

Factors Influencing Effective Teaching of Chemistry: A Case Study of Some Selected High Schools in Buffalo City Metropolitan Municipality, Eastern Cape Province, South Africa

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ABSTRACT The present study sought to investigate the factors that influence effective teaching of chemistry in the secondary schools in Buffalo City Metropolitan Municipality, Eastern Cape Province of South Africa. The relationship between the students and teachers responses to these factors was critically examined. The instrument used for data collection is a structured questionnaire developed from the literature review. It contained 30 items, where 15 items were for the students and the other 15 items were for the teachers. The instrument used the 4-point Likert format of strongly agree, agree, strongly disagree, disagree and were administered to one hundred and twenty individuals comprising both students and teachers. The data was collected and analyzed using chi-square statistical tool. The result showed that there is no significance relationship in the responses of students and teachers to some of the factors considered. However, some suggestions were offered on how the management of the schools, government and students involved could be improved on the factors highlighted to make the teaching and learning of chemistry more effective and interesting.

INTRODUCTION

Chemistry has become one of the most important disciplines in the school curriculum; its importance in the general education has gained world-wide recognition. Chemistry as a branch of science that is rational and mathematical, discipline where certain measured and controlled inputs lead to certain predictable outputs (Learning Things 2014), was developed greatly throughout the 20th century and introduced in the curriculum of both the elementary and secondary education, as part of science courses or as separate discipline (Kasalta and Tzougraki 2004).

It is worth to emphasize at this junction that the field of chemistry, and science and technology are related to the economic heart of every highly-developed industrialized and technologically advanced society (Burmeister et al. 2012). The benefit of learning and advancing in science and technology can be intrinsic and extrinsic, and such has been identified with chemistry. Teaching and learning of science

have significant roles towards technological development in a developing nation since chemistry is embedded in our life and society, economical, ecologic and societal influences (Hofstein et al. 2011).

The performance of students in science based subjects like chemistry is closely related to their theoretical and practical knowledge while some are taught in isolation from the process of discovery or the conceptual applications. This however, depends solely on the subject at various classes and also on particular factors within and without the teaching and learning environment (Hume et al. 2011; Felder et al. 2013).

The practical experience also contributes an integral part of chemistry science, the subject consist of many topics that can be verified experimentally with an objective to create an enabling environment to stimulate student learning about chemistry that is commonly presumed as abstract, quantitative, and boring (Read and Kable 2007). The availability of laboratory equipment's, chemicals and materials, laboratory personnel, working conditions in the laboratory and safety measures, substantial recommended textbooks and accurate periods allocated for the teaching of the subjects (Adefunke 2008) are studied and carefully controlled, then effective teaching of chemistry could be achieved, which will in turn created a scholastically rich, rewarding environment (at-

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mosphere) for the students to learn the basic tools of science (Frank and Saxe 2012).

Furthermore, in some of the developing countries such as Nigeria, Ghana, Cameroon and Gambia; proprietors, proprietresses and school principals as the building leaders are influential personality to make change happen, take responsibility for technology (Al-Rawajfih et al. 2010) or any kind of innovations and enhance curriculum implementation in the schools due to their positions in policy making (Akbaba-Altun 2004; Chang et al. 2008; Nnachi 2009). However, with the take-over of schools from principals by the government with the introduction of free education, schools now depend solely on the government for the provision of funds (Igbuzor 2006). This also lead to the increase in the number of students (Afangideh 2009) thereby, causing a lot of problems in the teaching and learning processes, especially, in the science and areas of practical's, inadequacy as a result of population explosion. Overcrowded classrooms and gross inadequate facilities are on the increase in the developing nation's school system (Esu and Anyanwu 2008). In addition, inadequate funding has contributed to inadequate facilities and resources required for the successful implementation of school curriculum (Asebiomo 2009).

In the light of this, the aim of the present research is to explore major factors influencing effective teaching of chemistry in high school which in turn increase or enhance the performance of students in chemistry both in theory and practical.

