

Assessment of Methods used by Chemistry Teachers to Enhance Learner Acquisition of Analytical Skills in Secondary School in Nyakach Sub- County, Kenya

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Abstract:- The purpose of the study was to assess the methods used by chemistry teachers to enhance learner acquisition of analytical skills in Nyakach sub- county, Kenya. The study employed a descriptive survey research design where data was collected using a questionnaires from 333 learners, interviews and observation rating scales from 18 teachers from the sub-county. Data from interviews was analyzed qualitatively by organization into categories as per the emergent themes then reported and presented in a narrative form while data from observation guide and learners questionnaire were quantitatively analyzed using SPSS to determine percentages and means and presented in form of tables. The study considered indicators of analytical skills that were evidenced in the methods used by teachers as they taught chemistry. The study revealed that, the Chemistry teachers in secondary schools were acquainted with the methods of enhancing acquisition and development of analytical skills such as questioning, use of models, discussion and use of ICT and that even though the teachers were aware of the skills that would develop analytical skills among the learners, their classroom practices are at variance with this since the methods were minimally used. 25.01% of the chemistry teachers were used the method effectively while 74.99% were found to minimally use the said methods effectively. The study recommended that the Chemistry teachers should be encouraged and assisted to improve the teaching methods by moving from the general methods to specific ones that target the acquisition and development of analytical skill. They should also make the teaching and learning activities to be intentional as they target these specific skills. This can be achieved by organizing capacity building and in-service trainings on the targeted areas.

Keywords:- Analytical skills, scientific thinking, critical thinking.

I. INTRODUCTION

The teaching of science in the recent past has undergone many changes, the proponents of these changes argued that children should be taught more than just facts, should be taught methods and general principles, as well as ways in which science relate to the child's world (B. Odden et al 2021).

One of the major aims of teaching Chemistry like any other science subject to develop scientific attitude and science related values among learners, it should train the learner to develop method of science and should also help develop scientific temper. Chemistry therefore is deemed as a very instrumental science subject in the lives of every learner of every nation, its place in the education and curriculum especially its teaching and learning should be reviewed and considered with respect to developing the learners thinking skills

Teaching Chemistry to learners at secondary schools should enable the learner make sense of natural phenomena and to help the learner explore the complexity of natural world, it should also enable the learner develop investigative and practical skills which can help them solve problems, in so doing the teaching of Chemistry should stimulate enthusiasm amongst learners and provides a means of making abstract concepts more concrete in addition to process skills.

According to KIE syllabus (2002) some of the objectives of teaching chemistry include making accurate measurement, observation and drawing logical conclusions from experiments.

With all the above importance of chemistry, the teaching of Chemistry still remains challenging in secondary schools in Kenya since Chemistry requires learners to think abstractly. Also according to the ministry of education in Kenya, the learners are supposed to select According to the Ministry of Education in Kenya, the learners are supposed to choose any two sciences at the end of form two. Chemistry being an elective science subject in secondary schools in Kenya, KNEC reports indicate that it has the highest enrolment compared to Physics and Biology. Despite the fact that the learners opt for Chemistry by choice, the performance is low.

Also the changing trends in the setting system in the Chemistry paper three where learners are asked to select and describe tests that could be carried out consecutively to confirm the identity of substances, in as much as the said skills are necessary KNEC reports 2017 found out that candidates were unable to write the procedures and draw logical conclusion from experiment, this displays learners to be in possession of inadequate analytical and inferential skills.

Due to the importance of science to the society, the mentioned goals aren't easily achievable, it calls for the development of high order thinking skills such as analytical, inferential and evaluative skills in Chemistry hence the development of scientific thinking through enhancement of critical thinking amongst learners. Also the societal problems and increasing demand for solving such problems deems it necessary to equip learners with high order thinking skills that would enable them survive in the society Alkin, et al (2016).

