European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available on-line at: www.oapub.org/edu

DOI: 10.46827/ejes.v10i2.4665 Volume 10 | Issue 2 | 2023

IMPLEMENTATION OF LEARNER-CENTRED CURRICULUM IN THE COLLEGES OF EDUCATION IN GHANA: AN ASSESSMENT OF CHEMISTRY TUTORS' CLASSROOM PRACTICES

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Abstract:
This study examined the implementation of the new 4-year Bachelor of Education (B.Ed) Chemistry Curriculum in the Colleges of Education (CoEs) in Ghana and to determine whether the strategies used by the approaches used by the implementers were in line with those prescribed in the curriculum document. The theoretical framework for the study was based on Rogan and Grayson (2003) framework for curriculum implementation. The study was conducted in five Mathematics and Science CoEs in the Northern Zone in Ghana. Fourteen (14) Chemistry tutors comprising 10 males and 4 females who were directly involved in the implementation of the new curriculum were purposively selected for the study. The study used a descriptive survey design with a mixed methods approach. The quantitative data were collected through a survey questionnaire while a classroom observation checklist and semi-structured interview guide were used to collect the qualitative data. The qualitative data were analysed using descriptive statistics such as mean, and standard deviation. On the other hand, the observational data were analysed by coding and interpreting tutors' classroom strategies. Moreover, the interviews were tape-recorded, later transcribed and categorised into themes. The study found that the tutors' classroom strategies and assessment methods were not in conformity with those prescribed in the new curriculum. The study recommended the intensification of the continuous professional development (CPD) activities for tutors and also suggested that the external components of assessing students should include the learner-centred approaches as prescribed in the curriculum.

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Keywords: curriculum, chemistry tutors, instructional strategies, assessment methods, implementation, learner-centred, classroom practice

1. Introduction

Over the past few decades, Ghana has undertaken several reforms in teacher education curricula with the aim making them responsive to the needs of the 21st century. The curricula were changed in terms of contents and instructional approaches. The duration of pre-service teacher training has also witnessed changes from three years to four years. Further, the certificate awarded to pre-service teachers has also changed from Diploma in Basic Education (DBE) to Bachelor of Education (B.Ed). These changes were in response to a general concern about the quality of teachers produced by the teacher training institutions (Ayeampong, 2017; Akyeampong & Lewin 2002; Lauwevier & Akkari, 2015).

One of such reforms took place in the year 2004 as a response to recommendations by a Presidential Committee set up to review pre-tertiary education in Ghana. According to Aziaba (2018), the Committee was set up because of public concerns about the failure of the education system to meet quality and equity expectations. In that reform, the teacher training colleges were upgraded from certificate-awarding to diploma-awarding institutions to be known as Colleges of Education. The student teachers were to undergo one semester of on-campus teaching practice where they would teach their peers under the guidance of the tutors. Subsequent to that, they spend the final two semesters on practicum in selected basic schools, under the tutelage of practicing teachers (mentors).

Despite these efforts to improve the quality of pre-service teachers, a study conducted by Ampadu (2012) revealed that the CoEs had failed to adopt practical teaching approaches in the classroom. This problem was attributed to the teacher-centred didactic methods of teaching (Ampadu, 2012). Stakeholders in education have argued that the quality of education can be improved by reforming the way pre-service teachers were being trained. For the quality of pre-service teacher education to be improved, stakeholders assumed that modernising the classroom practices of college Tutors was the surest way (Transforming Teacher Education and Learning [T-TEL], 2017a).

The latest reform was done in 2018, when all the CoEs were upgraded to degree-awarding institutions. They now offer 4-year Bachelor of Education (B.Ed) programmes with an emphasis on basic education. The reason for the upgrading was to produce teachers with the requisite quality and motivation to help achieve the expected outcomes at the basic school level (T-TEL, 2018). These frequent reforms mean that the previous attempts by different Governments at improving quality at the college level have not yielded the desired outcomes. The failures of the reforms suggest that the problem was at the implementation stage.

Since the inception of this current 4-year B.Ed Chemistry curriculum in 2018, studies conducted by many researchers (e.g., Amoako, Attia, Awini & Denteh, 2021; Buaben, Ntow & Otami, 2020; Oduro, Akuka, & Kuranchi, 2022) have not touched on

how the curriculum was being implemented. This current study seeks to find out the instructional strategies and assessment methods used by Chemistry tutors in the implementation of the curriculum. It is specifically to find out whether the approaches used by the Tutors in their classroom practices were in line with those prescribed in the curriculum document. The importance of this study is that it would bring to the fore how the new Chemistry curriculum is being implemented and the possible challenges that might affect its success.