Literature Review

Factors Influencing Effective Teaching of Chemistry

A greater deal of work has been done in an effort to identify problem that are inherent in the teaching of chemistry in secondary schools. These factors influence the effective teaching of chemistry which in turn plays a vital role in the lives of the students as it affects their performance. These include: physical classroom and laboratory: instructional arrangement and school management (Johnson 2011). The physical classroom and laboratory represents the presence of good ventilation, availability of good chalkboard, preparatory room, enough chairs and tables, charts and clean environment.

The other factors include the presence of instructional materials in the laboratory such as apparatus and chemicals (Owoeye and Yara 2011). The dissemination of information with to students through bulletin boards, posters, and charts, if well organized and accessible to students will enhance assimilation and performance in their academics. Finally, the school management or organization is another vital factor that may be considered before anticipating a good result. The school management's responsibility now includes positioning of the school laboratory, school library, provision of essential services like water supply, light, food, vendors, counselor services and first aid services (Owoeye and Yara 2011).

Effective Chemistry Laboratory

A lot of concern has been show about the inadequacy of science laboratory in South Africa. Laboratory has been given a central and distinct role in science education, and science educationalists have suggested that rich benefits in learning accumulate from using laboratory activities. The science laboratory is a setting in which students can work supportively in small groups to investigate scientific occurrences (Aina 2012).

To achieve the desired objective of effective teaching of chemistry in secondary schools, operational chemistry laboratory equipments has to be provided but it is dish-eating to note that most of our schools do not have functional laboratories. Sam (2009) observed that infrastructure is often stressed as a result of the insufficient or incomplete laboratory equipments in most of the public primary and secondary schools both in the urban and the rural areas. With inadequate laboratory infrastructures, the students will be taken into the existing dilapidated existing one if any. Effective science teaching is the gateway to attainment of scientific and technological greatness and this can be achieved via integrating theory with practical work (Abuseji 2007). Laboratory program is an integral part of chemistry teaching as it is used when (Owoeye and Yara 2011; Nwoye 2012):

- ♦ It is needed as a means of obtaining and learning scientific information,
- ♦ Stimulates learners' interests as they are made to personally engage in useful scientific activities and experimentation,

- ♦ It is needed as means of verifying scientific principle, law or a theory that is already known to the students,
- ♦ It can be easily engaged with text books and other learning materials,
- ♦ Knowledge obtained through laboratory work promotes long term memory.

Abdulahi (1982) in Harry (2011) said that even though laboratory activities breed interest in student's attitude to science education, it does not warranty realization of the goal of science teaching and learning, rather the combination of all the teaching and learning methods should be used due to the variation in the students.

Practical work allows students to have experience that are consistent with the goals of science literacy and have been used in many natural science disciplines to teach students of many age spans in different cultural and classroom contexts (Hofstein and Mamlok-Naaman 2007). Thus, laboratory experience shoulders distinctive importance for assisting students/ learners to think through chemical concepts and enlightenments (Bond-Robinson 2005)

Emphasis has been placed on examination to the neglect of practical knowledge gained in the laboratory as observes by Okafor (1998). The author pointed that effective laboratory facilities are not provided for the teachers. Onafo (1993) had observed that equipment, material and chemical are not stocked specifically for the teaching of chemistry and the outcome of such a situation is that most chemistry teachers handle the subject negligently and superficially. The student activities are completely neglected and practical classes are held not according to schedule but according to how convenient it is for the teachers. Adefunke (2008) and Owoeye and Yara (2011) observed that an important ingredient for the effective science teaching is an appropriate items; laboratory equipment and materials.

Rai (1985) viewed that a standard laboratory should make provisions for:

- ♦ Preparatory room with the following facilities, like storage shelves for chemicals; storage shelves for tools used for servicing maintenance; trolleys for moving equipment and chemicals about.
- ♦ Central storage room; where dangerous chemicals are kept.
- ♦ Resource room where students carry out their project work.

