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Abstract
This paper appraises and addresses the new trends, best practices, opportunities and challenges in chemistry education on the international and/or regional scenes and how can chemistry teachers adopt and adapt the new trends that may be appropriate in their culture/country (Nigeria). The hands-on projects, in line with the new trends are highlighted to support the learning of our chemistry students. Science has been characterized as a body of knowledge evolved by scientists while science education builds on the knowledge and skills acquired by the learners so that students can understand scientific principles, laws and theories. The emphasis on the teaching and learning of science is on ensuring that teachers not only teach the processes of science but also enable sensory learners to learn scientific concepts. The paper suggest that teachers should provide the students with opportunity to learn independently in acquiring science process skills. Skills required to do science and technology successfully through observation, hypothesizing, experimenting, collecting data etc. Hence, the use of various suggested new trends/approaches such as the use of computer and the internet facilities, group work, discussion on ideas etc with the provision of enough laboratory facilities that can create more opportunities for inculcation and acquisition of desired skills in the students were elaborated and emphasized. Challenges of conducting
practical examinations under limited science equipment’s that limits teachers freedom and authority for content selection and delivery, teachers are pressurized to cover the entire content, perception and practices on the nature of science where textbooks which emphasizes on factual information and lack of personal relevance and appeal for students were all stressed. So as chemistry educators we have a key role to play. Hence, better teachers are needed to improve science education.

**Keywords:** Chemical education, New Trends, Best practices, opportunities and Challenges.

**Introduction**
Chemistry Education as an activity has been existent “in one form or another as long as there has been chemistry” (Taber, 2015). That is having life, current or occurring now. Chemical education is dynamic and ever changing subject and as such is fascinating field of endeavor. Chemistry education or chemical education as it is also known, is the study of the teaching and learning of chemistry in all schools, colleges and universities.

A major focus of science instruction over years has been the development of achievement in science courses. This can best seen in students when a student attempts to solve a scientific problems through manipulation of variables or collection of data. Topics in chemistry education might include understanding how students learn chemistry, how students improve learning outcomes by changing teaching methods and appropriate training of chemistry teachers, within many modes, including classroom lecture, demonstration and laboratory activities. There is a constant need to update the skills of teachers engaged in teaching chemistry. The skills of observation, hypothesizing, collecting data, making inferences, performing an experiment etc. all these need to be addressed.

The new trends in chemistry teaching can be identified by selecting the best articles from the relevant literature-those which give evidence of changes in **content and in the methods** used to teach this subject chemistry and by reflecting on the external as well as internal factors which influence the chemistry syllabus. It is now becoming accepted that these factors must be taken into consideration with a view to adapting chemistry teaching more closely to the needs and
motivation of the students, and more generally, making it correspond more closely with what societies have a right to accept from their educational system.

➢ There is an increased emphasis on improved methodologies which is students-centered learning system, which has led to the discovery/adoptions of different approaches varying from the orthodox teaching/learning processes previously used. In Nigeria, these methodologies evolved from the informal gathering of students under trees and moonlights to formal yet local classroom and school programmes as Obanya and Toure, (2003), rightly pointed out that there has been an influx of ‘new methodologies’ into the school system, promoted largely through new teaching-learning guidelines and localized in service training programmes. These new methodologies going by different names, such as active methods, audiovisual methods, pedagogy by objectives (outcome based learning), etc.

Prior to the advent of these new methodologies, (Ouedraogo, 2000 cited in Kearney,2000) asserts that classroom activities were characterized by “rigidity” a conclusion of a study from Cotedivoire which explains “rigidity” as occasioned:

➢ insufficient and poor training, leading to poor mastery of appropriate teaching techniques

➢ Poor supervision and large and unmanageable class size. These are the predominant features in most Nigerian Universities and colleges of Education, “despite” global uniformity in many areas of society, structure and policies for higher education, research and innovations. (Kearney,2000)

Promoting the exchange of information on the content, methodology and techniques of science teaching at all level is an important aspect UNESCO programme devoted to the improvement of science and technology education.