2. Research Questions

The study was guided by the following research questions:

1) What is the level of preparedness of Chemistry tutors towards their classroom instructions in the implementation of the new 4-year B.Ed. Chemistry curriculum?
2) What are the instructional strategies employed by Chemistry tutors during classroom implementation of the new 4-year B. Ed. Chemistry curriculum?
3) What are Chemistry Tutors assessment practices in the implementation of the new B. Ed. Chemistry curriculum?

3. Literature Review

The analytical framework developed by Rogan and Grayson (2003) formed the theoretical basis for this study. This theory was deemed appropriate because of its relevance to curriculum implementation, especially, science education curricula in the context of developing countries like Ghana. The theory provides mechanisms for assessing curriculum implementation. It contains three constructs (i) Profile of Implementation (ii) Capacity to support innovation, and (iii) Support from outside agencies. Out of the three constructs, the Profile of Implementation is important to this current study.

2.1 Profile of Implementation

Rogan and Grayson (2003) argued that the Profile of Implementation construct was an indication of the fact that the implementation of a new curriculum could be done at levels or degrees of perfection. They further explained that the Profile of Implementation provides the opportunity for curriculum planners to take into consideration the ability of the implementing agents, especially, the teachers, to execute the implementation as expected. The Profile of Implementation has four sub-constructs. They are (1) Classroom interaction (2) Science Practical Work (3) Science in Society and (4) Assessment (Rogan & Grayson, 2003). Teachers' classroom interaction and assessment are the focus of this study.

It is expected that teachers' pedagogical approaches and assessment strategies be geared towards 'open-ended learner-centred investigations' instead of 'teacher-centred demonstrations' (Rogan & Grayson, 2003, p. 1182). This learner-centeredness coincides

with the prescribed approaches recommended by the developers of the new 4-year B. Ed. Chemistry curriculum for the CoEs in Ghana.

The new 4-year B. Ed. Chemistry curriculum was introduced in September 2018 in all 46 CoEs in Ghana to replace the old 3-year diploma in basic education (DBE) curriculum. During the implementation stage, everyone within the teacher education system, especially, the tutors needed appropriate knowledge about what was expected of them. Some of the key documents which were critical for the implementation of the change aside from the curriculum document were the National Teachers' Standards (NTS) developed by the National Teaching Council (NTC, 2017), and the National Teacher Education Curriculum Framework (NTECF) designed by Transforming Teacher Education and Learning (T-TEL), a body which spearheaded the current reforms at the Colleges of Education (CoEs) in Ghana. While the NTS document outlined the professional knowledge, attitude and pedagogical competencies needed for someone to become a teacher, the NTECF documents detailed the pedagogical approaches and strategies required for the implementation of the new B. Ed. curriculum. Some of the learner-centred strategies outlined in the NTECF and also in the curriculum document for tutors to comply with were concept mapping, discovery learning, project works, modelling, group work, and talk-for-learning among others (T-TEL, 2017b; UEW, 2018).

In other to enhance the capacity of tutors to implement the new curriculum as envisaged by the designers, the tutors are taken through continuous professional development activities including workshops, seminars, and symposia among others. The instructional strategies and assessment methods of the Chemistry tutors are expected to be at higher levels as contained in the profile of implementation in Rogan and Grayson's (2003) framework of curriculum implementation.

2.2 The Need for Effective Teacher Preparation for Classroom Instructions

Planning towards classroom instructions is a prerequisite for effective lesson delivery. Planning involves reading the requisite curriculum materials to acquaint one's self with the content and approaches needed to achieve the curriculum objectives. After the knowledge of what should constitute the content and the pedagogical approaches, the next thing is to prepare a lesson plan that serves as a road map of what students need to learn and how it will be done effectively during class time. Available research supports the significance of teacher preparation for classroom practices (National Council for Accreditation of Teacher Education [NCATE], 2010). This means that tutors at the CoEs need to prepare adequately towards the implementation of the new Chemistry curriculum by first, reading the relevant documents and subsequently, preparing their pro forma, which serves as the lesson plan for effective and orderly lesson delivery. The need for this preparation agrees with the opinion of Cochran-Smith & Zeichner (2005) that, teachers who poorly prepare towards their classroom practices may feel lost in carrying out their instructional strategies and assessment of students' performance.

2.3 The Need for Alignment of Tutors' Practices with the Prescriptions in the New Curriculum

According to the National Council for Curriculum and Assessment (NaCCA, 2022), the surest way to determine whether a curriculum is successful is to assess the fidelity of its implementation. NaCCA (2022) defines fidelity of implementation as "*the degree to which teachers or stakeholders abide by a curriculum's original design when implementing it*" (p.9). It is therefore imperative for Chemistry tutors in the CoEs to align their instructional and assessment strategies to those recommended in the new Chemistry curriculum so that its successes or failures could be critically examined. In line with this, Tutors in the CoEs are expected to use creative approaches (T-TEL, 2015) and other strategies that would help the student teachers to discover knowledge by themselves (T-TEL., 2017b). Moreover, assessment procedures are expected to involve the use of subject project works, portfolios, and concept maps, among others (UEW, 2018).