- ♦ Staff office for laboratory assistants and technicians
- ♦ Fume cupboard for preparation of poisonous gases

In-service Training for Chemistry Teachers

This is a program or training which enriches the skills of the full time worker needed to carry out their normal duties with a view of becoming more efficient on the job. In-service training is program that intended to provide updating, improvement, conversion and support to teaching professionals along their careers; the training actions can be drawn by schools, according to the needs of their teachers or, simply, result from the individual initiative of the teacher (Pereira et al. 2013).

Teacher can be referred to as a catalyst that brings about changes in the behavior of the students/ learners. He/ She play a central role in the actualization of educational goals and the survival of the educational system (Okecha 2008). A continuous teacher training is the keystone of improvement and transformation in schools, for personal growth and professional development (Abuseji 2007; Okoro 2011). In-service training can be in the form of on-the-job training, workshops, post qualification courses, formal or informal, structured or unstructured (Mohammed 2006).

In-service on the job education create conducive environment for further learning which expose the workers to new development and ideas in their area of study. It could also be refreshing courses which make the professional not to lose grips with their skills, attitude or knowledge. In some cases, the reward for such training usually leads to a new rank or the acquisition of better and higher status; hence, absent of this training affect the teachers in delivery of their duties effectively.

The importance of in-service training and professional development of teacher has been given serious thought and effort. Okoro (2011) conducted a study on teacher education, school effectiveness, improvement and also stressed that teachers require professional knowledge and professional teaching skills, as well as a broad base of general knowledge in order to carry out instructional processes effectively. He further suggests that teachers should be both academically and professionally trained. Higher academically and professionally trained. Higher academically and professionally trained.

ic qualification and professional training improve teacher effectiveness on the job. It is a source of enthusiasm and devotion to teaching and helps them understand students better than untrained teachers. Dori and Barnea (2007) viewed that training for the teachers should be conducted in a comfortable and relaxed environment that is conducive to change. The theory and rationale behind the novelty and its detailed description should be unambiguous; and training should incorporate supervision and assistance from the teachers who have grasped the new teaching method and solved problems associated with its implementation for a teacher's training to be effective and influential.

Students, Teachers and Government Attitude towards the Study of Chemistry

The study on students' attitude towards science has been a fundamental feature of the work of the science education research community in the past 30-40 years (Osborne et al. 2010). Teaching and learning is an encounter which demands voluntary contribution from all party involved to achieve the desired result in school system. Attitudes, like academic achievement, are significant aftermaths of science education in high schools as research has confirmed that attitudes are linked with academic achievement and that attitudes predict behaviors (Cheung 2009). Dori and Barnea (2007) opined that teachers' attitudes toward science are a critical stimulus on their instruction and have a direct correlation to the instructional methods they adopt. To bring about conceptual change, it is equally important to promote students' awareness of the limitations of the instructional methods/ models, as it is to provide the learners with accurate information (Jaakkola et al. 2011). Adesoji (2008) have investigated the effect of teacher-directed and self-directed problem-solving strategies on students' attitude toward chemistry and came to conclusion that if students were allowed to develop higher cognitive processes through problem solving strategies, either as teacher directed or self-directed, their attitudes toward chemistry might change positively.

According to various theories, the key to success in any human endeavor is the desire of that person (human motivation); motivation may

