# Impact of In-Service Training Programme on the TPACK of Science Teachers: A Case of New Juaben-North Municipality in the Eastern Region of Ghana

**Victoria Patterson[1], Charles Kwesi Koomson[2], Ambrose Darku[3], Collins Owusu-Fordjour[4]**

[1]Department of Science Education, Faculty of Science Education, University of Education, Winneba, GHANA

[2]Department of Integrated Science Education, Faculty of Science Education, University of Education, Winneba, GHANA

[3]Department of Science Education, Faculty of Science Education, University of Education, Winneba, GHANA

[4]Department of Integrated Science Education, Faculty of Science Education, University of Education, Winneba, GHANA

victoriayanney@gmail.com, charleskoomson@yahoo.co.uk, komladarku@gmail.com, owusufcollins@gmail.com

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**Abstract:** This study assessed the impact that in-service training in selected Web 2.0 tools had on the performance of science teachers within the New-Juaben North Municipality of the Eastern Region of Ghana. The research adopted the case study design with a quantitative approach and was guided by two research questions. Twenty-five science teachers, drawn from some randomly selected senior high schools within the New-Juaben North municipality participated in this study. The questionnaire was used to collect data for analysis. The study found that in-service training in Web 2.0 tools had a strong positive impact on the TPACK of the science teachers and this had translated into improved performance of their students. It was recommended that more in-service training activities should be organised in diverse fields to enable teachers to acquire more skills to improve their teaching performance and hence students' achievement.

**Keyword:** TPACK, ICT, In-Service Training, Web 2.0 Tools, T-TEL

## INTRODUCTION

The success of education depends on several factors; crucial among which is the quality of the instructor. With the increasing invention of technologies that have the potential to maximise the benefits of classroom instruction, teaching and learning is experiencing a paradigm shift from traditional classrooms to virtual and ICT assisted classroom settings. Researchers of Archambault,

Wetzel, Foulger & Williams, [1] believed that this paradigm shift could transform teaching and learning tremendously, leading to more meaningful learning and increased feedback from teachers and students. That being the case, the need for in-service training programmes in senior high schools is getting more attention. Science teachers need to equip themselves with new knowledge and skills for them to face new challenges and reforms in education. In-service training could enhance the professional competence of teachers and invariably lead to improved performance of their students.

In-service training is a professional education programme geared towards improving teachers' efficiency, competence, knowledge and motivation in their professional work. According to Ong [2], In-service training is the totality of educational and personal experiences that contribute toward an individual being more competent and efficacious in an assigned professional role. The primary purpose of an in-service training programme in education is to enable teachers to acquire new understanding and instructional skills (Archambault et al., 2010). It focuses on creating learning environments that enable teachers to develop their effectiveness in the classroom. To Kazmi, Pervez and Mumtaz [3], in-service training for teachers is the driving force behind much change that has occurred in the area of teaching and learning.

Research of Garrison & Akyol[4], suggests that the quality of education could be improved by putting the focus on teaching methodologies espoused by teachers and the way teachers spend time in the classroom. The idea of sustained learning may be made possible by emerging instructional technologies. With an understanding of the collaborative possibilities provided by growing technology, progressive senior high school teachers have begun to dabble with how to make use of the myriad ICT tools in their teaching. Many senior high school science teachers are shifting from passive teaching and learning pedagogies toward the use of ICTs in education [5]. Notwithstanding the shift in teaching paradigms, Hemmi, Bayne and Land[6] asserted that very little exists in teacher training programmes to help teachers proactively address transformation changes in their teaching pedagogy. This knowledge gap could lead to teachers being left behind in the epoch of growing technology. Perhaps, in-service training programme could be used as a tool to bridge this gap and transform teaching practices to capitalise on the affordances of ICT tools. This research assessed the impact of in-service training programmes on the technological pedagogical content knowledge (TPACK) of selected science teachers in the New-Juaben North Municipality, Ghana.

## LITERATURE REVIEW

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**Technological Pedagogical Content Knowledge (TPACK)**