In the CoEs in Ghana, student teachers are taken through formative and summative assessment processes. The summative assessment process takes place at the end of every semester. The questions for this assessment are usually sent to the colleges by their respective affiliated universities to be conducted on the premises of the colleges with supervision by external supervisors from the affiliate universities. The formative assessment also has two components: One is a mid-semester quiz usually conducted with the supervision of the affiliate or mentoring university. The remaining part is carried out by the subject tutors. It has several elements which include subject project works, portfolios, concept maps, report writing, and class presentation among others. The component of the formative assessment that is conducted independently by the college tutors is the focus of this study. Predominant use of paper-and-pencil modes like quizzes and tests is not encouraged in this component. It is the contention of this study, that, it is only when the Chemistry tutors tailor their practices in terms of instructional and assessment strategies in line with those prescribed in the curriculum document that the goal of the new 4-year B.Ed. Chemistry curriculum to produce the desired competent teachers from the CoEs can be achieved.

Several studies on curriculum implementation in the CoEs in Ghana have found disparities between tutors' practices and curriculum intentions (Kumabia, 2014; Yekple, Kumi & Kumah, 2022; Anderson, 2020). Kumabia (2014) carried out a study on the implementation of the Chemistry curriculum in CoEs in the Volta Region of Ghana. The findings showed that the mode of implementation was at variance with the curriculum's demands. On the part of Yekple, Kumi and Kumah (2022), their finding was that tutors at the CoEs were very much prepared to implement learner-centred approaches but their classroom practices were a deviation from what the curriculum designers intended. Similarly, a study by Anderson (2020) revealed that the implementation of the New National Teachers Standard Curriculum at the University of Education, Winneba, Ghana, was faced with several challenges.

Biggs (2003) proposed what is termed constructive alignment in curriculum implementation, which is explained as the process that allows students to construct their

own knowledge through the desired learning activities that are in line with the curriculum's objectives. This proposition is in line with the learner-centred character of the new Chemistry curriculum which expects tutors to take the student teachers through activities that would enable them to construct their own knowledge. This was to prepare the student teachers to handle the standard base curriculum at the basic school level after completion.

Rogan & Aldous (2005) have argued that there is a nexus between the degree to which an innovation is implemented with fidelity on one hand and the school contexts in terms of human and material resources and facilities on the other. In view of this human resource context, tutors in the CoEs were taken through capacity-building programmes such as seminars, workshops and weekly professional development (PD) activities. Tutors are expected to abandon their old practices and embrace the new approaches contained in the new curriculum.

Studies have shown that the effectiveness of the implementation of a curriculum change depends on whether it is implemented with fidelity (Bruhn, Hirsch, & Lloyd, 2015; Keller-Margulis, 2012). If an innovation is not implemented as intended, the possibility of achieving its objectives is "*minimal at best*" (Gage, MacSuga-Gage, & Detrich, 2020, p.1). For the purposes of this study, any implementation strategies that are closely in line with those prescribed in the new curriculum would be interpreted as the acceptable degree of fidelity and hence would help achieve the objectives of the programme. On the other hand, if the strategies do not adhere to the prescriptions in the curriculum, it means the objectives would not be achieved.

3. Methodology

3.1 Research Design

The study used a descriptive survey design with mixed methods approach. The survey was used because it enabled the researcher to ascertain the true situation on the ground from the respondents' perspectives regarding their classroom practices. Both qualitative and quantitative data were collected through survey instruments in order to get a better understanding of the research problem (Creswell, 2005). The qualitative data were obtained through a survey questionnaire while an interview guide and observation schedule were used for the qualitative data.

3.2 Population and Sample

The target population for this study comprised all Chemistry tutors in the Science and Mathematics Colleges of Education in Ghana. The accessible population was all the 14 Chemistry tutors in the five Science and Mathematics colleges in the Northern zone of Ghana. They were purposively selected because they were directly involved in the implementation of the new 4-year B.Ed. Chemistry curriculum at the time (Ary, Jacobs, & Seronsen, 2010).

3.3 Instrumentation

The main instrument for the study was a 23-item 5-point Likert-type scale ranging from 1 (Never) to 5 (Always). The items were structured in such a way as to determine the level of preparedness of the tutors prior to their classroom interactions, the kind of strategies used during classroom instructions and the methods used to assess the students. The questionnaire was supplemented with a classroom observation checklist, as a means to validate the data obtained through the questionnaire, and an interview guide was used to triangulate the questionnaire data. In all, 5 Chemistry tutors (one from each college) participated in the classroom observation as well as the interview.