be rooted in the basic need to minimize physical pain and maximize pleasure, or it may include specific needs. This means that success or failure depends to a great extent on the interest or attitude of the learners involved in learning models (Pyatt and Sims 2012). The attitude of children in their school work is deeply affected by the degree of encouragement their parents give them and by their own level of emotional stability. The students often muddle their parent's attitude, where this happens, there is the tendency for them to exhibit positive or negative of encouragement by way of information or demonstration given or exhibited to them from the onset. It, therefore, becomes imperative to estimate students/ learners' attitudes towards the instructional medium and instructional approach used for conceptual change to occur, and these approach should: be developmentally appropriate for students of all ages and ability levels; facilitate conceptual change, cognitive conflict and promote access for all students (Jaakkola et al. 2011; Pyatt and Sims 2012). Cheung (2009) reported that the correlation between high school students' achievement in chemistry and their attitudes toward chemistry ranged from 0.24 to 0.41. Helen (2010), in her report reveals that poor results in science subjects by girls may be attributed to gender polarization and perception towards the subjects. "Girls are expected to be passive and subjective, and more interested in people than ideas". Francis and Greer (2006) concluded that boys showed a more positive attitude to learning chemistry than girls, but his research examined one particular year group while Barnes in Sydney used three items to measure student interest in chemistry by exploring sex differences in enrolment intentions expressed by 449 year 10 students from five high schools and concluded that males found chemistry more interesting than females (Cheung 2009). Subsequently, the promotion of favourable attitudes towards science, scientists and learning science, as a component of science education, is a progressive matter of concern. Nevertheless, the concept of learners' attitude towards science has become vague, and often poorly enunciated (Osborne and Dillon 2010). Students' attitude toward science education could be aroused through interest and motivation which gears towards the selection of the

school courses and leads to the student careers (Aschbacher et al. 2010; Harry 2011). Thus, the attitude of students toward science and science education could be either positive or negative depending on the relative situation of the following: - (i) Age and previous experiences, (ii). Sex differences, (iii). Student's motivations, (iv) Lack of text book, (v) Textbook contents, (vi) Ability and aptitude of student, (vii) Teaching and learning method, (viii). Classroom activities (ix) Laboratory activities, (x) Academic Achievement, (xi) Home or family environment, (xii) Social class of parents, (xiii) The culture and philosophy of the student (Harry 2011).

Furthermore, on the part of government, cutting backs in funding and unfulfilled promise are the problems, where government promise some allowances for the science teachers and raise their moral surprisingly the promises are not fulfilled. (Nzekwe 2013). So lack of encourage to teachers by the government also contributes to ineffective teaching of chemistry. Adefunke (2008) stated that "most laudable educational programs in the nations (especially in the developing countries) are usually wonderfully planned but they usually crumble at the execution stage because of inadequate funding". A group of educators have argued that education, being a fundamental human right, must be funded by the government since there are sufficient resources to fund at least basic education for all children. According to this group, the hindrance to the realization of education for all children is corruption, misplaced priorities, inequality and poor policy choices (Okoro 2011). Abdullah (2009) blamed government for mass failure in chemistry and other science subjects due to the following reasons: little resources are made available without implementing effective government policies and servicing of education; inadequate trained staff for monitoring and evaluation of schools; collapsed infrastructure, lack of instructional materials; hostility of the environment, inadequate laboratory trained and experienced personnel, inadequate professional teachers' development and funding of the schools are inadequate.

The Learning Environment and the Community Based Resources

It is almost impossible for a single school to have all the necessary facilities for science teach-

ing, then it will be important for the science teacher to look into the environment for community based resourced. The term 'learning environment' is often related with the psychological or emotional conditions of the classroom as well as the social and cultural influences that are present (Afari et al. 2013). The science and technology learning environments included the classrooms, laboratories, library, workshops, toilets, and sporting fields can promote pupils' skills and knowledge through rich and various characteristics (Doppelt 2006; Adefunke 2008). The science teaching community denotes the contemporary science environments which should promote "hands-on", inquiry-based experiences and investigations that stimulate conceptual change (Pyatt and Sims 2012). And *Hands-on* can be assumed to physicality and real conceptual change, that can upsurge engagement and motivation via kinesthetic manipulation of physical equipment and materials (Akpan and Strayer 2010; Pyatt and Sims 2012).