Theories in science education

Piagetian theory was the first cognitive theory that became internal to science education in the late 1970s, in that not only were the students classified into developmental levels, but scientific concepts were also classified as requiring for their understanding either concrete or formal logic (Herron, 1978; Shayer & Adey, 1981). The impact of Piagetian theory on science education was confirmed by a special issue (Vol. 2, Issue 3, 1964) of the Journal of Research
in Science Teaching that was dedicated to Piaget, which included a paper by Piaget himself. A central tenet of Piagetian theory, in addition to the developmental levels, was personal constructivism, which forwarded the notion that knowledge is constructed actively by the student through a process of cognitive conflicts / disequilibria and the subsequent equilibration / the accommodation of new concepts. This process is very relevant to what has become important to science educators in recent years, that is, to conceptual change.

**Current New Trends in Chemistry Education:**
The most important and interesting trends among others is based on context-based chemistry and inquiry-based learning. Context-based chemistry provides meaning to the learning of chemistry as should experience their learning as relevant to some aspect of their lives and be able to construct coherent mental maps of the subject (Gilbert, 2006:960). At the turn of the century (August, 2000), the 16th International Conference on Chemical Education held a workshop at Budapest, Hungary, that included participants from countries in Europe, Asia, USA and Africa (Bradley, 2002). **Four New trends** that were identified and discussed were the following:

- A trend to focus on learners or **student-centeredness**,  
- A trend that reflects that a **multi-disciplinary** approach where Chemistry is packaged with other sciences is needed to solve present and future problems,  
- A trend that recognizes the need to develop **scientific literacy** in all students, for they would serve as future citizens and leaders; while also developing future scientists,  
- A trend that moves away from the authoritarian style of teaching, or **methodology**, where teachers are the owners of knowledge, to a democratic style emphasizing active learning for individual, as well as for collaborative group work (Bradley, 2002).

The **first trend** on student –centeredness in Chemistry education (Bradley, 2002) is in line with Ausubel’s learning theory that it is the student who must construct the knowledge of Chemistry, science etc. from observation and recognition of information and events through existing concepts or previous
knowledge (Ausubel, 1960). Curiosity and the desire to learn should have students question about the natural world; and learn science. By this, the “hands and “minds” and even the eyes focusing of learners must be on scientific activities such that learners will be able to learn actively and thereby participating in knowledge construction (Ausubel, 1963). Students have to apply science to solve problems in daily life in our present world including making tools and processing actions, and this is technology. Clearly, science and technology are intertwined to solve a specific problem or accomplish a particular outcome in daily life.

The second trend of using a multi-disciplinary approach in the teaching and learning of Chemistry (Bradley, 2002) was echoed by Bybee, Powell, and Trowbridge (2010) who called for more emphasis on connections among the basic sciences and other disciplines including mathematics, technology, social studies and ethics. This is in line with the knowledge requirements we need to think and behave as a responsible and ethical human being; and not just a bare understanding of some scientific concepts. By including the nature of science into our curriculum, topics in every discipline of science such Biology, Chemistry Physics, Agricultural science etc will be included and integrated that remove distinct boundaries among the sciences and other disciplines, providing the multi-disciplinary approach that we desire since societal problems are dynamic in nature.

The third current trend on the need to develop scientific literacy (Bradley, 2002) was also emphasized by Bybee et al. (2010) as the main purpose of science education for all students, including Chemistry education. Clearly there is a need for all students to have scientific literacy to live and interact in a physical world that is bound by the rules of science. In an era when resources are dwindling and the earth is threatened with climate change, humans need science literacy to enable us define the parameters of responsible behaviour for a sustainable environment. That is we may think that the need for universal scientific literacy comes before the need to develop a certain number of scientists, experts and science educators.

The fourth current trend of using a more democratic methodology in teaching Chemistry (Bradley, 2002) that moves away from the authoritarian approach where teachers are the owners of knowledge. A democratic approach focuses on the learner constructing the links between new information and existing knowledge and hence we have the trend to active individual and collaborative
learning. Active learning techniques may incorporate blended learning and the flipped classroom; and the use of media to interconnect students to other students with Skype, histogram, twitter and Facebook messenger, and resources that include video games.