3.4 Validation of the Research Instruments

The questionnaire items were carefully constructed taking into consideration, the objectives of the curriculum as well as the contents of the NTECF and the NTS. This was to ensure that the items were within the context of the study (Ghauri & Gronhaug, 2005). Cronbach's alpha reliability test was used to determine the internal consistency of the questionnaire after a pilot test. The Cronbach alpha coefficient was determined to be 0.85, which was considered to be very good (Ursachi, Horodnic, & Zait, 2013).

The coding of the classroom observation was done independently by two of the three researchers. Cohen kappa inter-rater reliability (Marston, 2010) was used to determine the agreement between the two coders. The kappa statistic was found to be 0.83 ($p < 0.001$). This value indicated that the kappa coefficient was statistically significant, and also, the agreement between the raters (0.83) was almost perfect (McHugh, 2012).

During the interviews, respondents were encouraged to ask for clarity if they were not sure of the questions (Gadd, 2004). The interview sessions were tape-recorded and played to the hearing of the respondents to find out whether they stood by their responses or would like to make changes.

3.5 Data Analysis

Statistical Package for Social Sciences (SPSS) software version 22 was used to analyse the quantitative data. The data were analysed using descriptive statistics such as the mean and standard deviation. The results were presented in tables according to the sub-scales of the questionnaire.

The five colleges were given codes from the letters A to E. Due to this, each tutor who participated in the qualitative data collection processes was given a code name that corresponded to that of his or her respective college. For example, a tutor from college A was coded as college tutor A (CTA); the one from college B was coded named college tutor B (CTB) and so forth. These codes were used to refer to the respondents in the analysis of the interviews and observational data.

On the part of the interview, the recorded audios were transcribed and categorised into themes. The themes provided insight into the various responses to the items and the

rationale for the choice of some of the approaches used in the implementation of the curriculum.

3.6 Ethical Considerations

Before data collection, a letter seeking permission to conduct the study was sent to each of the principals of the five colleges. Written permissions were granted before data were collected. Moreover, the expressed consent of the respondents was also sought before the commencement of data collection. Respondents were informed of the anonymity of their identities throughout the study. They were further informed of their liberty to withdraw from the study at any point if they felt so.

4. Results and Discussions

The results are presented according to the sub-scales of the questionnaire. The data were obtained through the questionnaire and validated using the observational checklist. Additionally, interviews were used to ascertain why certain instructional strategies were adopted by the tutors.

Each of the three sub-scales of the survey questionnaire focused on a different issue: (a) level of preparedness of the Chemistry tutors (b) instructional strategies Tutors employed in their classroom, and (c) methods used in assessing students' learning. In each of the sub-scales, descriptive statistics were used to organise the Tutors' responses into mean scores and standard deviations.

4.1 Analysis of the Research Questions

Research Question One: What is the level of preparedness of Chemistry tutors towards their classroom instructions in the implementation of the new 4-year B.Ed. Chemistry curriculum?

The items in the Tutors' Preparedness sub-scale sought to find out whether the tutors usually prepared adequately towards their instructional practices. It specifically focused on the preparation of pro forma and also, whether in preparing for classroom instructions, tutors take into account the requirements in the NTS, NTECF and the professional development (PD) guides. In view of the 5-point Likert-type scale used, the determination of the tutors' level of preparedness was done using mean intervals such that mean < 2.50 = not prepared, 2.50 ≤ mean< 3.50 = fairly prepared, and mean ≥ 3.50 = highly prepared (Anderson, 2020). Table 1 presents the results of the analysis of the data under this sub-scale.

The data in Table 1 showed that the Chemistry tutors appeared highly prepared towards their classroom instruction. The results indicated that apart from Item 1 which was about the preparation of pro forma, in which the tutors did not prepare (M = 1.64, SD = 0.93), the tutors were highly prepared in terms of the content of the new curriculum and the PD guides (Item 3) (M = 4.14, SD = 0.54), followed by their consideration of the prescriptions of the NTS and the NTECF (Item 4) (M =4.50, SD =0.52), then followed by

preparation of the teaching and learning materials ahead of the lesson (Item 2) (M = 4.71, SD = 0.61). Overall, the tutors appeared highly prepared (M=3.75, SD = 1.42) for their classroom instruction.

Table 1: Chemistry Tutors' Preparedness Towards Classroom Instruction

Item No.	Item description	Mean	SD	Level of preparedness
1	I prepare my pro forma for each lesson	1.64	0.93	Not prepared
2	I prepare the teaching and learning materials ahead of the lesson	4.71	0.61	Highly prepared
3	I plan my lessons taking into consideration the prescriptions in the chemistry curriculum and the PD guides	4.14	0.54	Highly prepared
4	I plan my lessons taking into consideration the prescriptions of the national teachers' standards (NTS) and the national teacher education curriculum framework (NTECF).	4.50	0.52	Highly prepared
	Overall preparedness	3.75	1.42	Highly prepared

Note: M = mean, SD = standard deviation.
Source: Survey Data, 2022.