Learning environment does not only include the physical resources for learning, such as class arrangements, computers or laboratory experiment kits, also re-counts the teaching methods, learning styles and evaluation methods which in-turn facilitates learning environments research at all levels of education (Doppelt 2006; Holding and Fraser 2013). Learning environment assessments have been used in educational productivity research and in the evaluation of educational innovations (Chionh and Fraser 2009). Learning environment research do involve investigations into associations between students' cognitive and affective learning outcomes; perceptions of psychosocial characteristics of the classroom environments; evaluations of anthropometry activities; as a source of process criteria in curriculum or program evaluation (Wolf and Fraser 2008; Chionh and Fraser 2009); the possibilities of adequate support for students on a surface-feature level or on a deep-structure level and informed on the cognitive demands of establishing a coherent mental model (Harr et al. 2014). Ikoya and Onoyase (2008) and Adewuyi and Okemakinde (2012) expressed that one of the purposes of education is to give the students the ability to appreciate good things and live in beautiful surrounding which give rise to pure thoughts and clean deeds. Jegede (2003)

reported that failure in chemistry among the students could result in part from the nature and psychological classroom environment. It could well be that in chemistry classroom, interaction among teacher and their students are not conducive for desired performance. The feature of chemistry classroom in the college of education, schools, higher institutions where chemistry teaching subject is taught may not be conducive for learning.

Ikeoji et al. (2002) summarize the following as ways to make more effective use of community based resources:

- ♦ Motivation of the teacher's resourcefulness. The teacher should be motivated to look inward to see alternative uses of community resources in the day to day instruction.
- ♦ An initiative for cordial-social community relationship. The community hosting every school should be made to accept their roles in conducive environment where the learning can take place.
- ♦ Retraining and workshop for science teachers. There is need for science teacher (chemistry) to be re-trained for effectiveness.

Research Objectives

The purpose of the present study was to determine the extent to which some factors have influenced the effective teaching of chemistry which is a foundation of science and technology. The study therefore investigates the adequacy of facilities available in chosen schools, the adequacy of periods allocated for the subject (both theory and practical) and the type of employed personnel for chemistry as well as the type of recommended chemistry textbooks used compared with the present syllabus.

RESEARCH METHODOLOGY

The study used the quantitative research design and survey research method of data collection. Five schools were selected in the Buffalo City Metropolitan Municipality area. The study involved twenty students and four teachers selected at random to respond to the questionnaire in each school making a total of one hundred students and twenty teachers in secondary schools in the Eastern Cape Province of South Africa in the Buffalo City Metropolitan Municipality selected town of East London. The

factors considered in the research include: standard and equipped laboratories; enough science practical periods, relevant and recommended textbooks, teachers academic and professional qualifications. Data for the research study was collected through self-administered questionnaires and the use of random sampling method. The research instrument used contains two questionnaires developed for the teachers and the students of chemistry in the selected schools. Questions related to the factors influencing effective teaching of Chemistry are usually insightful. Participants in the survey were assured strict confidentiality in order to obtain the necessary information. Responsive questions such as the names and contact addresses of the respondents were removed from the questionnaire. The questionnaire consisted of structured questions which made it easy for the respondents to indicate their views. The use of four-point likert scale questions enabled respondents to indicate their opinion on various factors influencing effective teaching of Chemistry in the Secondary Schools in Buffalo City Metropolitan Municipality in the Eastern Cape Province of South Africa. The likert scale is a scale in which respondents indicate their level of agreement with statements that express a favourable or unfavourable attitude towards a concept being measured, comprising of five categories (Cooper and Schindler 2003). Primarily, five-point Likert scale consists of strongly disagree, disagree, neutral, agree, and strongly agree. But for the purpose of this study, four-point likert scale questions which consist of strongly disagree, disagree, agree, and strongly agree except for demographic questions were used. Data analysis included Statistical Package for Social Sciences (SPSS), using Chi-square of goodness of fit test to confirm the authenticity of the data collected as the statistical tool. The empirical research for the study was conducted in the main survey.

RESULTS AND DISCUSSION

The instruments designed for this study were used to collect data for the study. A total number of one hundred students and twenty teachers were given the test items which were collected for analysis. The statistical result is presented in the table followed by a general discussion of the results.

