A Study of Performance in Chemistry among Lower Secondary Government Schools in Zanzibar

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Abstract
Performance in chemistry of form two national examinations in Zanzibar government schools have not been encouraging since 2009 to date despite several attempts made through additional carefully planned instructional strategies and models to improve the status of teaching and learning chemistry. From the performance data of 31 government schools sampled gotten from the Ministry of Education and Vocational Training Zanzibar shows the average mean score is 30.16 with a mean standard deviation of 2.1995 while those who passed are 30 ± 10 %. With percentage pass mark set at 35 %, performance has been poor and persistent. Conclusively, enhancement of teachers' effectiveness, improved economies of education and setting aside fewer schools for science studies is mandatory. The study recommends heuristic approach of teaching intertwined with instructional objectives to bring learners into meaningful learning and effective understanding guided by the four domains of Bloom's taxonomy with more motivational orientations and innovations.

Keywords: Performance, Chemistry, Instructional Strategies, Economics of Education, Bloom's Taxonomy

1.0 Introduction

Performance is a unique term and determined by several variables depending on which field the evaluation is being done. It is increasingly judged on the basis of effective learning outcomes. In academic world, the performance depends on teacher's effectiveness, student's attitude and input, type and nature of the subject, curriculum and logistic factors governing economics of a sound

education. These factors need to be frequently assessed in order to achieve a meaningful outcome. School and education system evaluation should also not be left behind.

Chemistry is a very broad, universal and dynamical (historical development of scientific knowledge) non-descriptive science subject and serves as the interface to practically all other sciences. The main aims of teaching traditional chemistry in secondary schools is to prepare students for college chemistry, conceptualize the basic facts, introduce students to scientific methods, to develop their scientific mind, reasoning and approach, to stimulate their curiosity, interest, enjoyment and good attitudes towards the subject, to develop an understanding of the consequences of chemistry on humans and their environment (Lederman, 1992). Thus, chemistry education should take into account not only ontological chemical knowledge, i.e. knowledge about chemical compounds, concepts and models, but also philosophical and sociological perspectives related to chemical practice and reflection on the role of chemistry in society (Kathrine, 2002). These are subjective to the teachers' competency, innovation, skills and professional growth.

According to Dalgety et al (2003), chemistry is not just a collection of knowledge, but more of a culture, with learned patterns for thinking and acting transmitted through theory, skills and values. A chemistry curriculum should therefore embrace the empirical nature of scientific chemistry knowledge, observation, inference and theoretical entities in chemistry, distinction and relationship between theories and laws, creative and imaginative nature of chemistry, the theory-laden nature of chemistry knowledge, the social and cultural emboldens of chemistry concepts, the myths, paradoxical aspects and its tentative nature. In addition, the subject aims is to provide chemistry knowledge needed for the individuals from a natural science starting point to be able to participate in public debate, form their views on environmental issues, and contribute to a sustainable society (National Agency for Education, 2000).Thus, formulating a chemistry examination should hence take into consideration critical testing, creativity, diversity of scientific thinking and questioning basing on the concepts, hypothesis and predictions based on analysis and data interpretation, applicability and consequences.

Although school chemistry programs are set out to develop conceptual understanding in students and an appreciation of the way scientists do things, the relevance of teaching in providing a useful education and hence determines performance is suspect (Novick & Nussbaum, 1981; Osborne & freyberg, 1985; Aikenhead & Ryan, 1992; Guzzetti, 1993; Yager ,1996 & Lederman et al,2002). Different approaches have been put in place for teaching instructions in order to induce and promote direct learning in chemistry. Instructors can impart knowledge using any teaching technique from the continuum of teaching methods (© Stephen (in press), Twoli, 2006 , pg 44 & Yazachew, 2015) depending on the education level, nature of the student, environmental factors and guided by the laid curriculum strategies. All these teaching techniques have their own pros and cons. Chemistry is an experimental discipline therefore, science process and problem solving skills should be measured during the laboratory phase, not just their understanding (Ayas et al 1994; Cartier et al, 2001 & Reid et al, 2006). Thus, there is the need of an adequate laboratory otherwise practical illustration of laid theoretical findings may not agree with the stipulated chemical theories as described in the textbooks (Twoli, 2006 chapter. 5).

Among the factors which influence the quality of education and its contribution to National Development are the quality, competence, effectiveness and characters of teachers which undoubtedly are the most significant (Education and national development, 1964 – 66 & Dochy, 2001). Thus, in addition to proficiency in chemical knowledge and pedagogical training, a

chemistry teacher should also have both cognitive and non-cognitive competencies, basic knowledge in chemistry related fields such as mathematics, physics and biology, technology, philosophy, sociology and psychology, language (English), reading and writing skills. The teacher should also know how to select a suitable method for teaching a topic in chemistry, able to design a continuum to support effective teaching, has skills in implementing curriculum objectives, assessment and instructional strategies(Wiggins & Mc Tighe,1998) in order to realize the stipulated learning outcomes and finally should not forget his/her professional growth (Selvi,2010). Thus, to analysis performance, it is also very important to have a holistic understanding of instructional process covering all teaching and learning activities before evaluating learning results.