The implication of these scores is that the tutors did prepare adequately towards their classroom instruction. They, however, fell short of preparing an elaborate lesson plan or pro forma. During the observation, none of the respondents prepared their pro forma. When asked during the interview why they did not prepare the pro forma, the respondents indicated their dislike for it. "*This thing about pro forma is very disturbing. Sometimes officials from our affiliate university would come around asking of pro forma. Truth is, I don't prepare it*" (CTC revealed). Another respondent narrated how he was condemned by supervisors for teaching without pro forma. *"….They came to my class to supervise my lesson. After the exercise, they commented that I taught without the use of pro forma. I was not happy about it*" (CTE).

Teacher preparation is one of the important variables in effective classroom practice. Darling-Hammond (2000) reported that teacher preparation is one of the important contributors to students' achievement. This is because one of the qualities of an effective college teacher is to be conversant with and abide by the recommended strategies in the relevant curriculum materials. Effective prior preparation engenders confidence in teachers during classroom practices (Koedel, Parsons, Podgursky, & Ehlert, 2012). In agreement with this, Kraut, Chandler, and Hertenstein (2016) argued that one of the contributory factors to effective teaching and learning is the level of teacher preparedness.

The government of Ghana and the implementing advisers also made the assumption that the quality of pre-service teachers in the CoEs could be guaranteed by improving tutors' classroom practices (T-TEL, 2017b). Judging from the tutors' level of

preparedness, it is expected that their classroom practices would improve (Kilpatrick, Swafford & Findel, 2001) notwithstanding the fact that they did not prepare the pro forma.

Research Question Two: What are the instructional strategies employed by Chemistry tutors during classroom implementation of the new 4-year Chemistry curriculum?

This research question sought to find out the predominant teaching and learning strategies used by the Chemistry tutors in the implementation of the new Chemistry curriculum. The purpose was to determine whether the strategies conformed to what had been prescribed in the curriculum document.

The items to answer this question were from items 5 to 17 of the questionnaire. The items under this sub-scale were classified under two categories: (1) Old and traditional strategies and (2) New and innovative strategies. The old and traditional strategies were the instructional strategies that were contained in the previous curriculum; hence, the tutors were familiar with them. The new and innovative strategies were those that were exclusively contained in the new curriculum and were not familiar to the tutors. The purpose of classifying the items was to ascertain whether tutors were stuck to their old instructional strategies or they had adopted those in the new curriculum. The following intervals adopted from Kasapoglu (2010, p.65) were used to categorise the mean scores: 5.0-4.21 represented "Always", 4.20-3.41 represented "Often", 3.40-2.61 represented "Sometimes", 2.60-1.81 represented "Seldom", and 1.80-1.00 as "Never". Table 2 displays the results of the analysis of the data pertaining to tutors' classroom instructional practices.

The issues in items 5, 6, 7, 10, 13, 15, 16 and 17 were classified as 'new and innovative strategies'. The respondents claimed in item 5 that they always used the recommended creative approaches in their lessons (M = 4.36, SD = 0.91). However, during the classroom observations, none of the tutors used any of the creative approaches contained in the curriculum and the PD guides. The implication of the disparities between the tutors' responses on one hand and the data from the observation is that the tutors did not use creative approaches in their classroom practices. Meanwhile, these creative approaches which include the use of games models, songs, storytelling and role-play were some of the important strategies the tutors were expected to use in their classroom practices (T-TEL, 2015).

The use of audio-visual devices such as projectors in classrooms (Item 6) had a mean score of 1.78 (SD = 0.7). This indicated that the respondents never used the projector in their classrooms. However, in the case of the use of videos in the classroom (Item 7), the mean score indicated that respondents 'sometimes' used this strategy (M = 2.64, SD = 0.93). The tutors further indicated that they had always allowed their students to use their smart mobile phones in the classroom to search for information online (Item 17). During the observation, only one tutor (CTB) used videos from a computer and projector. However, in almost all the lessons observed, the students were seen searching for information using their smartphones. This practice of allowing students to use

smartphones in lecture halls was in conformity with recommended practices in the new B.Ed. Chemistry curriculum.

The results again showed that the tutors sometimes guide their students to carry out activities that could lead to the discovery of knowledge (Item 13). The mean score was 2.57 (SD = 0.76). Moreover, in the observed lessons, none of the tutors led the students to carry out activities that could result in knowledge discovery. This implied that the tutors did not comply with this recommended strategy in the new curriculum.