There is need to develop the learners thinking so as to equip them with problem solving skills necessary for real life issues. Through the teaching of chemistry, the teachers should employ methods and strategies that would help the learners develop their critical thinking skills, Suits (2013) Chemistry curriculum generally combines numerous abstract concepts in which they are the center of learning Chemistry and any other disciplines. When learners fail to write procedure and also draw logical conclusions from the experiments and further when they evade questions that require such skills in examinations. It is an indicator that these skills aren't developed among the learners. Since acquisition of skills is dependent on the teaching methods it is imperative to investigate the methods used by the chemistry teachers to develop analytical skills among the learners.

II. LITERATURE REVIEW

The teaching of chemistry in the recent past has been dominated by the use of lecture method where the teacher is seen as the source of knowledge and the learner a novice. It is evidenced that such methods of teaching do not foster the development of high order thinking skills and are not appropriate for teaching science for the betterment of the society. Adamu, M. et al(2018) observes that lecture method is not quite suitable to realize the real aim of teaching chemistry, also according to Banenjee (2015) Intelligence and memory can make your students pass exams, but you will only be able to give them a true education if you foster critical thinking skills within them. He further postulates that, when you give your students the facts they require, they will memorize the facts and use them to serve their short-term goals of passing tests and graduating to a higher class. When you give them critical thinking skills, they will be able to find the necessary information for themselves; they will be able to evaluate the merits and consequences of that information; and they will be able to utilize that information to solve any problems at hand. This is the goal of teaching science. Analytical thinking also known as logical thinking as an element of critical thinking includes skills such as ordering, comparing, contrasting, selecting constructing and evaluation. It is a necessary skill in Chemistry since it provides a logical framework for problem solving which is one of the goals of teaching Chemistry. According to Owen, (2016). Analysis is the ability to break down or distinguish the parts of a material into its components so that its organization structure may be better understood.

Analytical skills helps the learners to select the best alternative from the ones available by narrowing the range of the possibilities. This is a skill that is necessary for the learners in secondary schools. According to ITS Education Asia (2017) the learners need the analytical skills to help them solve problems, where the many possible causes have to be identified and analyzed to find the real.

In Kenya, the Kenya National Examination Council (KNEC) - the examination body at the secondary level noted that logical analysis of concepts and critical thinking must be encouraged during the teaching and learning process of Chemistry KNEC (2017). According to CEMASTEIA TNA (2015) reports, Science and mathematics will play a significant role and that the lessons should nurture skills of identifying and solving real world problems in students. Despite the importance attached, findings of survey by TNA showed that teachers rarely provide learners with opportunities to solve non familiar problems. By so doing the teachers deny the learners chances of developing high order thinking skills and instead promote rote learning in chemistry classroom hence the development of such skills left unattended to during the teaching learning sessions. This state of affairs is also reflected in examination performances where real world problems in sciences are avoided by most candidates KNEC report (2022).

If analytical skills are taught and adequately developed among the learners they will enable the learners to select best alternatives from those available by narrowing down to the range of the possibilities. Analytical skills would also play the role of enabling the learner to link the observation they make and knowledge that they learn from chemistry class this would be the first step towards problem solving.

According to Politsinsky et al (2015) the system of methods that allows a successful development of analytical skills in chemistry is through problem solving in chemistry. During problem solving, a student performs thinking actions and that problem solving facilitates a deeper comprehension of obtained knowledge and formation of comprehensive ideas or reality. He further poses that teaching school and university student's general methods of mental activity and particularly analysis is the most effective during organization of problem solving. It is therefore necessary to develop analytical skills among learners to help in problem solving. If the skills lack among the learners, then it could be an indicator that the teaching methods used to develop such skills are wanting and this warrants a research in this area.

Analytical skills are logical operations that require the learner to mentally divide the object under study into components (feature, properties and relations) and each of them is investigated separately as part of the whole. As pointed earlier KNEC (2017) that the learners still lack adequate analytical skills to tackle questions in paper three, it is a pointer that these skills have not been adequately developed during teaching and learning of Chemistry.