Apart from School Difficulty (SD) which is related to pedagogical and/or socio-cultural problems, learning disability (LD) of a student should also be considered as a contributing factor to poor performance. Learning disability is related to problems of acquisition and development of brain functions involved in learning, such as dyslexia, dyscalculia, and writing disorders. In addition to specific learning disabilities, attitude, attention deficit/ hyperactivity disorder (ADHD), cerebral palsy, cultural witchcraft illusions and developmental coordination disorder (DCD) should also be mentioned as entities (intrinsic issues) related to poor student performance. It is also worthwhile to note that a working memory have an essential role in acquiring new skills (learning). The working memory has the ability of selecting, analyzing, connecting, synthesizing and retrieving information from what has already been consolidated and captured (*long-term memory*) thus makes the connection between new and already learned information. Children with LD often fail to learn because high working memory demand of the learning task often exceeds their working memory capacity (Pradeep & Vibha, 2017)

For a nation to develop in science and technology, the teaching and learning of chemistry need to be improved and continually assessed (Buhagiar, 2007). Therefore, it is pertinent that performances in chemistry and in science generally should be of high levels. However, this seems not to be the case in Zanzibar because students' performances have not been encouraging in chemistry for couples of subsequent years since 2009.
Since chemistry subject consist of complex rules and principles, a lot of secondary students rate chemistry as their least favored, feared and most challenging course in the curriculum (Arce, 1997). Without a firm comprehension of these rules and an understanding of what they mean, it will be a burden for the students to understand scientific facts and information (Schreiner,2010) , consequently creating chemistry anxiety affecting students' performance according to Eddy(2000).Thus, it is essential to continuously kindle students' interest in chemistry teaching process considering their regrettable performance scenario in this field of science which needs to be valued and appropriately assessed for early diagnosis and interventions. With the rapid technological development, there is the need for students to have cognitive skills such as problem solving, critical thinking, analyzing data, and presenting them orally and in written format (Dochy, 2001).There are several attempts made through the use of borrowed instructional strategies and models to improve the status of chemistry teaching and learning in Zanzibar. With all these efforts, students' performance in chemistry, which is a compulsory subject at this level, has remained persistently poor at the form two lower Secondary School Certificate National Examinations (LSSCNE), (refer to table 4).

This research paper therefore attempts to analyze the situation in conjunction with the data obtained on performance index from the academic years 2009-2017, most probable causes of poor performance and present the effort being made to rectify the situation, challenges in the chemistry

education and to give a practically oriented teaching strategy and policies which should be put in place and adaptable to the Zanzibar Secondary Schools. This study was guided by the hypotheses that the performance of chemistry subject in Zanzibar is low**;** lack of equipments and resources; understaffed with competent chemistry teachers and in-effective teaching; less motivated and lack of innovations among chemistry teachers ; students' intrinsic issues and attitude towards the subject, and lack of understanding of English language.

2.0 Research Methodology

2.1 Study Area

The study was conducted in urban and west, south and north district of Unguja Island (1539km^2) of Zanzibar because in each district there are government schools that offers chemistry subject.

2.2 Schools Sampled and Data Collections

The study was conducted at government schools shown in table 4 and performance data obtained from Ministry of Education and Vocational Training, Zanzibar. Other sources of data are obtained from the education stakeholders, professionals, students, societal, and secondary schools.

2.3 Research Design

This study employs descriptive survey method of research as one of the most popular method of gathering data or information through the use of questionnaires, unstructured interviews and observations, and inferential performance statistical data obtained for relevant education stakeholder.

2.4 Instrument

Observation method is the most common method used especially in study relating to behavioral science. In this study the direct observation was also used since it involves participant observation, structured observation and interviews. Research questionnaires was prepared and used in gathering information from the respondents which includes Teachers, School heads, Students, Stakeholders, Societal and Professionals. The questionnaire for teachers had two (2) parts. Part I covered the profile of the faculty respondents, such as age, gender, length of teaching experience, teaching methodology, relevant trainings and seminars and field of specialization. Part II covered teachers' level of competencies in laboratory work, knowledge in other science fields, attitude, motivation and social infrastructure. Competence (Kouwenhoven, 2009) gauged as per the scale shown in Table 1. Motivation gauged as per the scale shown in Table 2.

Table 1

Range	**Verbal interpretation**
4.51-5.0	Highly competent
3.51-4.50	Competent
2.51-3.50	Moderately competent
1.51-2.50	Slightly competent
1.0-1.50	Not competent

Table 2

Range	**Verbal Interpretation**
4.51 – 5.0	Highly motivated
3.50 – 4.50	Motivated
2.51 – 3.50	Moderately motivated
1.51 - 2.50	Less motivated
1.00 – 1.50	Not motivated

2.5 Validity

Check by experts for language, clarity, relevance, and comprehensiveness of the content. The validity of the questions was rated as shown in table 3:

Table 3
4 – Very relevant
3 – Quite relevant
2 – Somewhat relevant
1 – Not relevant.
The Content Validity Index (CVI) according to the formula shown below:
CVI = (Items rated as very relevant and relevant (3 and 4)) ÷ Total number of items
For the questions in the questionnaires to be valid, the CVI should be within the accepted statistical range of 0.7 to 1. The Computed CVI for teachers in the first questionnaire was found to be 0.7 respectively, and for the second questionnaire 0.76 respectively thus confirms the validity of chemistry teachers' questionnaires

2.6 Reliability

Each set of structured questionnaires was designed to identify the needs of each identified target group.In order to establish the reliability of the instruments; a test study was conducted using fifteen people who were not part of the study sample. Using the results of the study, the reliability of the questions was computed using Cronbach's Alpha Coefficient to prove the reliability of questions with the coefficients within the accepted statistical range of 0.7 to 1. A coefficient of 0.71 and 0.87 for the first and second questionnaires respectively was achieved hence proving the reliability of the questions.