Table 2: Chemistry Tutors' Classroom Instructional Practices

Item No.	Item description	Mean	SD	Frequency of practice
5	I apply specific creative teaching strategies in my lessons.	4.36	0.91	Always
6	I use a projector to display the contents of my lesson to my students.	1.78	0.70	Never
7	I download and use videos from online sources to demonstrate processes and procedures in chemistry to my students.	2.64	0.93	Sometimes
8	I use questioning to stimulate thinking among my students.	4.07	0.83	Often
9	I use questions to investigate students' misconceptions.	3.36	0.84	Sometimes
10	I encourage my students to look for information from open educational resources (OERs) like Khan academy, Coursera, etc.	4.64	0.75	Always
11	I encourage my students to work in groups	4.93	0.27	Always
12	I give topics to my student groups to prepare on and deliver group presentations.	3.86	0.66	Often
13	I guide my students to carry out activities that lead them to discover knowledge for themselves.	2.57	0.76	Sometimes
14	I use demonstrations to explain certain concepts to my students.	4.71	0.47	Always
15	I consider gender issues in my classroom practices.	4.50	0.65	Always
16	I guide students to construct concept maps on certain chemistry concepts.	1.57	1.09	Never
17	I encourage my students to use their smartphones to search for information during classes.	5.0	0.0	Always

Note: M = mean, SD = standard deviation.
Source: Survey Data, 2022.

One of the most important instructional strategies, that is, concept mapping (Item 16) was never used by the tutors (M = 1.57, S.D = 1.09). This was confirmed during the classroom observation as none of the tutors used concept maps in their teaching. This meant that the use of concept mapping as a strategy was not complied with by the chemistry tutors. Wilgis and McConnell (2008) view concept mapping as a strategy that promotes active learning among students. It also promotes the discovery of knowledge by students (Caputi & Blach, 2008), and enhances students' understanding of concepts (Halford, 1993).

The tutors were asked during the interview section why they did not use concept maps in their classroom practices. Some of them expressed lack of understanding of concept mapping while others mentioned time as a factor. "*For me, to be frank with you, I don't understand it. I have read about it but it seems complicated to me*" (CTA). Another respondent claimed that the use of concept maps in teaching was time-consuming and so he never used it in his lessons. "*Concept mapping, even though is interesting, more time is needed to use it effectively in a lesson. I tried it once and it did not work for me and my students*". He explained further: "*I mean, we could not cover even half of what I had planned to teach for the period. That is why you did not see me using it*" (CTB). For CTD, concept mapping can only be used if it is incorporated into the examinations. For him, it is a waste of time to use concept maps in class. *"…Once the students are assessed through concept maps, I mean during the end of the semester, I will apply it in class, otherwise, it is time-wasting*" CTE suggested.

The items that were classified as 'old and traditional' were Items 8 (M= 4.07, SD = 0.83); 9(M = 3.36, D= 0.84); 11(M = 4.93, SD = 0.27); 12 (M = 3.86, SD = 0.66) and 14(M= 4.71, SD = 0.47). Judging from the mean scores, Items 8, 11 and 14 were interpreted to mean 'always' while Items 9 and 12 were interpreted as 'sometimes' and 'often' respectively. This meant that the tutors always: (i) used questioning to stimulate the students to think (Item 8), (ii) give the students' group task to perform (Item 11) and (iii) used demonstration to explain concepts to the students. Further, the tutors often provided topics to student groups to prepare on and carry out group presentations in class (Item 12) and sometimes use questions to investigate students' misconceptions (Item 9).

It was noted during the classroom observation that all the tutors used demonstrations to explain concepts to students instead of the hands-on activities prescribed in the new curriculum. Moreover, it was observed that almost all the tutors employed questioning but none of them used it to deal with students' misconceptions. This implied that the tutors did not use questioning to target and deal with students' misconceptions as recommended by the curriculum.

The results indicated that for the strategies classified as 'new and innovative', the tutors did not comply with many of them. However, they complied with many of the strategies classified as 'old and traditional'. This conclusion is based on the fact that the mean scores for some of the items classified as 'new and innovative' were very low as compared to those classified as 'old and traditional'.

The implication of the results is that the tutors' classroom instructional practices did not conform to the strategies set out in the new B.Ed. curriculum. They did not comply with the strategies that were new to them or those they were not conversant with. Examples include the use of concept maps, discovery learning activities, and handling of students' misconceptions, among others. These findings implied that the tutors were stuck with the old instructional strategies which they were familiar with instead of adopting the new approaches prescribed in the new curriculum.

The need for teachers to adhere to the dictates of a curriculum has been much discussed in the literature (e.g., Graves, 2008; O'Donnell, 2008; Pence, Justice, & Wiggins,

2008). For the new B.Ed. Chemistry curriculum to achieve its intended objectives, the tutors must adhere strictly to the strategies outlined in the curriculum document. In other words, the instructional practices of the chemistry tutors must be in line with those stated in the curriculum (MacDonald, Barton, Bagulwey, & Hartwig, 2016).