Mishra and Koehler [7] define TPACK as the connections and interactions between and among pedagogy, content, and technology, which are the components needed to ensure quality instruction. TPACK incorporates an understanding of the complexity of relationships among students, teachers, content, technologies, practises, and tools [8]. In crafting professional development programmes, the areas of pedagogy, content, and technology need to be addressed to ensure that the experience is as transformative as possible. TPACK is useful in addressing professional development, as it integrates technology with the domains of content and pedagogy rather than allowing technology to be taught in isolation. To Harris, Mishra, and Koehler [9], typical approaches to technology-related professional development are based on the assumptions that it may be enough to just expose teachers to particular educational technologies and possible curriculum-based uses of those tools and resources. Approaches that teach only skills (technology or otherwise) are not adequate. Learning about technology is different from learning what to do with it instructional wise. This lens offers a way to begin looking at how these domains are currently addressed within teacher education and professional development programmes, and how they needed to be altered to meet the needs of teachers entering 21st-century classrooms. Using TPACK as a framework for effective professional development and concentrating on helping instructors leverage the affordances of technology to most effectively teach their curriculum, teachers can use emerging ICTs to capitalise on the social aspects of learning and allow students to move beyond the acquisition of foundational knowledge to a depth that enables implementation in teaching and learning. The professional science teacher's content, pedagogical and technological knowledge, coupled with his motivation and beliefs influence his decision making in the science classroom as regards the type of instructional approach or method to espouse. These decisions and choices tend to affect the students' learning experiences. in-service teacher training programmes provide valuable learning opportunities for teachers to refine their pedagogical, technological and content knowledge.

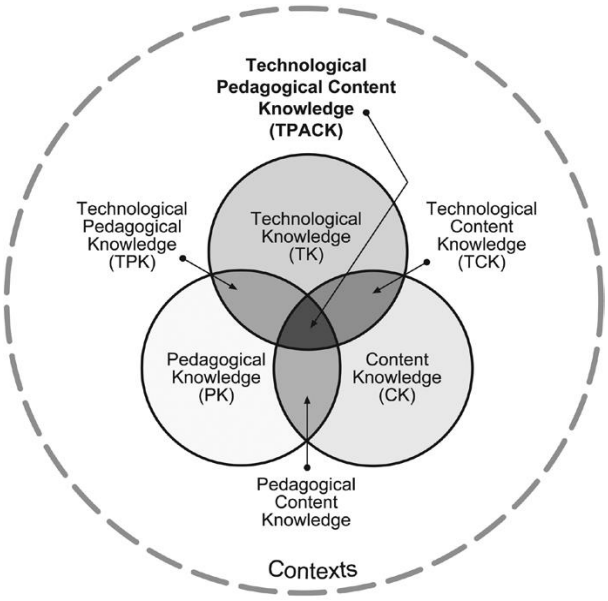


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**Figure 1: Interaction of Content, Pedagogical and Technological Knowledge, TPACK[10].**

**Transforming Teacher Education and Learning (T-TEL)**

With the growing recognition that teacher quality is critical in preparing students for a society undergoing far-reaching economic and social changes, the need for policies and strategies to strengthen teacher preparation, and as a consequence, teaching, is even greater. Building a high-quality education system relevant to 21st century social and economic realities has become a top priority for most governments and nations. Central to the idea of a quality education system is the quality of the teaching provided by teachers to students. Grossman and McDonald (2008) noted that high-quality teaching should be characterised by greater emphasis on teachers' values, skills and knowledge that are fundamental to good teaching and personalising learning for individual students to accommodate greater diversity in learning contexts.

There is a pressing need, therefore, to recognise that teachers' work is multifaceted and challenging and that improvement in teacher quality requires a re-conceptualisation of how new teachers are trained. Accordingly, a change in the form of teacher preparation would be best based on a recontextualised professional competence. The concept of recontextualised professional competence according to Penin:

1. recognises teacher's work as being based on specialised knowledge and skills, expecting all teachers to have the ability to use them appropriately in a variety of institutional contexts and with diverse student demographics;
2. expects teachers' self-directed commitment to continuous learning related to the individual's expertise and experiences and is directed towards enhancing student outcomes and strengthening professional identity.

Teachers' continued learning and professional development are key avenues for developing the knowledge, skills and dispositions required to teach all students to reach higher standards. Effective professional development programmes (Elliott, 1991) must lead to transformative changes in the knowledge and skills of teachers to make them effectively respond to the reform of practice. An in-service training programme may be a tool for attaining these transformative goals.

**METHOD**

This research used the case study design with a quantitative approach to assess the impact of in-service training programmes on the TPACK of selected science teachers in New-Juaben North Municipality. The accessible population of this study comprised all senior high school science teachers in the New-Juaben North Municipality, Ghana. The purposive sampling technique was used to select twenty-five (25) science teachers from some randomly selected schools in the New-Juaben North Municipality in the Eastern Region of Ghana as the sample for the research. Participants of this study were exposed to selected Web 2.0 tools through hands-on in-service training programmes for four weeks. The selected Web 2.0 tools included Google Classroom, Google Docs and Google Slides. The participants were taught how to effectively integrate these tools into science education to make teaching and learning more interactive and sustained. Questionnaires were administered to collect data from the respondents for analysis. The reliability of the questionnaire was assessed by using Cronbach's Alpha Coefficient. An alpha value of 0.81 (> 0.7) was realised. The questionnaire was administered to the participants to collect data on the impact of the training programmes they underwent on their TPACK and classroom practice. All twenty-five questionnaires administered were retrieved. SPSS version-25 was used to

[10] Archambault et al., "Professional Development 2.0."

analyse the data through descriptive and inferential statistics.