The school heads questionnaire was assessing type of teachers, competency, teachers effectiveness, complains to the higher authorities on factors affecting the effective learning of chemistry, collaborations and assistance, curriculum, students' academic background and parentage, etc while the Stakeholders questionnaire based on economics of chemistry education, chemistry curriculum, teachers recruitments and placements, etc. Societal (e.g. non-academicians, retirees, cultural elders, religious society, parents, corporate, business society, etc) questionnaires were basically assessing environment and social influence on the students' attitude towards studying sciences, schooling, etc and Professionals drawn from colleges and universities were also interviewed on their views towards the poor performance. Some questions were prepared based on a four-point Likert scale, ranging from "1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree". ". Majority means above 50% , minority means below 50% and quite a minority means below 25% of the sampled population.

This study also adopted descriptive correlation design. Descriptive correlation design was chosen because data was collected from large number of students interviewed in order to determine their subject understanding, science process skills (SPS) adopted from the work [34], demographic characteristics of the respondent, chemistry infrastructure within their school environment, the relationship between their chemistry teachers, parentage, school leadership and the level of student attitudes towards chemistry. Questions were prepared based on a four-point Likert scale, ranging from "1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree

2.7 Sample Size and Sampling Strategy

Most schools have two streams and averagely 48 students per class. From a population 1820 students, the sample size of 244 students was drawn using the Slovene's formula as follows:
$n = N/(1+Ne^2)$,where n is sample size, N is population and e is margin of error (0.05).
Therefore, the sample size (n) = 328 respondents Systematic random sampling was used. In this

strategy, each respondent was selected after a given equal interval which is called a systematic random number and it is given by the ratio of the population size to the sample size (N/n), that is, 1820/328~ 6. This means that after every 6 respondents, 1 respondent was selected.

2.8 Data Analysis

The SPSS version 16.0 was used and tables (frequency counts and percentages) to analyze the profile of respondents, mean to analyze the respondents' level of knowledge of science process skills as well as the level of their attitudes towards chemistry and Pearson's to analyze the data with respect to the relationship between respondents' level of knowledge of science process skills and level of their attitudes towards chemistry. Average Test Score Techniques was used by the Ministry to formulate the data shown in the table 4 below.

Table 4: Mean Score data in Percent from Ministry of Education and Vocational Training-Zanzibar

School	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Average
Muembeladu	26.8	51.6	23.2	24.9	29.7	23.1	25.8	22.7	28.48
Haile Selassie	28.3	55.2	24.0	22.7	30.6	24.1	27.0	25.8	29.71
Chumbuni	30	55.7	26.7	27.3	29.1	25.7	25.0	28.1	30.95
Jang'ombe	29.1	52.5	22.5	24.9	31.4	24.6	28.8	20.7	29.31
Kidongo Chekundu	31.5	47.8	25.5	25.4	30.8	24.7	25.5	25.2	29.55
Hurumzi	40.6	40.6	22.8	17.9	34.8	28.0	31.5	13.4	28.70
Kwamtipura	31.9	44.2	26.4	27.4	29.8	25.0	25.1	24.5	29.29
Nyerere	29.1	49.5	28.6	31.9	30.7	24.6	27.5	24.5	30.80
Forodhani	20.6	45.7	31.3	32.5	30.9	26.6	28.0	28.8	30.55
Darajani	30.3	57.1	24.7	22.0	26.1	25.2	24.8	26.2	29.55
Langoni	24.9	47.8	21.8	20.7	29.3	23.3	24.3	19.5	26.45
Mfenesini	32.9	46.2	28.6	29.8	30.9	29.8	29.1	25.3	31.58
Mwanakwerekwe 'A'	29.1	54.2	24.8	22.1	30.4	25.8	28.1	24.4	29.86
Bububu	23.0	49.2	28.6	20.8	31.6	25.7	26.7	24.0	28.70
Bwefum	40.3	59.8	25.4	28.9	33.9	27.4	23.5	24.9	33.01
Kiembe Samaki	38.4	41.2	26.3	27.4	31.3	25.3	26.5	27.6	30.50
Kombeni	25.8	51.5	20.7	22.8	30.0	22.2	25.3	18.0	27.04
Kisauni	34.5	43.2	22.5	27.9	31.7	24.6	25.5	20.7	28.83
Mtopepo	37.8	49.4	25.1	22.6	31.0	22.6	27.6	26.3	30.30
Fuoni	29.9	50.4	27.7	21.3	30.5	25.8	27.3	24.7	29.70