The findings of this study suggested that the tutors had difficulty in transitioning from their old instructional practices to the new ones. Fullan (1993) argued that changes in systems such as curricula are usually characterised by the coexistence of the old and the new approaches. This is applicable to this finding because the tutors frequently carried out strategies that were similar to those in the old curriculum compared to the new ones which they were not familiar with. This finding agrees with that of Anchan, Fullan and Polyzoi (2003) who contended that if the differences in approaches between a new curriculum and an old one are wide apart, teachers would find it difficult to implement it. They would rather stick to the old approaches which they are comfortable with.

The findings also corroborate those of earlier studies on the implementation of curricula changes (e.g., Kasapoglu, 2010; Kumabia, 2014; Melese, 2019; Mthethwa, 2007; Ndirangu, 2017). In Kasapoglu's (2010) findings in respect of new curriculum implementation in Turkish schools, the classroom practices of the teachers were not in conformity with what the curriculum had recommended. In a similar vein, Mthethwa (2007) findings on the implementation of a new Swaziland junior secondary science curriculum were that, though teachers had a positive attitude towards it, their classroom practices did not reflect the intentions of the curriculum developers. Kumabia (2014) also carried out a study that evaluated the classroom implementation of elective chemistry programme in selected science and Mathematics CoEs in the Volta Region of Ghana. The study found that the implementation strategies used by the tutors were at variance with those in the curriculum.

Research Question 3: What are Chemistry tutors' assessment methods in the implementation of the new B.Ed Chemistry curriculum?

This subscale sought to establish whether the methods used by the tutors in assessing the students were in conformity with the required practices. Some of the assessment strategies prescribed in the new B.Ed curriculum include the use of mini projects works, reports writing, portfolios, and concept maps. Tutors were required to use these 'new and innovative methods in assessing the students instead of the 'old and traditional methods such as quizzes, class exercises and assignments. The results of the analysis of the items are presented in Table 3.

Table 3: Tutors' Assessment Methods

Item No.	Item description	Mean	SD	Frequency of Practice
18	I carry out reflective practices at the end of the instructional periods.	3.00	1.52	Sometimes
19	I carry out a reflection on my performance with a colleague's tutors to determine how well my lesson went.	1.14	0.36	Never
20	I give my students quizzes in class to assess their understanding of chemistry concepts.	4.57	0.85	Always
21	I guide my students to develop videos or charts on the concepts discussed in class for purposes of assessment.	2.00	0.55	Seldom
22	I assess my students' using project work.	2.36	1.22	Seldom
23	I guide my students to prepare their chemistry portfolios.	1.12	0.80	Never

Note: M = mean, SD = standard deviation.
Source: Survey Data, 2022

The results in Table 3 revealed that the most frequently used modes of assessing the students by the tutors were quizzes and tests (Item 20). The mean score was 4.57 (SD = 0. 85). In the observed lessons, four out of the five respondents used quizzes to assess the students. The new 4-year B.Ed Chemistry curriculum prescribes methods of assessment such as project work, portfolios, concept maps, and report writing among others instead of the traditional paper- and - pencil formats. This finding indicated that the tutors did not comply with the prescriptions in the new chemistry curriculum. The remaining items in this sub-scale had low mean scores, which meant that the frequency of usage of those methods was low. For instance, the tutors 'sometimes' carried out reflective practices on their performance (Item 18) but 'never' involved their colleagues in the reflections (Item 19). Similarly, the tutors 'never' guided the student teachers to prepare chemistry portfolios as a means of assessing them (Item 23).

Some of the respondents said during the interview that the portfolio was difficult for them to assess. Others said they were not familiar with portfolio preparation. "*To me, the portfolio is difficult to assess. Sometimes so many things are put in it, and scoring becomes very difficult*" (CTA). CTB had this to say: "*I myself don't understand the portfolio thing. Even I haven't prepared it before. How can I assess my students using something I'm not familiar with?*" (he quizzed). Some agreed that assessing students through portfolios was good but called for more education on how it should be done. "*I think the portfolio thing is good. However, my understanding of it is little; I need more education, especially, the how to score*" (CTE).

Some of the reasons for using certain' assessment methods by the tutors were gathered during the interview sessions. They mentioned time constraints, inadequate knowledge and lack of interest as the reasons for their inability to use the recommended methods. One of them had this to say: "*In my assessment, I don't include the videos. I won't get time to watch videos prepared by students in order to assess them*" (CTA). For CTD, the development of videos and charts for assessment was unnecessary. "*I don't use videos or charts to assess them*" (the students). He continued, "*I don't see it as necessary because they*

are several ways to assess students. Some of them are difficult and time-wasting. I will rather use quizzes or tests for assessment". These excerpts from the interviews implied that the respondents were not ready to use videos or charts to assess the students. In this case, they did not comply with the prescriptions in the curriculum.