Table 1: Chi-square for the students and teachers' responses on the adequacy and inadequacy of good recommended textbooks

Items	Student	Teacher	Total
Adequate good recommended textbooks	83 (81.7)*	15 (16.3)*	98
Inadequacy good recommended textbooks	17 (18.3)*	5 (3.7)*	22
	100	20	120

*Figure in the parenthesis is the expected score

From the result in the Table 1 as for the teachers' response to the adequacy of good recommended textbooks of chemistry, the expected value of 16.3 is greater than the observed value of 15. This, however, contradicted the values obtained in the response of student in which the observed value of 83 is greater than the expected value of 81.7. This shows that there is no relationship in the two responses. The observed value for the teachers' response to the inadequacy of good recommended textbooks of chemistry of 5 is greater than the expected value of 3.7. However, the students' response to inadequacy good recommended textbooks gave expected value of 18.3 which is greater than the observed value of 17. This shows that there is no relationship in the two responses. To confirm this further, the data were subjected to chi-square statistical tool and it was found out that the calculated value of 0.6735 is lower than the table value of 3.841 ($p > 0.05$) which shows that there is no significance relationship in the response of teachers and students as to the adequacy and inadequacy of good recommended chemistry textbooks.

Table 2: Chi-square for the students and teachers' responses on the adequacy and inadequacy of practical periods for chemistry

Items	Student	Teacher	Total
Adequate periods	33 (34.2)*	8 (6.8)*	41
Inadequacy periods	67 (65.8)*	12 (13.2)*	79
	100	20	120

*Figure in the parenthesis is the expected score

From the result shown in the Table 2, 34.2 which is the expected value of students' response to adequacy of period allotted to chemistry is greater than the observed value of 33. Besides, the expected value of 6.8 is lesser than the observed value of 8 for the teachers' response. As for the response of students to the

inadequacy of period allotted to chemistry the observed value of 67 is greater than the expected value of 65.8 which is quite different from the response of teachers in which the observed value of 12 is less than the expected value of 13.2. Again, the overall expected value in the responses of students and teachers to the adequacy of period allotted to chemistry and that of the responses of the inadequacy of period allotted is the same as the observed value. So, all these figures show that there is no significance relationship in the responses of students and teachers on the adequacy and inadequacy of period allotted to chemistry.

Using Chi-square statistical tool, the value for the Table 2 is 0.3849, which is greater than the table value of 3.841 ($p > 0.05$) hence; it showed that there is no significance relationship in the responses of teachers and students on the adequacy and inadequacy.

Table 3: Chi-square for the students and teachers' responses on the adequacy and inadequacy of chemistry laboratory

Items	Student	Teacher	Total
Adequate chemistry laboratory	62 (64.2)*	15 (12.8)*	77
Inadequate chemistry laboratory	38 (35.8)*	5 (7.2)*	43
	100	20	120

*Figure in the parenthesis is the expected score

The results obtained as indicated in Table 3 showed that, the value calculated for the students' response to the adequacy of chemistry laboratory is 62 which is less than the expected value of 64.2, while in the case of teachers' response, the calculated value of 15 is more than the expected value of 12.8. Besides, for the response to inadequacy of chemistry laboratory, the value calculated from the students' response which is 38 is more than the expected value of 35.8. However, in the teachers' response, the calculated value of 5 is less than the expected value of 7.2. These two results show that there is no relationship in the two responses that is teachers' and students' responses to the adequacy and inadequacy of the chemistry laboratory. When tested with chi-square statistical tool, the calculated value was found to be 1.2609 ($p > 0.05$) which is quite lower than the table value of 3.841 and as result, it showed that, there is no significance relationship in the responses of

teachers' and students' as to the adequacy and inadequacy of the chemistry laboratory. The research questions showed that, lack of adequate practical periods, adequate laboratory facilities make the teaching of chemistry to be ineffective in most schools used for the research. This was supported by Adefunke (2008) and Asebiomo (2009) in their series of experimental statements said, "For effective teaching and learning of a subject, there must be adequate learning and teaching facilities such as good and well-equipped laboratory experienced and qualified teachers with good teaching methods."