Mwanakwerekwe 'B'	37.2	53	26.8	32.6	33.0	25.5	26.2	24.3	32.33
Mwanakwerekwe 'C'	29.8	47.7	22.7	21.5	37.7	25.2	26.4	23.8	29.35
Regeza Mwendo	33.2	43.1	31.4	31.3	32.9	24.8	26.0	28.8	31.44
Chukwani	46.2	57.2	25.6	35.5	32.7	26.0	28.3	22.2	34.21
Chuini	28.2	50.5	24.6	21.5	29.1	22.7	24.3	24.4	28.16
Mwenge	24.8	48.2	20.5	13.6	31.3	22.4	23.3	20.8	25.61
Kibondeni	34.1	35.3	24.0	27.0	27.8	24.1	24.4	27.1	27.98
Maungani	48.5	68.9	23.2	19.4	31.7	25.2	26.6	25.3	33.60
Kianga	28.9	64.3	25.6	22.9	30.3	24.9	24.9	26.7	31.06
Kinuni	41.1	64.7	26.5	28.1	31.7	23.7	25.4	27.1	33.54
Mtoni	44.4	47.1	39.7	41.8	28.9	23.1	27.3	26.2	34.81

2.9 Data analysis
The data collected were subjected to both descriptive and inferential statistics.

3.0 Results and Discussion
From the data (table 4), the performance mean is 30.16 with mean standard deviation of 2.1995. The average mean score lies between 26.45 – 34.81% as shown in figure 1(bar-graph) below plotted schools against average mean score using the data obtained from table 4.

Figure 1.

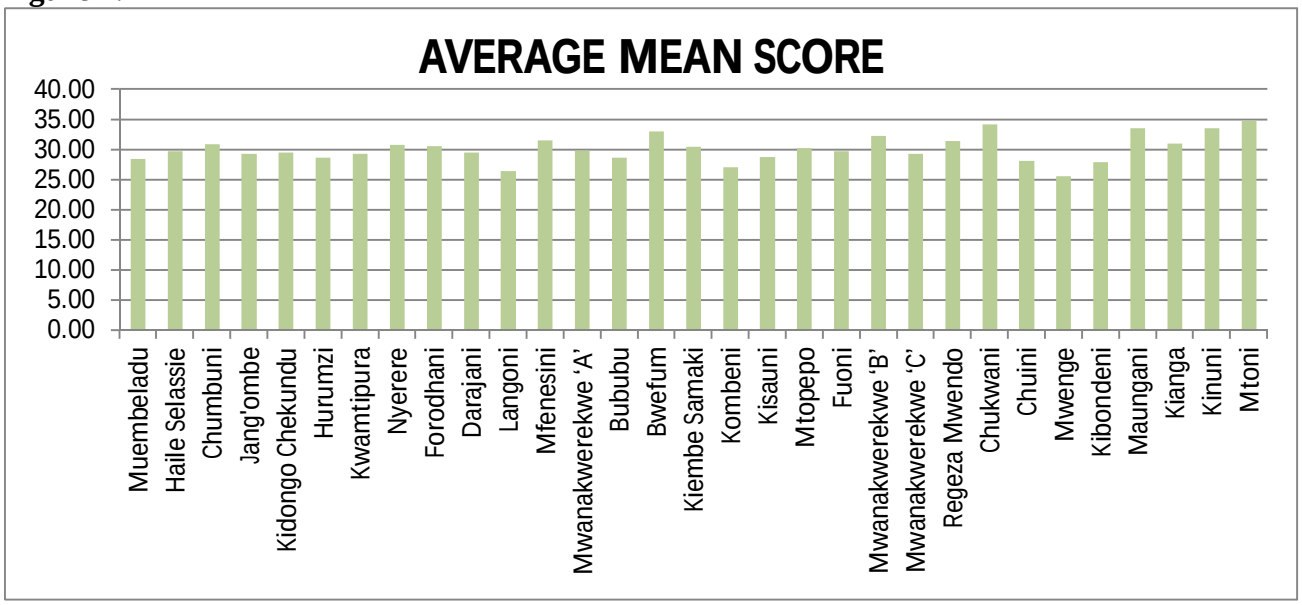
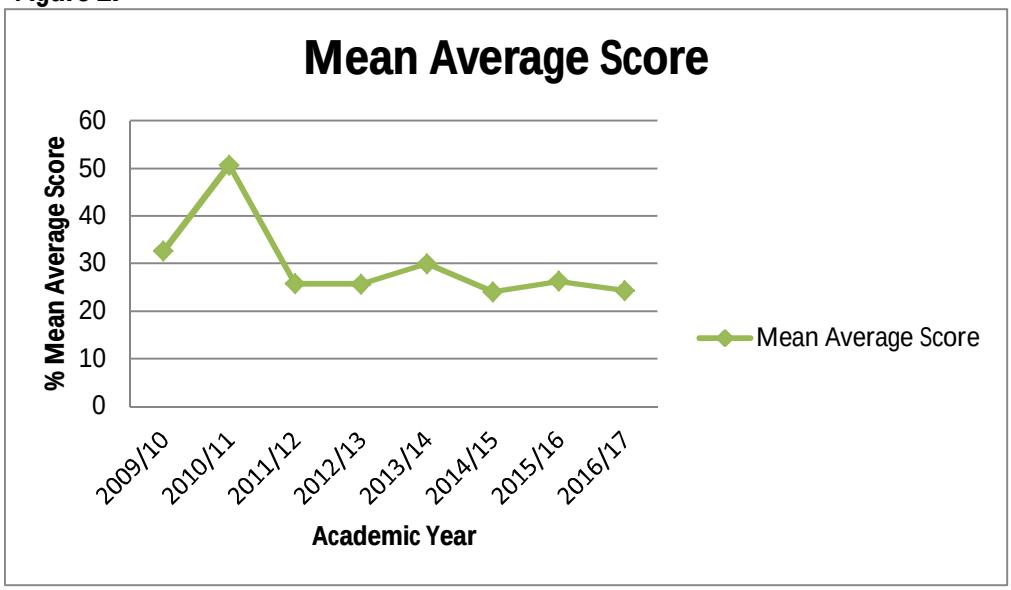


Table 5.