The lack of fidelity regarding the tutors' assessment methods, just as in the instructional strategies, implied that the tutors did not comply with the prescriptions in the new 4-year B.Ed curriculum. For the outcomes of the new chemistry curriculum to be predictable, the instructional and assessment approaches must be congruent with those prescribed in the curriculum document (Dusenbury, Brannigan, Falco & Hansen, 2003). It is when this is done that sure conclusions can be drawn about the effectiveness of the new B.Ed curriculum (Walton, Spector, Tombor & Michie, 2017).

The finding of this study regarding tutors' failure to carry out reflective practice as expected is very worrying. This is because reflection allows them to understand themselves, their practices and their students (Priya, Prasanth & Peechattu, 2017). This finding agrees with Kano, Ayana and Chali (2017). They conducted a study on practices and challenges of reflective teaching among teachers in second-cycle primary schools in South West Cluster Zones of Oromiya Regional State in Ethiopia. The study found that teachers' practice of reflective teaching was below expectations.

It could be deduced from the sections of the study that the tutors prepared towards their lessons taking into consideration the provisions in the relevant documents such as the PD guides and the NTS. They were familiar with the demands of the new B.Ed chemistry curriculum but their teaching strategies and assessment methods did not conform to the prescriptions in the curriculum. Many reasons could account for this observation. It is probably due to the case of prior convictions and familiar practices (Spillane, Reiser, & Reimer, 2002). Spillane, Reiser and Reimer argued that teachers can be so confident and comfortable in their current practices to the extent that they become reluctant to alternative approaches in a new curriculum.

Several factors could have accounted for the tutors' inability to use some of the new and innovative learner-centred strategies outlined in the new curriculum. Some of these factors could be a result of the attitudes and perceptions the tutors had about the new curriculum. For example, the tutors knew they were supposed to prepare the pro forma prior to instructions but they failed to do it. They, however, during the interview, expressed unhappiness about the fact that supervisors chided them for not preparing it. As indicated by one respondent: "*This thing about pro forma is very disturbing*" (CTC). Another one had this to say about portfolio assessment: "*To me, the portfolio is difficult to assess. Sometimes so many things are put in it, and scoring becomes very difficult*" (CTA).

Another issue is a lack of understanding of some of the expected strategies. On concept mapping strategy, a respondent said: "*For me, to be frank with you, I don't understand it. I have read about it but it seems complicated to me*" (CTA). This revelation suggested that some of the issues discussed during continuous professional development (CPD) are not far-reaching enough to deal with some specific approaches. Yekple, Ofosu and Vinyo (2022) carried out a study to determine the knowledge basic school teachers

had bout creative pedagogies in developing oral literacy. They found that the teachers had knowledge about creative approaches but did not use them in their classrooms.

Another factor that could account for the tutors' failure to comply with the recommended strategies is the nature of the external examinations conducted by the mentoring universities. The mentoring universities conduct two assessments in the affiliated colleges: one is the mid-semester quiz, which is formative in nature, and the end-of-semester examination, which is a summative assessment. In these two components of assessment, the items are usually content-laden with little or no inclusion of learner-centred strategies. During the interviews, a respondent had this to say as a justification for his failure to use concept mapping: *"…Once the students are assessed through concept maps, I mean during the end of the semester, I will apply it in class, otherwise, it is time wasting*" (CTE). This finding agrees with that of Yeple, Kumi and Kumah (2022) that the assessment practices of the CoEs in the Volta and Oti Regions of Ghana were more cognitive-driven than the expected learner-centred approaches.

The tutors did not assess the students through subject projects, portfolios, report writing or concept mapping. However, the dominant tools used to assess the students were quizzes. This runs counter to the new curriculum recommendations and stakeholders expectations.

5. Conclusions

The Chemistry tutors in the Science and Mathematics CoEs in the Northern Zone did good preparation towards their classroom practices. However, their instructional strategies and assessment methods were not in conformity with the recommended approaches prescribed in the new 4-year B.Ed Chemistry curriculum. The fact that the implementers did not adhere strictly to the curriculum demands is an indication of implementation failure, which could affect the competence of the pre-service teachers trained in these colleges.

We, therefore, conclude that the objectives of the new 4-year B.Ed Chemistry curriculum would not be achieved in the selected Science and Mathematics CoEs in the study area.

6. Recommendation

From the evidence from the results, it is recommended that continuous professional development (CPD) activities should be focused on the various instructional strategies specified in the curriculum. This would enhance the capacity of chemistry tutors to be able to implement the curriculum as prescribed by the designers. Moreover, the summative assessment methods by the affiliate universities should reflect the strategies in the curriculum. In that case, tutors would be motivated, if not compelled, to also tailor their classroom practices to the recommended strategies in the curriculum.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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