The premise that supports teaching and learning of higher order thinking skills is no longer an issue for contention (Heong, Yunos, et al., 2011). Hence the issue lies with how best to teach this highly needed skill (HOTS). In a study conducted by Anderson et al. (2001), former students of Bloom, they reviewed Bloom's taxonomy of higher order thinking, and came up with a six step taxonomy which includes; remembering, understanding, applying, analyzing, evaluating and creating process. These six steps they propose promote the development of higher order thinking skills, but emphasis was placed on analyzing, evaluating and creating. They suggested that educators and teachers should teach analysis by using approaches that integrates—differentiating, organizing, attributing (to break into constituent parts) and determine how the parts relate to one another and also to an overall structure and purpose (Yunos et al., 2010).

According to Hasnain, A., & Bhamani, S. (2014), it was found that teachers focused more on theoretical work and rote learning, which put pressure on students and had a negative effect on their intellectual abilities. They further point out that students are pressurized to some extent and focus on rote learning of the content. Due to this cramming system, there is huge pressure on students which effects their creativity and capabilities. This call for methods that would foster the development of high order thinking skills.

A. Use of questioning

Problem solving through proper questioning as a method of teaching and learning Chemistry would aid in the development of analytical skills. Questioning ability is an integral part of meaningful teaching and scientific inquiry. The formulation of a good question is a creative art and at the heart of what doing science is all about.

Asking questions as an essential component of thinking skills, for learning tasks and as a key stage in the problem solving process. Chin and Osborne (2008) indicate the importance of providing a learning environment that supports and fosters the ability to ask questions amongst students who learn science, since science is a discovery discipline and discovery is achieved fast by asking questions and then by conducting research in order to find the answers to that or any other questions. They further suggest that, for students that learn science their questions have the potentials to: direct their learning and drive knowledge construction; foster discussion and debate there by enhancing quality of discussion and classroom talk; helps them to self-evaluate and monitor their understanding and increase their motivation and interest in a topic by arousing their epistemic curiosity. In this way it is evidenced that proper questioning skills among the learners would improve their quality of thought.

For chemistry teachers, students questions raised in class have the potentials to: helps the teachers evaluate students understanding and help them tap their thinking thereby facilitating formative assessment and improve future teaching, evaluate high order thinking, stimulate further inquiry into the topic being studied via open investigation,

problem based learning and project work and provoke critical reflection in classroom practice.

Shanmugavelu, Ganesan, et al. (2020) opine that to question well is to teach well and that questioning techniques will increase motivation and promote students' ability to think critically and creatively. In the skillful use of the question more than anything else lies the fine art of teaching; for in it we have the guide to clear and vivid ideas, the quick spur to investigation, the stimulus to think and the incentive to action. Jesus who is considered by Christians as a great teacher often used questions to stir the thinking of his listener and disciples. For example in Mathew 18:12 instead of just telling his subjects directly what he had in mind he posed a question to them. What do you think? This is meant to stir and challenge the thinking of His followers. This can also be applied as a technique by the chemistry in their teaching to help improve the quality of thought as the learners interact with the chemistry content.

B. Use of ICT

The government of Kenya enacted the Information Communication Technology (ICT) policy in 2006 purposefully for making the country an ICT hub and to foster economic growth of the country. For an economic growth to be realized, the education sector has to be given the first priority, consequently the use of ICT in the teaching and learning of different subjects and courses at different levels of education, for this reason the government of Kenya through the Ministry of Education has in the recent past made the first step by rolling out grants to schools inform of computers. This would foster the use of ICT in teaching and learning.

The Ministry of Education (2010) in Kenya stated the objectives of ICT integration in teaching and learning as: enables the teacher to explain abstract concepts, promoting learner centered approach to learning, implementation of instructional methods such as simulations and computer games become more feasible, improving learner motivation by making teaching and learning process more interesting.