Academic Year	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Mean Average Score	32.62	50.74	25.74	25.7	30.02	24.06	26.32	24.32

Figure 2.



There was a better performance in the academic year 2010/2011 as shown in figure 2, otherwise poor performance persist in the subsequent years with mean average scores rarely surpasses 30%. From the average mean score data and given percent (32 ± 10%) of total students who scored above the pass mark of 35% from 2009 to the academic year 2016/17 clearly indicates that performance in the subject is far below from the normal expected average of 50%.

Performance in academic institutions is evaluated after learning which is subjective to teaching aims. Generally, the observed teaching of chemistry at these lower Secondary Government Schools in Zanzibar is well fashioned to mainly classroom activities and less laboratory work. It is basically conventional teacher centered, a pure educational essentialism and not considering the importance of child centered concepts in effective teaching as emphasized in (Gravoso et al, 2008) research work. Classroom evaluation practices generally encourage non- pedagogical, superficial and rote learning techniques which have been the main tradition, consequently students concentrates on recall of isolated details and usually items of knowledge is easily forgotten. This culminates in tests reinforcing memorizing rather than the critical thinking, innovations, conceptual applicability and understanding (Subair et al, 2017). This does not conform to the standards of a chemistry examination nor comparable to the official national examinations conducted by the government. Despite teachers do review the assessment questions that they use which are generally simple contextual problems but rarely they do not discuss them critically with scientific approach as required with the peers, hence there is little reflection on what is being assessed. During any science teaching, teachers should ask questions that activate students' prior knowledge, focus their attention, and invite them to make predictions, before, during, and after reading the expository text

.These types of questions promote children's comprehension of the text and improve science learning (Obuchere et al., 2014).

Quite a huge fraction 78% of teachers determines student learning based exclusively on scores and/or sub scores, suggesting an over-reliance on these measures. There is also a tendency to use a normative rather than a criterion approach, which emphasizes competition between pupils rather than personal improvement of each and as a result de-motivates (Black & Wiliam, 1998). According to Angelo & Cross (1993) and Sundberg (2002), it is crucial to consider basic classroom assessment from the beginning of the study to adequately gauge the knowledge acquisition disciples in order to generate good data leading to a meaningful conclusion. Since Bloom's taxonomy is recognized as a standard framework that teachers can use to measure productiveness (Vivekanandhan & Mohan 2014), typical continuous assessments should be able to move student through the hierarchy of the taxonomy (Lister 2000) in order to achieve a meaningful outcome.

Averagely 65% of the societal, professional educators, school heads, students and stakeholders agree firmly that the effectiveness of a secondary school education program is largely determined by the quality and character of teachers as they interpret, imbibe and transmit knowledge, hence should have more influence on the performance index. This study realized that 14% of chemistry teachers teaching form I and form II classes did not study chemistry in their undergraduate classes(non-chemistry subject teachers) and schools they teach performs poorest in the subject at form two national examination. They are mainly local volunteer with decimal peripheral knowledge in the subject. 38% studied diploma in teaching science and 48% of the chemistry teachers are degree holders. All the degree holders had studied chemistry with either biology or physics or mathematics making them reliable to teach chemistry despite 64% of them graduated with lower second. This study reveals that majority of chemistry teachers teaching chemistry in the lower secondary did not score well in chemistry subject and chemistry was not their best liked subjected but have to teach since there is scarcity of chemistry teachers. At the moment, it is one teacher for 85% of the schools sampled to teach at lower secondary.58% of the schools rely on teaching practice college students to support the situation. 40% still rely on canning if a student do not take in a concept and performs decimally in the given test. But (Brown & McIntyre ,1993) disagreed with the idea of canning and concluded in their research that teachers should actually counsel and motivate their students, show the willingness to design teaching and learning that is fit for the purposes. 48% of the chemistry teachers agree that they do not have the ability to differentiate curriculum in relation to the range of pupil achievement, only 32% agree to have the ability.58% have never attended any performance enhancement program to upgrade their science teaching profession career. Thus, teacher should not only orient ontological chemical knowledge, but also philosophical and sociological perspectives of chemical practice and reflection on the role of chemistry in society and this is subjective to the teachers competency, innovation and awareness, professional growth and skills. 62% still believes in the traditional ways of teaching and cannot implement the teaching technique as per the latest approved government curriculum requires. This study revealed that 58% of teachers have moderate communication skills in English language while 12% have remarkable communication skills. The study realized that demographic variables had no significant influence on teaching competence despite 58% is female teachers. The study realized that 60% of teachers in overpopulated schools with oversize classes and divided into several streams each above fifty students has excess of periods to teach thus interfere with their ability to monitor a number of classroom events and effective management.