**Current Practices in Science Teaching**
Existing teaching methods have long been based on “the rhetoric of well-established conclusion”. The dominant paradigm that most teachers work with according to experts “is essentially” I know and you do not know, and I am to communicate it to you and explain it to you and not you to perform, act and be able to experience your learning. Key issues with how chemistry has traditionally been taught emphasizes:

- Dominated by teacher/talk lecturing
- Extensive curriculum
- Unequivocal (ambiguous terms) and uncontested knowledge
- Minimal opportunity for discussion and critical thinking.

All these occurs as results of the following:

- An overloaded of content in courses due to the rapidly emerging body of scientific knowledge.
- Curriculum being taught as a series of isolated facts that do not facilitate the formation of meaningful connection between facts.
- Lack of transfer of problem solving skills
- Lack of relevance to students’ lives
- Inadequate emphasis on the skills necessary to advance in further studies of chemistry or inadequate emphasis on scientific literacy for those who will not be continuing in the field of chemistry (Gilbert, 2011).

**Contemporary Teaching**
Contemporary practice in teaching science generally emphasizes interactive in nature. Learning science involves **construction and critique**, i.e. knowing why you are wrong on matters, as much as knowing why you are right. Emphasises should be on the following:

- Group work
- Discussion on ideas and not just about facts
- Evidence and argumentation
✓ Use of think-pair share
✓ Concepts cartoons.

The idea of setting chemistry within particular contexts and structuring courses as modules to enhance students’ engagement and learning as developed in the 1980s in United Kingdom (UK) and United States (US) was becoming increasingly popular.

**Context-based chemistry** as opined by (Gilbert, 2006:960) provides meaning to the learning of chemistry as students should experience their learning as relevant to some aspect of their lives and be able to construct coherent “mental maps” of the subject. This is done through providing a focal event or story line based in in a particular cultural setting. Providing this context also allows students to experience relevancy of chemistry to their lives and connect personal stories with the materials to promote more motivations rather than overloading students with the abundance of information. Concepts and facts are only introduced as needed to fully deal with a story line event. Examples of fully implemented context-based chemistry teaching are the Seuters chemistry courses in the United Kingdom (UK) (Bernet and Lussen, 2006). The Chemo and chemistry in context courses in the United States (US). (Schwartz, 2006) and an Israeli industrial based chemistry curricular (King, 2009).

Many chemistry courses based on context-based places emphasis on algorithmic problems. Although these have their place in offering learner confidence in routine procedures and providing techniques and approaches which work more in an open ended problem (especially group-based) have been shown to be highly effective in developing scientific attitudes, generating enjoyment in chemistry and addressing issues where chemistry can be applied in real life situations. These offers opportunities for genuine understanding:

- To develop inquiry-based learning which involves interaction with laboratory work in the curriculum.
- Develops learning outcomes relating to the learning of chemistry which makes chemistry real, tangible, relating to actual materials and their behaviors’
- To illustrate ideas and concepts
- To expose theoretical ideas to empirical testing scientifically i.e. skills by deduction and interpretation, an opportunity to see the enquiry, opportunities to devise experimental apparatus which can offer genuine insights into chemical phenomenon
➢ Practical outcome: most specific skills are irrelevant, but more generic skills are important. Careful observation, safe experimentation, being accurate where appropriate.

➢ General outcome: team working, presenting data, discussing, time management, developing ways to solve problems are enhanced.

**Inquiry-based learning** allows students participate in a community of scientific practice in keeping with the history of how chemistry knowledge has evolved and how chemistry actually is done by scientists. Ways in which inquiry-based learning has been implemented include:

➢ Problem-based learning (guided discovery). Virtual laboratories (guided or full inquiry), Students-led design of laboratory experiments (fully inquiry) and simulation or modeling of chemical concepts such as organic molecular structures (guided or full). All these approaches as case studies has shown to increase students’ engagement, motivation and understanding and long term retention. (Deslauriers, schelew and Wieman, (2011). Strobell and Van Barnevald, (2009), Walker and Leary, (2009). Laboratory experiments in combination with these case studies provide a more authentic scientific experience.

The trends in science education these days is that learning institutions should keep up with the recent advances in technology to better teach their students. The computer and internet’s evolution these past few years have been staggeringly fast. A computer that used to file an entire building in 1960s has about the same computing power as a modern day cell phone. Most of the popular form of media like Television, Radio, and print are slowly being nudged from their pedestal by the internet. Everything seems to have change drastically and so also the instructional strategies in education system. Whether or not technology has a place in the classroom. Consider, tablets, cellphone, twitter, and even video games have found their way into the teaching plans of teachers. Even kindergarteners and low primary pupils are using iPad in the classroom. The use of these new technologies have resulted in a significant increase in curriculum’s efficacy and students’ productivity.