One of the difficulties identified in this study is that understanding some contents and the interactions between the microscopic particles and the sub atomic particles. With the development of Information Communication Technology, its integration and incorporation in the teaching and learning of chemistry is deemed useful in enabling the learners develop a deeper understanding of scientific phenomena.

Information and communication technology is a general term that emphasizes on the integration of telecommunications, computers, software and audio visual systems to enable users to create, access, store, transmit and manipulate information, Ambuj (2021). During five last decades there have been five generations of learning technologies for science education with the last one being: a variety of learning technologies are being used by educators to enhance learning and teaching, such as; learning management systems (LMS), high – level 3D animations, mobile devices, virtual reality and distance learning software. Science educators and researchers have

encouraged the use of ICT in the science classroom of both high school and tertiary education. Chiu & Linn (2011), Ng. (2010), Rodrigues (2010).

Online blogging is an excellent way for Chemistry teachers to teach Chemistry concepts, build 21st century skills and keep students excited and focused about learning Chemistry. While blogging can be done through discussion boards, using sites, such as a wiki, allows students to actually conduct group projects in class or at home while being able to monitor progress in real-time. Seery M (2013). Web browsers, applications (apps), and 2D barcodes to create smart objects, can all serve as learning tools that facilitate independent learning. Williams AP (2011). Video tutorials and quizzes can serve as differential methods of instruction for chemistry teachers inside and outside of the classroom.

For teachers, finding time to provide additional support to help students overcome weak areas can be very difficult. Using technology as a way for students to build skills in weak subject areas will make difficult times of learning fun and enjoyable, but most importantly it will help students build the confidence they need to succeed. Technology is not only beneficial to struggling students; rather, it is beneficial to all students. By using technology, teachers can bring chemistry to life and students will be able to visualize abstract concepts and test new learned concepts in chemistry. Exposing students to technology while teaching chemistry will increase their knowledge and help them build skills that will make them competitive.

During five last decades there have been five generations of learning technologies for science education with the last one being: a variety of learning technologies are being used by educators to enhance learning and teaching, such as; learning management systems (LMS), high – level 3D animations, mobile devices, virtual reality and distance learning software. Science educators and researchers have encouraged the use of ICT in the science classroom of both high school and tertiary education. Chiu & Linn (2011), Ng. (2010), Rodrigues (2010).

ICT based learning play a significant role education, I.Eilks & A. Hosftin (2013) points out that if properly used the incorporation of ICT helps the learners develop higher order thinking skills. There has been a growing understanding of the important role of information and communication technologies in the teaching and learning in secondary schools in Kenya despite the challenges that seem deterrent to the integration in teaching and learning. Integrating virtual models and creating learning opportunities, the digitalization of content that enables the Chemistry teachers customize, edit and retrieve the information as desired and in a way that promotes learning, virtual laboratories that enables to organize demonstrations in cases where there may be lack of apparatus. The observed steps towards the application of ICT leave the teaching and learning at an ICT aided learning environment.

The use of visual support also helps make abstract concepts more easily understood. The computer aided learning environment also has clear goals and immediate

feedback, characteristic that often offer increased motivation to learners, Barkaley (2010), Wlodkowski (2008). Another important effect of the use of these ICT tools in education is that they permit students to control the pace of learning thereby providing easier digestion of new concepts, Bransford Brown & Cocking 2000; Willingham 200.

The use of ICT in teaching chemistry enables the visualization capability that allows the teachers and learners alike to present and view of chemical phenomena and processes via multiple representation. Dori & kaberman (2012). This the researcher opines that it would enable the learners overcome the difficulty brought about by the abstractness of the content.

It is therefore essential for the chemistry teacher to build up competencies to quickly catch up with new development and to integrate them in the classroom practice. In assessing the importance of ICT incorporation in teaching of chemistry Bresslow & Belcher (2007) indicated that the learning gains were significantly greater than those obtained by traditional lectures and recitations settings without the use of ICT,.