Increased teaching loads and the curriculum claims of covering more topics in the introductory course leaves less time to set up and perform demonstrations. 42% has habit of imposing their own

views and ideas particularly the volunteers (non-chemistry subject teachers) to students thus contribute to ineffective teaching. In addition, 71% of chemistry laboratory are in deplorable conditions thus contributes to less demonstrations consequently students understanding through scientific investigation is weaken since the science process and problem solving skills should be measured during the laboratory phase (Twoli,2006), not just their understanding (Ayas et al, 1994; Cartier et al, 2001; Reid et al, 2006). This does not commensurate well with constructivist learning environment which allows learner-centered activities to take place where the teacher provides the students with experiences that allow them to develop problem-solving, critical-thinking and creative skills, and apply them in a meaningful manner (Neo and Neo, 2009). 51% believes as a way out of hook is integration of multiple teaching methods into a general chemistry classroom which only enhances students' participation and aided mastery of the materials (Francisco et al, 1998).

The study also revealed that 84% school Principals complains of inadequate chemistry staff, 45% of head teachers revealed incompetency of their chemistry teachers while 35% reveals their chemistry staff are moderately competent, have moderate integrity with less interpersonal interaction and less motivated due the claimed non-improving working conditions and low wages. Thus, majority of teachers are focused more on other economic businesses rather than teaching. 78% complained of poor library, inadequate chemistry laboratory and too little finance at their disposal to run the curriculum. 80% claims that they submit their recommendations to the Relevant Authority but rarely do they get positive response. 52% revealed that there is poor coordination with students' 'parents. 54% of the school heads agrees that their staffs are not well familiar with the chemistry curriculum implementation and the art of pedagogy is missing. 48% revealed that their staffs have never attended performance enhancement programs to improve their skills and effectiveness. This does not eager well with management of chemistry program and students performance. 62% of the school heads revealed that management of the program is left to the hands of chemistry staff. This is also a societal concern. 44% of societal claim that the curricula has failed to achieve learning with understanding. 51% of societal claims environmental factors (socio-cultural influences, economy issues, etc) have influenced students' concentration in learning and quite a minority still believes that poor performance is related to diabolism. Majority of societal claims that most students do not see the practicability and the role of the chemistry in their society. Even concerning health issues, most prefer taking raw or semi processed herbs or consult witchdoctor for treatment claims. The role models in chemistry from the society are too silent.65% of societal claims there are no jobs for chemistry students apart from teaching in this tourist resort island. These demoralizes too.

The government, the main stakeholders, mainly works in collaboration with higher institutions on changes in the chemistry curriculum to heal the situation and does not have enough funds to take in-process chemistry teachers even for short-term courses. With the introduction of free primary education in the first four years of secondary school, intake increased by 33.4% in 2016. The government resources are limited despite doubling the budget for education in 2015/2016 inconsistent with the recommendations formulated in 2015 by the Committee on the Convention on the Rights of the Child(Tanzania) that advocated for increasing budget allocation to education in line with the country's growing population. Spending also increased by 55% during the same period, thus, relying on donations or seminars financed by different non-government education stake holders mainly from USAID, UNESCO and donors from Muslim world is inevitable. The objectives of instruction in chemistry are for students to know how to use their chemical knowledge as consumers in order to promote health and sustainable development and in discussions and

decision-making processes concerning nature, the environment and technology. Thus, there is the need for the government to invest in adequate and skillful teaching of chemistry to meet the objectives. To fill in the gaps, apart from volunteers, additional chemistry teachers were imported from outside the country e.g. Nigeria, etc but mode of communication due to different diction has been realized. 78% agreed that skillful and qualified teachers are still needed to spearhead the improved curriculum.

From the data, on demographic characteristics of the respondents shows that majority of the respondents are male (42.79%), female (56.15%) being the majority at schools and age ranges from 15 yrs to17yrs. The science process skills are the building block of critical thinking and enquiry in science which includes observing, classifying, inferring, predicting, communicating and measuring; these skills can be obtained by learners through science instruction activities. The science process skills test (SPST) reveals that an average of 61% scored below 35% mark, thus suggests majority have inability to understand and solve chemistry questions correctly using the appropriate concept. This can also be subjective to either lack of scientific mind upbringing, poor mathematics background attitude, extrinsic (environmental influence), individual factors or intrinsic (Oliveira et al, 2016) or even both. This indeed a concern for both Teachers, School heads, Professionals and Societal (parental).68% admits they go to school in the morning on empty stomach. Intrinsic issues tolls to 29% of students' population sampled. School-going children in third world countries often do not achieve foundational learning outcomes such as literacy, numeracy and life skills, which determine future performance (UNICEF, 2017). The early childhood education is mainly religious based which is not molded on scientific reasoning logistics norms but focuses more on behavioral, attitude and other social science philosophies. Thus, a change is required. 45% of the parents are below diploma level of education, 31% are degree holders and above while the rest are in business thus leaving the teachers to act and should act as a good role model to the students upbringing in the science subject. Despite the religious restrains and influence, the environment influence mainly tourism has influenced 48% of students' minds to commercial activities. All students complained lack of books in the library and 69% has difficulty in English communications skills yet examinations are set in English language.62% are not good in mathematics thus creating a dilemma in problem solving skills. 72% admits they lack practical skills due to poor inadequate chemistry laboratory which does not meet the standards as per the chemistry curriculum requirements. A research on instructional strategies according to (Abraham, 1989) reported that students exposed to the laboratory/discussion had higher test scores than those in the lecture or reading groups. This was supported by (lindstrom ,1994) that people remember 20% of what they see, 40% of what they see and hear but about 75% of what they see, hear and do simultaneously. Thus, there is the need for a proper chemical laboratory setup (Twoli, 2006). No comments on attitude towards their subject teacher since it is against their faith to do so but 52% just does not like the subject. 40% of the students claims parents has very little input to their studies while 35% revealed that parents do a lot of follow up since they see the realisms of learning and some have reached higher institution of learning, 15% parents are not bothered and the rest are there.
All professionals agree that there is indeed limited resource to manage the program and are really concerned about the poor performance. 35 % believes that the main stakeholder is to take the blame.65% reveals that performance of student highly depends on efficiency of the subject teacher. 72% says that the in-process teachers requires more professional training in order to bring their own value-set to the task of selecting and implementing the intended curriculum as also claimed by (Hildebrand,2007 & Twoli, 2006).