Some of the popular trends in our education today are:

✓ **The use of internet and social media as a teaching tool.** Most students these days know how to use a computer and the internet and most of them are using social media network such as
histogram, face book, what-Sapp etc. to their thoughts and to support each other.

✓ **Condition of educational facilities affects performance:** Better buildings conditions, better the students and their teachers’ performance. A survey done with different schools in the United States as a subjects, they sought to find out how much of an impact a school buildings conditions and facilities affect the students and teachers. Some results point out that better facilities led to less truancy, smoking and substance abuse in the students. It was determine that with better school buildings test scores rose up significantly. And even the behavior of the teachers and how well they instruct their students seem to increase along with improvements in the school.

✓ **Students Teaching Teachers:** Students perform better when they have the opportunity to tell their teachers what things in the class room needs improvements. Contrary to the old believe that students are too young to know what they need. Current trends in education now give the students the opportunity to give pointers to their teachers on how they can better deliver their lessons so that the students can understand. Hence, giving students the chance in contributing and even revising the classroom rules actually make the students abide to and gives them the feelings that they actually have a say on what goes in the classroom. Students tends follow the class rules now since they had a role in making the rules and regulations.

✓ **Paying close attention to each student’s needs:** Educators are not looking at their class as a collective, they see them as different individuals with different needs, which is why some students lag behind the others when it comes to the lecture in teaching. Educators can help these students keep up by giving them personalized attention so that the weaker achiever ones are brought up along with the higher achievers. (www.teach.nology.com) these could be by reinforcement, eye focusing on the students, repetitions of points, frequent giving of assignments, alternative assessment, collaboration, cooperative learning etc.
A Challenge with Conquering.
Challenges of conducting practical examinations under limited science equipment’s limits teachers freedom and authority for the content selection and delivery. Teachers are pressurized to cover the entire content in a limited time at the cost of students learning. Issues that influence learners perception and practices such as the nature of science textbooks which emphasizes on factual information and lack of personal relevance and appeal for students. Integrating technology into the classroom demands as much patience both of teachers and students. Given the tools available, a more efficient effective classroom is well only within reach for most resources both material and human resources in school.
Educators, administrators and those in higher education who are committed to ensuring quality experiments for students across the ages should be excited for the 21st century by ensuring production of quality and professional science educators.

Conclusion
This paper therefore highlights the current changes/new trends, best practices, opportunities and challenges in science education in the academic environment in Nigeria. The emerging trends in science education are resultant effects of technological developments in line with the prepared and well-designed curriculum of that country (Nigeria) that requires proper implementation. Using the current trends as suggested by experts a new educational paradigm containing innovative structures can promote educational reform beyond mere curriculum revision and domain-specific pedagogical innovation. However, implementation measures remains rare and hence context-based and inquiry based on content-driven approaches to teaching and learning, rather than emphasizing the traditional type.

Recommendations
The following recommendations are based on the foregoing highlights
1. Students should been given an opportunity to perform the task at hand and construct meaning and acquire understanding. It is activity focus on core concepts, allowing students to develop thinking process skills and encouraging them to ask questions and seeks answers that enhance their understanding.
2. Teachers should therefore assess students on the different kinds of science process skills needed in science classes; and educate them on the relevance they play on their everyday life so as to arouse students’ interest towards chemistry and also reduce students difficulty on process skills acquisition.

3. The number of periods per week for practical Chemistry lessons should be increased to create room for more elaborate laboratory activities with students. This may help eradicate students’ difficulties in science process skills acquisition and enhance meaningful teaching-learning process which will lead them in acquiring more process skills.

4. Chemistry students’ acquisition of science process skills is negatively affected by large class size, deli belated buildings/facilities, the student-teacher ratio should be drastically reduced to help improve small class sizes, building facilities, hygienic environment such that adequate attention will be paid to students during laboratory exercises since large class size, nature of school buildings and its facilities etc.is identified as a major hindrance for effective teaching and learning.

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