The use of ICT in the teaching of chemistry helps the learners to visualize concepts that are otherwise abstract as presented in the textbooks, these include concepts like interaction between atoms, structure and bonding, the structure of the atom and other topics which the learners have viewed as abstract and may not easily comprehend. According to Jerry Suits (2013) the use of ICT in the teaching of chemistry world enables visualization of such concepts and would help the learner deepen their thinking.

III. METHODOLOGY

A. Research design

The adopted descriptive design, a methodology used to investigate population by selecting samples to analyze and discover occurrences and to describe the characteristics of a particular individual or group (Kothari: 2004). The design was selected for the study because the researcher was interested in describing and explaining events as they are and as they take place within the chemistry classroom.

B. Population and sampling

➤ Population.

The study targets fifty four (54) secondary school teachers of Chemistry and two thousand five hundred and forty (2540) form three students drawn from 54 secondary schools in Nyakach Sub - County. Chemistry teachers were selected for the study because they are the major agents of curriculum implementation in their respective schools.

➤ Sampling and sample size

18 Chemistry teachers were randomly sampled for the study, while Krejcie and Morgan table was used to randomly sample while 333 out of 2540 learners were drawn from the schools using simple random sampling technique. Hamed (2016) states that simple random sampling is used when every case has equal probability of inclusion in a sample. The form three were chosen for this study because Chemistry is an elective subject, and at form three the

learner have made a choice to take the subject and therefore are bound to give better information regarding instruction in chemistry. Also compared to forms one and two the form three are better placed in that they have been exposed to

more Chemistry content. The form four may not be easily availed by teachers because of the tight schedules as candidates. The researcher therefore opined that the form three students stand a better for this study.

Table 1: Population and Sample size

Respondents	Population	Sample size	Percentage
Teachers	54	18	30.00
Learners	2540	333	13.11
Schools	54	18	30.00

C. Instruments

In the study, the researcher used three instruments; observation guide using rating scales, unstructured interview schedule, learners' questionnaire. The quantitative data was collected using the learners' questionnaire and teachers' observation guide using rating scale while qualitative data was collected using interview schedule for teachers. The questionnaires consisted of open ended items and a Likert Scale was used to gather the learners' opinion on the skills of developing analytical skills. The interview schedules consisted of open ended items which focused on the methods used by chemistry teachers to develop analytical skills.

IV. DATA ANALYSIS AND PRESENTATION

Data was analyzed using both quantitative and qualitative approaches. Data collected from observation schedule and questionnaires were grouped as per the research questions for ease of quantitative analysis, to achieve this the researcher used a five point Likert Scale (rating scale) which was scored per item and tally counts obtained converted to frequencies and finally percentages calculated for analysis. The Likert scale covered much information and was less timeconsuming. The researcher used descriptive statistics such as frequency counts using tally sheets and calculating percentages. This allowed the researcher to meaningfully describe the distribution of information or measurements and give a valid conclusion about all the research questions. (Mugenda and Mugenda; 1999). Data is presented in form of tables (Mugenda and Mugenda; 2003), observes that the use of tables helps summarize information in logical format and sequence hence described figures can be easily located. The tables makes it possible for patterns within figures that cannot be seen in narrative form to be revealed.

The data collected through interviews was thematically arranged as per the research questions and transcribed into written texts. The data was examined for credibility in answering the research questions.

Presentation will be done in a narrative form.