Adeyemi (2008) and Adesoji and Olatunbosun (2008) described practical chemistry as candidate's ability to use manipulative skills, accurate and sharp use of five senses in a well coordinate manner and ability to apply the knowledge acquired to solve other problems. To achieve this, enough materials, science and technology learning environment must be provided to promote learners' skills and knowledge through rich and various characteristics (Doppelt 2006; Holding and Fraser 2013). According to Ojimba (2013), students learn more from scientific lessons when they are given the opportunity to learn through doing the work themselves than when they are simply allowed to watch. Hofstein and Mamlok-Naaman (2007) attributed that:

"Laboratory activities appeal as a way to learn with understanding and, at the same time, engage in a process of constructing knowledge by doing science". He therefore advocated that meaningful learning is possible in the laboratory if students are given opportunities to manipulate equipment and materials to be able to create their knowledge of phenomena and related scientific concepts. According to Hofstein and Lunetta (2004) and Hofstein et al. (2005), school laboratory activities have special potential as media for learning that can promote important science learning outcomes for students and professional development experiences have the potential to help teachers develop skills and the confidence to construct effective learning environments that include substantive science laboratory experiences. Students enjoy measuring, manipulating apparatus, classifying data, designing experiments, hypothesizing and making inferences.

Adeyemi (2005, 2008) observed that equipment, material and chemical are not stocked spe-

cifically for the teaching of chemistry and the outcome of such a situation is that most chemistry teachers handle the subject negligently and very superficially and the science laboratory is a critical variable in academic performance. The student activities are most completely neglected and demonstration classes are held not according to schedule but according to how convenient it is for the teachers. Abdullah (2009) observed that an important ingredient for the effective science teaching is an appropriate items; of equipments and materials.

It was also discovered that the relevant chemistry textbooks were inadequate for the students, thereby making the work cumbersome for the teachers and thus ineffective. Textbook institutes an important tool for academic achievement; this is in support of Owoeye and Yara (2011) and DomNwachukwu and DomNwachukwu (2010) that most chemistry textbooks recommended for use in schools are not comprehensive enough and, therefore, hinder effective learning among students. This at times leads to the loss of interest in the subject as it would not serve the primary aim of setting up to a good foundation for the students on the subject. Textbook exposes student to a common learning experience. The textbook is a potential valuable asset to teachers due to the support and self-confidence embedded therein (Igaro et al. 2011). The issue of personnel was not left out in the findings as most of the teachers handling the subject are not professionals on the job, though they are graduates. For instance, a biochemist who had to teach chemistry in the secondary school will not be as effective as a specialist in the subject itself and this is what operates in most of the schools visited. The few qualified and experienced teachers only have few opportunity of attending in-service courses, workshops and seminars (Afolabi 2013).

This was supported by Ojibara (1998) in Afolabi (2003) and Grissom (2005) emphasized that the teacher is expected to be academically, physically and intellectually fit in society at large. It was further intimated that the teacher skills, disposition and most especially teacher professional's status could affect their efficiency at desirable behavior and enhance the academic achievement of the students. Adesoji and Olatunbosun (2008) also stated that whatever the profession, there is need for training to create

awareness of the problems of that profession. He stressed that such training, would improve the level of competence for dealing with such problems. This means that schools with stable, experienced and qualified teachers usually have better school facilities in terms of textbooks, equipments and the laboratories than that school which have difficulty in attracting experienced and qualified staff. He further said that attendance at chemistry workshop is expected to enhance the understanding of the teachers as to the facilities which are necessary for students' achievement in chemistry.

In-service on the job education create form for further learning which expose the workers to new development and ideas in their area of study. It could also be refreshing courses which make the professional not to lose grips with their skills, attitude or knowledge. In some cases, the reward for such training is promoting to a new rank or the acquisition of better and higher status in essence of this view, absent of this training affect the teachers in delivery of its duties effectively and paying teachers' enhanced salary to take care of their socio-economic needs to avoid divided attention in their duty (Nbina 2010, 2012; Ojimba 2013).