4.0 Conclusions

The conclusion drawn from this work, teachers' ineffectiveness which is more personal than de-motivated as claimed and inefficiency has contributed a lot to performance problem. However, the poor performance of students in chemistry was due to lack of innovation, relevant logistics, encouragement, improper English communication skills, improper approach of teaching chemistry and resourcefulness by the teachers. The chemistry teachers require periodical reassessment and evaluation. They need to be taken for more professional training on teaching skills ,knowledge impactions , how to create alternative metaphors for learning, using authentic problems to elicit authentic skills and making examinations reflect the goals. Students have not been able to see the relevance of chemistry to the society thus affects their learning. Therefore, there is the need to introduce industrial academic trips to their program in order to brew up cooperative learning strategies so as to create a productive learning environment. They also need a minilab instead of conventional laboratory which is expensive to put in place and library with approved chemistry books of latest edition. The government needs to review and implement the strategic approach to the development of evaluation and assessment framework and provides an opportunity to reflect on the articulations between students' assessment, teacher, school and education system evaluation. This should actually lead to initiating a suitable policy which prevents inconsistencies in the meaningful learning objectives.

5.0 Recommendations

This study recommends the heuristic approach as "modus oparandi" of teaching intertwined with socratic instructions and instructional objectives to bring learners into meaningful learning and effective understanding guided by the four domains of Bloom's taxonomy with more motivational orientation and innovations. The in-process teachers should be retrained in curriculum implementation, assessment and delivery. They should also be motivated, committed and engaged in teaching. Frequent visits by government chemistry subject inspectors to schools should be fruitful and encouraged. The study also recommends fewer schools to be set aside for science only or if possible classes be divided into two categories that is science and art so as to commensurate well with the few skillful and knowledgeable qualified chemistry staff . Practice in English language communication skills should be in the oathing since examinations are set in English language and this to some extent can alleviate the rote learning styles. A good nutrition for students and effective psychological services should not be forgotten.

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7.0 References

1. Abraham M.R. (1989). Research and Teaching: Research on Instructional Strategies, *J Colloid Sci Teach*, 18 (3), 185–87,200.

2. Aikenhead G. S. & Ryan A. G. (1992). The development of a new instrument: "Views on Science-Technology-Society", *Sci Edu*, 76, 477-49. Doi:10.1002/sce.3730760503.

3. Angelo T.A. & Cross K.P. (1993). Classroom Assessment Techniques, *A Handbook for College Teachers*, Jossey – Bass, San Francisco, CA

4. Arce J. & Betancourt R.(1997).Student-Designed Experiments in Scientific Lab Instruction. *J Coll Sci Teach*, 27 (2) 114 – 118.

5. Ayas A., Cepni S. & Akdeniz A. R. (1994). Importance of laboratory in Science education-II, *Contemp Educ J*, 205:7-11.

6. Black P. & Wiliam D. (1998). Assessment and Classroom Learning, School of Education, King's College London, *Assessment in Education: Principles, Policy & Practice*, 5 (1): 7 - 74. DOI: 10.1080/0969595.

7. Brown S. & McIntyre D. (1993). Making Sense of Teaching, Buckingham, Open University Press.

8. Buhagiar M.A. (2007). Classroom Assessment within the Alternative Assessment Paradigm: Revisiting the Territory, *Curriculum Journal*, 18 (1):39-56.

9. Cartier J., Rudolph J. & Stewart J. (2001). The Nature and Structure of Scientific Models, NCISLA, *Wisconsin Center for Education Research*. http://www.wcer.wisc.edu/ncisla

10. Dalgety J., Coll K.R. & Jones A. (2003). Development of Chemistry Attitudes and Experiences Questionnaire, *J Res Sci Teach*. https://doi.org/10.1002/tea.10103.

11. Dochy F. (2001). A New Assessment Era: Different Needs, New Challenges, *Research Dialogue in Learning and Instruction*, 10(1): 11-20.

12. Eddy, R. M. (2000). Chemophobia in the college classroom: Extent, sources, and student characteristics, *J Chem Educ*, 77, 514-517

13. Education and National Development: Report of the India Education Commission, The Kothari Commission, 1964-66, Vol I:

14. Francisco S.J., Nicoll G. & Trautmann M. (1998)**.** Integrating Multiple Teaching Methods into a General Chemistry Classroom, *J Chem Edu*, 75 (2):210 - 213.