V. ETHICAL CONSIDERATIONS

The researcher ensured ethical standards by observing the ethical requirements. The researcher sought the consent of the respondents before administering the research instruments by providing a detailed consent letter to the respondents, the letter explained to the respondents the purpose of research and further explained to the respondents

what is expected of them. The consent of the form three learners who are minors was also sought from the school principals. A part from seeking permission from the administrators, a consent form was also be given to all the respondents and the form three learners and only the willing respondents were be asked to fill the forms. The respondents were not required to write their names on the questionnaires thus the participants remained anonymous though out the study. The researcher also did not reveal the identity of the respondents. The learners and teachers were talked to prior to the research in order to willingly give information, Bryman and Bell (2007). The researcher also introduced himself by producing identification cards and letters of introduction and state the mission and purpose of the study.

Physical forms used for data collection were handled with utmost confidentiality by the researcher, while the data entered as soft copy will be stored in an external hard disk only handled by the researcher. Information obtained from other sources and other authors to support the relevance of this research were acknowledged in the form of references and this minimized plagiarism. Consent from relevant authorities was also sought by the researcher. Prior to data collection the researcher also sought for permission from Maseno University Scientific and Ethics Review Committee and relevant Educational offices which granted the permit after approval of the study. Mugenda (2003), observes that ethical issues in research encompasses analyses and employment of concepts such as right and wrong, good and evil and transparency, accountability and responsibility. He further states that, in research process, ethics focuses on the application of ethical standards in the planning of the study: data collection analyses, dissemination and the use of results.

VI. RESULTS AND DISCUSSION

This section presents the results and the finding of the study that sought to establish whether or not the chemistry teachers use the teaching methods that foster the acquisition of analytical skills as the teaching and learning of Chemistry took place.

The researcher considered the indicators of analytical thinking skills that can be taught to learners so as to enhance the acquisition of the analytical skills as Chemistry is taught. Such include observation skills, correct scientific language and logics. The instrument used to collect data in the above table was a five point scale that was used to observe the Chemistry teachers as they taught in the classroom.

The findings are presented in the table below.

Table 2: Responses from teachers' observation rating scale on methods of enhancing learners' acquisition of analytical skills

Statements The teacher:	Responses									
	Always		Frequently		Occasionally		Rarely		Never	
	F	%	F	%	F	%	F	%	F	%
Guides learners to make their observations	3	(18.75)	0	(0.0)	1	(6.25)	6	(37.5)	6	(37.5)
Asks learners their views about observations made.	2	(12.5)	1	(6.25)	3	(18.75)	4	(25.0)	6	(37.5)
Guides the learners to use scientific language in making observations	4	(25.0)	1	(6.25)	1	(6.25)	8	(50.0)	2	(12.5)
Helps learners to make logical observations	4	(25.0)	1	(6.25)	3	(18.75)	4	(25.0)	4	(25.0)
Uses ICT to explain challenging analytical concepts	1	(6.25)	0	(0.0)	0	(0.0)	4	(25.0)	11	(68.75)
The teacher asks the learners questions probe their thinking.	3	(18.75)	2	(12.5)	2	(12.5)	5	(31.25)	4	(25.0)
The learners are guided to follow procedures correctly while doing experiments.	2	(12.5)	1	(6.25)	3	(18.75)	3	(18.75)	7	(43.75)
Allows the learners to take step by step analytical procedures to perform tasks.	1	(6.25)	2	(12.5)	7	(43.75)	4	(25.0)	2	(12.5)
Guides learners to measure quantities accurately	2	(12.5)	3	(18.75)	4	(25.0)	5	(31.25)	2	(12.5)
Draws learners' attention to note color changes during experiments	5	(31.25)	2	(12.5)	2	(12.5)	3	(18.75)	4	(25.0)
	Always		Frequently		Occasionally		Rarely		Never	
Overall mean percentages.	16.88		8.13		16.25		28.75		29.38	

The general information from the rating scale has revealed that teacher rarely and never use approaches that equip the learners with analytical skills. The results reveal that the inadequate provision of the analytical skills to the learners by the chemistry teachers is vast among the chemistry teachers, implying that the skill is ill developed and this corresponds to learners avoiding questions that require such skills in examinations as pointed by KNEC 2017 reports. The role of teachers in instilling analytical skills to learners through the teaching of Chemistry is at its minimum level. This is in line with Banenjee, (2015). Intelligence and memory can make your students pass exams, but you will only be able to give them a true education if you foster critical thinking skills within them. He further postulates that, when you give your students the facts they require, they will memorize the facts and use them to serve their short-term goals of passing tests and graduating to a higher class. When you give them critical thinking skills, they will be able to find the necessary information for themselves; they will be able to evaluate the merits and consequences of that information; and they will be able to utilize that information to solve any problems at hand.