CONCLUSION

The finding showed that, lack of adequate practical periods, inadequate laboratory facilities make the teaching of chemistry to be ineffective in most schools used for the study. It was also discovered that the relevant chemistry textbooks were inadequate for the students, thereby making the work cumbersome for the teachers and thus ineffective. The issue of personnel was not left out in the findings as most of the teachers handling the subject are not professional on the job, though they are graduates. Some of the respondents also highlighted that some of the teachers teaching chemistry in the high schools will not be as effective as a specialist in the subject itself due to inappropriate educational qualification to teach the subject and this is what operates in some of the schools. The few qualified and experienced teachers only have few opportunity of attending in-service courses, workshops and seminars. Most of the schools had no laboratory attendant and where present, they are just school certificate holders.

This makes the teaching of chemistry ineffective because the teacher has to over work himself/herself before presenting the lesson proper to the student, and this may even discourage the teacher in the area of practicals thus, affecting the whole module.

In addition, the finding also showed that only one school had 'First Aid' materials in their laboratory. This is also important and can make the teaching of the subject to be ineffective as little accident is always found to accompany chemistry practicals and to reduce such, both enlightenment program and availability of certain drugs must be sought for. From the analysis of some of the high schools visited, it was discovered that, those schools with adequate facilities, like good and well equipped laboratories, relevant and recommended textbooks, few number of chemistry students, with enough practical periods enjoy effective teaching of the subjects by their teachers.

IMPLICATIONS OF THE STUDY

Generally, the implications of this study are mostly relevant to the educators, teachers and government as well as some other policy-makers in order to bring about changes in the learning environment and improve educational standard in the nation. The educators will see the need to ensure that the areas of problem to both the teachers and students will be handled. The researchers may also locate gaps for research based on the suggestions for further studies.

RECOMMENDATIONS

Considering the findings and the conclusions drawn from this study, some recommendations were made for effective teaching of chemistry. These are:

- ♦ As practical is an integral part of the subject. Then there should be well-equipped laboratories with essential amenities like water system, electricity and fire extinguisher, to mention but few.
- ♦ Most importantly, the teachers' academic and professional qualifications should be based on the required discipline, that is, chemistry. Non-chemistry graduates should not be employed to teach chemistry as this will affect the effectiveness of such teachers as he/she can easily run away from difficult topics.

- ♦ Another important factor is the employment of qualified laboratory attendants to help the teacher in preparation of laboratory for practicals. This will make the work of the teacher to be less cumbersome and thus promote effective teaching.
- ♦ Provision of relevant and up-to-date textbooks for both teachers and students will also promote effective teachings as the teacher can prepare ahead from different textbooks and the students can also read ahead of the class. Besides, the government should prevent the infiltration of those irrelevant and low standard textbooks into the schools.
- ♦ the teaching of the subject to encourage the student of the subject and to promote effective teaching. This is because the teacher would not need to rush over the topics in an attempt to beat time.
- ♦ Another important factor or suggestion is the issues of the teaching methods. The chemistry teaching methods must be re-oriented. The curriculum for chemistry must be properly addressed and the same of work must not be overloaded. Further, because what was discovered in the present scheme of work is that, it is overloaded and this does not call for effectiveness on the part of teachers. As a matter of fact, the classroom teachers should be involved in the drawing of scheme for the teaching of chemistry.
- ♦ Lastly, prompt payments of teachers' salaries, allowances and organization of seminar will promote effective of the subject.

LIMITATIONS AND AREA FOR FURTHER RESEARCH

The study focused on only a small sample size which was utilized in this study and did not cover a large sample size and also, it's included only some selected high schools in the area but did not cover all the high schools in the municipality area. This study investigated the factors influencing effective teaching of chemistry in high schools with a particular reference to Buffalo City Metropolitan Municipality, Eastern Cape Province of South Africa, using 180 respondents. The future researcher may repeat this study by using larger population such as a whole province or nation.

In addition, future researchers should focus on such variables as improvisation of the science equipment, the role of counselors in advising the students of their choice; contribution of government policy and availability of industries.

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