## RESULTS AND DISCUSSION

### Impact of In-service Training Programmes on the TPACK of Science Teachers

**Table 1: Impact on Science Content Knowledge**

| Variables | Observations | Mean | S. D. | $t_{cal}$ | $t_{crit}$ |
|---|---|---|---|---|---|
| Performance After Training | 25 | 15.6 | 2.4 | 7.84 | 1.96 |
| Performance Before Training | 25 | 12.4 | 2.7 | | |

***S.D. = Standard Deviation**

**Table 2: Integration of Technology in Science Teaching**

| Variables | Observations | Mean | S. D. | $t_{cal}$ | $t_{crit}$ |
|---|---|---|---|---|---|
| Performance After Training | 25 | 12.7 | 1.5 | 3.73 | 1.96 |
| Performance Before Training | 25 | 10.2 | 2.5 | | |

**Table 3: Understanding of Context of Science Teaching**

| Variables | Observations | Mean | S. D. | $t_{cal}$ | $t_{crit}$ |
|---|---|---|---|---|---|
| Performance After Training | 25 | 18.3 | 3.7 | 4.8 | 1.96 |
| Performance Before Training | 25 | 15.6 | 2.9 | | |

**Table 4: Pearson's Correlational Analysis**

| Response Variables | Covariate | Pearson's r | Conclusion |
|---|---|---|---|
| Teachers' TPACK | In-service Programme | +0.73** | Strong positive correlation |

**Table 5: Impact on Students' Achievement**

| Variables | Observations | Mean | S. D. | $t_{cal}$ | $t_{crit}$ |
|---|---|---|---|---|---|
| Performance After Training | 25 | 13.0 | 1.9 | 3.67 | 1.96 |
| Performance Before Training | 25 | 11.5 | 2.0 | | |

## DISCUSSION

This research sought to understand the impact that in-service training programmes in selected Web 2.0 tools had on the Technological Pedagogical Content Knowledge (TPACK) of the science teachers who took part in the study. Three domains, science content knowledge, integration of technology into education and the understanding of the context of science teaching were assessed before and after the teachers were exposed to in-service training programmes. The results showed that the performance of the teachers in all cases improved significantly after in-service training (Tables: 1, 2 & 3). Further, the correlational analysis revealed that the in-service training programmes had a strong positive impact on the TPACK of the science teachers. Additionally, when the participants of this study were asked to give their feedback regarding how their pedagogy shifted as a result of implementing technological tools in their teaching, the majority of the teachers (n = 17, 68%) reported that their teaching became more collaborative through the use of the technology. This theme was echoed perhaps concerning the number of feedback students were able to give when collaboration tools, such as Google Classroom and Sides, were used. This finding is in agreement with the findings of Mourshed[11] who reported a positive result regarding the TPACK of a group of secondary school teachers after taking them through in-service training workshops.

Concerning the impact of the in-service training programme on the performance of students, this study found that twenty-two (88%) of the twenty-five participants reported that the integration of the ICT tools presented during in-service training had a positive impact on their student achievement. Justification for this included improvement in the quality of the contributions that students made during content delivery coupled with improved assessment scores. Also, statistical analysis of the data (Table 5) showed that the performance of the students significantly improved after the in-service training programme. According to Boulos and Wheeler [12], ICT tools, such as those the participants of this study were trained on encourage significantly more interaction between users; a feature that many theorists argue is vital in the teaching and learning process. Interaction encourages deeper, active and more sustained learning engagement, builds communities of learning, and enables feedback from tutors to students. Perhaps, these accounted for the improved performance of the students. It is worth mentioning, however, that a few of the teachers did not share this view as they reported no change in the performance of their students following in-service training. This could be further investigated.

## CONCLUSION

On the premises of these findings, the following conclusions were arrived at:

a. The in-service training programme had a strong positive impact on the performance of the science teachers and has translated into improved performance of their students.
b. An in-service training programme is critical to the pedagogical transformation of the science teacher within the classroom.
c. In-service training programme plays a crucial role in the professional development of the science teacher; this invariably leads to improved performance of the science teacher.
d. The in-service training programme affected positively the TPACK of the science teachers.

[11] Michael Barber and Mona Mourshed, *How the World's Best-Performing School Come Out On Top*, *Serie Documentos*, 2008.

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From this perspective, the Ghana Education Service [GES] and its stakeholders should place more focus on the in-service training of its teachers. Training providers should introduce a variety of training activities with different teaching perspectives in mind. This will assist the teachers, particularly science teachers, to attain new knowledge and skills and thus improve the quality of science education in Ghana.

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