The results of the study show that the majority of chemistry 74.99% teachers inappropriately used pedagogical practices that adequately develop the analytical skills among the learners, this has logically translated into learners' inability to acquire and develop analytical skills. However 25.01% of the teachers employed methods that help the learners acquire and develop the said skills. This study concurs with A. Hellen et al (2014) that analytical skills when developed, improves the learners development of cognitive skills. This has been reflected in learners' lack of necessary skills of solving problems that require high order

thinking skills and avoid questions that relate to real life problems and experiences during KNEC chemistry examinations

More data was generated using the learner's questionnaire that also sought the learners views on the teaching and learning activities pertaining to the acquisition and development of analytical skills during chemistry lessons. The findings were as shown in the table below.

Table 3: Responses from the learners' questionnaire on the methods of enhancing acquisition of analytical skills

Statements	Responses									
	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
Our teacher:	F	%	F	%	F	%	F	%	F	%
Draws our attention to note color change during experiments	217	(72.33)	60	(20.00)	4	(1.33)	11	(3.67)	8	(2.67)
Guides us to measure quantities accurately	202	(67.33)	76	(25.33)	6	(2.00)	9	(3.00)	7	(2.34)
Make observations using scientific language	101	(33.67)	86	(28.67)	35	(11.66)	52	(17.33)	26	(8.67)
Guide us to record data accurately.	146	(48.79)	104	(34.55)	20	(6.67)	21	(6.97)	9	(3.03)
Guides us in organizing data for interpretation	94	(31.3)	103	(34.35)	47	(15.50)	42	(13.98)	15	(4.86)
Emphasizes on the use of correct language in stating observations	169	(56.34)	85	(28.33)	21	(7.00)	15	(5.00)	10	(3.33)
Facilitates categorization of elements into their families	167	(55.76)	83	(27.58)	14	(4.82)	25	(8.20)	11	(3.64)
Guides us to gather relevant evidence to be used in deductions	79	(26.44)	103	(34.35)	48	(16.11)	40	(13.07)	30	(10.03)
Draws our attention to the expected deductions based on data collected	150	(50.00)	92	(30.61)	23	(7.88)	20	(6.67)	15	(4.84)
Asks challenging quizzes dealing with testing and identification of ions.	153	(50.91)	93	(31.10)	23	(7.62)	15	(4.88)	16	(5.49)
	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
Overall mean percentages.	49.67		29.16		8.05		8.25		4.86	

Data analysis and interpretation of response from the learners revealed that most chemistry teachers use methods that do not enable the learners to acquire analytical skills necessary for learning of chemistry. Majority of the learners tended to strongly disagree and disagree with most of the statements intended to help foster acquisition of analytical skills.

The general information from the Likert scale shows that higher percentage 78.83% of the respondents in the study strongly disagreed while 13.11% agreed on the role of teachers in equipping them with analytical skills in chemistry. This indicates that the teachers minimally used methods and approaches to develop analytical skills among the learners as they teach Chemistry, this revelation also corroborates what was obtained by observation of how the teachers teach Chemistry in the classroom.

Further information on the acquisition and development of analytical skills was sought by the use of teachers' interviews where the respondents were chemistry teachers. Their responses were as discussed below.