15. Gravoso, R.S., Pasa, A.E., Labra, J.B. & Mori, T. (2008). Design and Use of Instructional Materials for StudentCentered Learning: A Case in Learning Ecological Concepts. The *Asia-Pacific Education Researcher*, 17(1), 109-120.

16. Guzzetti B. (1993). Promoting Conceptual change in Science: A comparative meta-analysis of instruction interventions from reading education and science education, *Read Res Quart*, 28, 116 – 159.

17. Hildebrand, G. (2007). Diversity, Values and the Science Curriculum. In Corrigan, D., Dillon, J. and Gunstone, R. (Eds.), *The Re-Emergence of Values in Science Education*, Rotterdam: Sense Publishers, P 45-60.

18. Kathrine K.E. (2002).The Future of Tertiary Chemical Education – A Bildung Focus? *Int J Phil Chem*, 8 (1):35 - 48.

19. Kouwenhoven W. (2009). Competence-based Curriculum Development in Higher Education: a Globalised Concept? DOI:10.5772/7297.

20. Lederman G.N., Fouad Abd-El-Khalick , Bell L.R. & Schwartz S.R. (2002). Views of Nature of Science Questionnaire: Toward Valid and Meaningful Assessment of Learners' Conceptions of Nature of Science, *J Res Sci Teach*, 39: 497–521.

21. Lederman G. N. (1992). Students' and Teachers' Conceptions of the Nature of Science: A Review of the Research, *J Res Sci Teach*. https://doi.org/10.1002/tea.3660290404 .

22. Lindstrom R. (1994). The Business week guide to multimedia presentations: Create Dynamic Presentation that Inspire. Mc Graw, New York.

23. Lister R. (2000). On Blooming First Year Programming and its Blooming Assessment, *Proceedings of the Australian conference on Computing Education* ,ACM Press, New York, 158 – 162.

24. National Agency for Education, Sweden,(2000), p. 53

25. Neo M. & Neo T-K.(2009). Engaging students in multimedia mediated .Constructivist learning – Students' perceptions. Faculty of Creative Multimedia, Multimedia University, Malaysia

26. Novick S. & Nussbaum J. (1981). Pupil's Understanding of the Particulate Nature of Matter: A Cross Age Study, *Sc Edu*, 65(2): 187-196.

27. Obuchere, Z. M., Okello, M. O. & Odongo, B. C. (2014). Role of teachers in integration of play in Early Childhood Development and Education curriculum. *Int J Educ & Res*, 2 (11), 503-5114

28. Osborne R. & Freyberg P. (1985). Learning in Science: The Implications of Children's Science. Auckland: Heinemann.

29. Oliveira S. A., Machado L.A. & Ana Carolina Araujo da Silva A. C.A. (2016).The Importance of Piagetian Reference for the Elucidation of Conceptual Development in Chemistry, *J Creative Education*, Vol.7 No.3.

30. Pradeep G. & Vibha G.(2017). Working Memory and Learning Disabilities: A Review. *Int J Indian Psych*, 4(4):111 – 121. DOI: 10.25215/0404.013

31. Reid E. E., Morgan P. L., Di Perna J. C. & Lei, P.W. (2006). Development of Measures to Assess Young Children's Early Academic Skills: Preliminary findings from a Head Start-University Partnership. *Insights on Learning Disabilities*, 3(2): 25-38.

32. Schreiner P.R.,Henning H. &Nicole G.(2010). Heuritic Thinking Makes a Chemist Smart. *J Chem Soc Rev*, Issue 5.

33. Selvi K. (2010). Teachers' Competencies, *Cultura*, 7(1): 167 – 175.

34. Stephen Petrina (in press), Curriculum and instruction for technology teachers, chapter four.

35. Struyven K., Dochy F. & Janssens S.(2005). Assessment and Evaluation in Higher Education. *Centre for Research on Teacher and Higher Education*, K. U. Leuven (Belgium), 30: 325-341. DOI: 10.1080/02602930500099102.

36. Subair R., Chugh I.K. & Reddy D.(2017). Automated tool for Blooms' Taxonomy, *Int J Civil Eng Tech*,8(7): 544 – 555.

37. Sundberg M. D. (2002). Assessing Student Learning. *Cell Biol Educ*, 1: 11 - 15

38. Twoli W. N. (2006). Teaching Secondary School Chemistry, *A Textbook For Teachers in Developing Countries*, Nehema Publishers, Nairobi, Kenya. ISBN NO.9966 -7049 - 4 - 9.

39. UNICEF-Tanzania, 2017.

40. Vivekanandhan R. & Mohan K.R. (2014). A Comparative Analysis of the quality of Work Life, of Teaching faculty members of Government and private Engineering institutions in Chennai, *Int J Adv Res Mgt*, 5 (4): 11 – 22.

41. Wiggins G. P. & McTighe J.(1998). Understanding by Design. Alexandria, VA: Association for Supervision and Curriculum Development.

42. Yager R. E. (1996). Science/Technology/Society as Reform in Science Education, ERIC Number: ED403112, ISBN-0-7914-2770-6.

43. Yazachew Alemu Tenaw , (2015). Effective strategies for teaching chemistry, *Int J Edu Res & Rev* ,3 (3) 78-84

44. Zeidan A. H., & Jayosi M. R.(2015).Science Process Skills and Attitudes toward Science among Palestinian Secondary School Students, *World J Edu*, 5 (1) :13-24.