 0 (no impact) to 3 (great impact). For the purpose of the discussion, a standard mean of 1.5 which averages the score was used for interpretation. Values below 1.5 were considered as low impact while values above 1.5 were considered as great impact. The responses of tutors to items that sought to determine the perceived impact of the professional development on instructional practices is presented in Table 1.

From Table 1, it can be seen that items like, use of games, use of story-telling, use of songs, use of role play and use of modelling which were on the theme "Creative Approaches" were all rated above the standard mean of 1.5 with the exception of the use songs. This mean that all the activities under this theme had great impact on teaching practice except the use of songs which had small impact ( $\underline{M}=1.40$ ,  $\underline{SD}=1.13$ ). The use of modelling was rated the highest in this theme with a mean score of 1.97 and a standard deviation of 1.02, followed by the use of role play ( $\underline{M}=1.72$ ,  $\underline{SD}=0.98$ ). It can be seen from Table 1 that all items related to "Questioning" had rating higher than the standard mean of 1.5 indicating that the professional development activities that involve the use of Questioning had great impact. As it can be seen from Table 1, the professional development activity that has the greatest impact on instructional practice was the use of questions to investigate misconceptions ( $\underline{M}=2.19$ ,  $\underline{SD}= 0.91$ ).

It can also be seen from Table 1 that items like "how to initiate talk for learning," "building on what others say," "managing talk for learning (eg. Use of think pair share)" etc which relates to the theme "Talk for learning" also had great impact on teaching practice. For example, the item "structuring talk for learning (eg use of concept mapping) had a mean of 1.79 with a standard deviation of 0.90.

At the heart of the professional development are the issues of gender and inclusivity. From Table 1, it can be seen that the items on these issues were rated by the tutors as having impacted greatly on their teaching. The item "Use of gender responsive pedagogy" had a mean score of 1.94 with a standard deviation of 0.89 while the "practising of inclusivity" had a mean of 1.96 and a standard deviation of 0.93. As shown in Table 1, the overall mean score and standard deviation for the impact of the professional development on instructional practice was 1.89 and 0.93. This shows that the overall impact of the professional development on instructional practice is great.

### 4.2 Hypothesis

There is no statistically significant difference in the perceived impact of the professional development by the physics teachers based on their experience.

The differences were tested using the one-way analysis of variance test to compare the mean scores of respondents at an alpha level of 0.05. The data was tested for "Homogeneity of Variances" assumption by inspecting Levene's test which was significance ( $p=0.726$ ). The significance value suggests that variances within the factor are assumed equal and hence, Homogeneity of variances assumption was not violated.

ANOVA was used to compare the perceived impact of the professional development by the physics tutors with regards to their experience. The result as displayed in Table 2 showed a non-statistically significant difference in the perceived impact of the professional development based on the tutors' experience,  $F(3,80)=0.616$ ,  $p = 0.607$ .

## V. DISCUSSION

Most professional development programmes are organized with the aim of enhancing teacher knowledge and improving classroom practice[27]. The results from the data indicates that the tutors perceived the professional development to have great impact on the teaching of physics at the colleges of education in Ghana. The main function of the colleges is to train teachers for the basic level of education. This level of education needs interactive and students-centered approaches in teaching. It is therefore expected that college tutors will adopt interactive and student-centred instructional strategies in teaching the pre-service teachers who will also teach using these students-centred approaches as they have experienced in their training. The professional development was therefore designed for colleges tutors to use interactive teaching approaches in teaching and training the students who will learn from the tutors [15].

This result supports a study by [15] which was carried out to examine the impact of T-TEL programmes in the colleges in which it was concluded that "a growing number of tutors have mastered the use of student-focused teaching methods and gender-responsive instructional strategies" (p.38). Comparable results were found in an experimental research of science teachers' professional development programme, involving 125 teachers and 1676 students by [8] who found that there was an effect on the teachers in their classroom practices as teachers in the treatment engaged in more interactive instructional practice than those in the control group. The results also support a longitudinal study to determine the effects of professional development on instructional practices by [26], in which it came out that professional development that concentrated on a particular teaching practice (technological, instructional or assessment) improved that instructional approach used by the teachers.

The result however is a contradiction of the view of [18] who indicate that professional development that generally focus on teaching techniques without focus on content are ineffective. These results are in support of the statement that the impact of professional development programmes to the science teacher leads to teacher ability to adopt teaching to the need of different students and improvement in instructional practice [1]. It is an evidence to support the fact that professional can influence teachers' classroom practices [12].

**Table 1:** Means and Standard Deviations Scores for Items on Perceived Impact of Professional Development on Teaching Practice

Item	Mean	Standard deviation
Use of games	1.65	0.99
Use of story-telling	1.61	0.98
Use of songs	1.40	1.13
Use of role play	1.72	0.98
Use of Modelling	1.97	1.02
Use of questions to investigate misconception	2.19	0.91
Avoiding common mistake in questioning	1.84	1.06
Use of questions to support student learning	2.01	1.03
Use of close and open ended questions	1.79	1.07
Involving everybody in questioning	2.00	1.08
Use of questioning to promote thinking	2.01	1.18
How to initiate talk for learning	1.91	1.03
Building on what others say	2.08	0.99
Managing talk for learning (e.g. using think pair share)	2.11	0.88
Structuring talk for learning (e.g. using concept mapping)	1.79	0.90
Use of low/no cost TLMs	1.89	0.87
Use of books and other written materials	1.93	0.92
Developing TLMs for use in teaching	2.02	0.99
Use of outdoor and environment to enhance teaching	1.92	0.92
Use of open education resources	1.84	0.96
Use of Group work	2.04	0.99
Use of gender responsive pedagogy	1.94	0.89
Practising inclusivity	1.96	0.93
Average scores	1.89	0.93

**Table 2:** ANOVA Test for Perceived Impact of Professional Development Based on Tutors' Experience

	Sum of squares	df	Mean Square	F	Sig.
Between groups	0.488	3			
Within groups	21.111	80	0.163	0.616	0.607
			0.264		
Total	21.599	83			

The result from the ANOVA as shown in Table 2 indicates a non-statistically significant difference in the perceived impact of the professional development based on tutors' experience. This means irrespective of the experience of the physics tutors, they perceived the influence of the professional development to be the same. This could be due to the fact the changes in the educational sector brought about largely by technology coupled with government reforms, will require that all the tutors acquire some new knowledge and skills. [3] posit that professional development is an on-going learning experience which begins and end with the teachers' career. It therefore means that teachers, no matter their level of experience need professional development. This is true for teachers who have experience but encountering new concepts of teaching as well as for new teachers who are coming into the profession [1]. It is therefore not surprising that there was no difference in the perceived impact of the professional development based on the qualification of the tutors.

## VI. CONCLUSION

The professional development which focuses mainly on teaching practice was perceived by the tutors to be making impact and there is a little a reason to doubt the tutors since they are willing to speak honestly about the impact of professional development programmes [27]. This result is however contrary to the widely held view that professional developments that generally focus on teaching techniques without focus on content are ineffective. The reason could be that physics contents taught at the college level may not be very difficult and so tutors are very comfortable teaching them but need the teaching techniques to making their teaching more student centred since they are "trainers of trainee". Therefore, if the student teachers who are being trained by these tutors will learn these ideas from their tutors and practice them, teaching at the basic schools will be more interactive, students-centered and gender responsive.

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