All sixteen teachers interviewed to positively identify the specific objective of teaching Chemistry that relates to the development of analytical skills as. "To develop scientific attitude and scientific thinking," this is an indication that the teachers are well conversant with the skills that are required for the development of the said skills. The teachers were further questioned on how they use chemistry to identify the skills that, 11 out of the 16 teachers never gave a clear on how to identify the skill despite the fact that they portrayed a possession of the knowledge of the skills. One of the respondent reported that.

"The only way to determine the skill acquired by the learners is through giving examinations and marking." **(One of the respondent)**

Going by the suggestion of the above respondent shared by the majority of the respondents, the chemistry teachers implied that it is only through examinations that can help identify acquired skills. This further implies that other methods and strategies that help develop analytical skills are ill employed. This finding agrees with W. Prawita, et al(2019), who found out that low percentage of students' analytical thinking skills also can be due to the teacher's learning strategy not yet oriented towards the empowerment of analytical thinking skills levels. Some of them are the teacher way of teaching only one way

On the methods that the chemistry teachers use to develop analytical skills, the following common method were sighted by the chemistry teachers.

"The following methods are found to be helpful in the development of analytical skills "use of models, use of ICT, experimental work and discussions with learners." (key respondents)

It is worth noting that the teachers mention positively the methods they use to develop the analytical skills, even though when observed in classrooms as they taught chemistry, the research revealed minimal application of such skills during instruction. There was observed sessions dominated by the chalk and talk method and learners given notes to copy.

Even though the teachers were conversant with the methods, when observed in class, the methods were minimally used implying that the teacher never implemented these skills during content delivery to the learners.

The teachers were further asked the place of questioning in developing analytical skills, all the 12 teachers were able to identify the place of questioning in general with only 4 being specific on how questioning is used to develop analytical thinking skills. The 12 teachers reported that they use questioning to evaluate performance at the end of a learning period. This implies that the skills are rarely developed and hence the learners lack the said skills. This is portrayed in the learners inability to answer questions that require such skills in the KNEC examinations hence they evade such questions. KNEC report, (2012). When the teachers were asked how they guide learners to make correct observations during experiments, a majority 14 out of 16 were able to state on helping the learners note colour change, some of the responses from the respondents include,

“Guiding the learner to make correct observations would involve such activities as guiding them to identify any gases produced and carrying out tests to positively identify them, guiding the learners to interpret the data collected from the observations made.”

The teachers were further interviewed on how they use ICT to help develop the analytical skills, 12 out of the 16 teachers, and reported minimal use of the ICT in the development of skills. A respondent reported that,

“ICT is important in development of skills and also helps make the abstract concepts concrete, despite this teachers of chemistry find it difficult to use because of computer illiteracy and unable to use it effectively in addition to limited computers and computer tools enriched with content in schools. In fact the furthest teacher employ the use of ICT is for making professional documents and making reference to the net, this is often done via smart phones.” **(Respondent)**.

The above sentiments were confirmed during observation in class as and few teachers were found to be using ICT in teaching.

The research revealed a mismatch in what the teachers indicated in the interviews and what was observed as the teach in the classroom implying that teachers omitted to employ the strategies that enable the learners acquire the analytical skills despite being well conversant with them.

This research has revealed that though the Chemistry teachers are aware of the methods that help the learners acquire and develop analytical skills, there exists a mismatch between the teachers' pedagogical knowledge and teacher' classroom pedagogical practices that relate to scientific development hence the methods used are inadequate to develop the skills among the learners.

VII. CONCLUSION

The research concluded that the methods used by the Chemistry teachers such as lecture method and dictation of notes are inadequate and to allow for acquisition and development of analytical skills.

VIII. RECOMMENDATIONS

The Chemistry teachers should be encouraged and assisted to improve the teaching methods by moving from the general methods to specific ones that target the acquisition and development of analytical skill. They should also make the teaching and learning activities to be intentional as they target these specific skills. This can be achieved by organizing capacity building in-service trainings on the targeted areas.

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