

CHEMISTRY EDUCATION AND VALUES RE-ORIENTATION THROUGH PROMOTING SCIENTIFIC ATTITUDE AND METHOD IN NIGERIA

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Abstract

The Nigerian society is characterized by high level of distrust and suspicion and everybody has become a suspect of misplaced value. Immorality and lack of sanctity of life have increased as murder and kidnapping have become daily occurrence that pervade the society in pursuit of materialism. The malady of corruption has polluted the character and personality of almost every Nigerian. In the present era of science, people are in pursuit of scientific knowledge necessitated by the space, age and the explosion in knowledge in information technology. Chemistry education has taken an important place because it has influential values in intellectual, vocational, aesthetic, practical, psychological, moral, cultural and adjustment arena of an individual. From the perspective of educational system, the Nigerian problem is easily described as the tragic failure of the education system to produce right values and right priorities for Nigerian intellectuals and political leaders alike. This paper examines how Chemistry education as a power instrument of social change could be effective in value re-orientation and how science teachers can utilize scientific attitude and method of science to inspire value re-orientation for socio-economic development in Nigeria.

Keywords: Chemistry education, value re-orientation, scientific attitude and method of science.

Introduction

Today, Nigeria is riddled with numerous values in all spheres of life which is inimical to national development. Changes over time have eroded the earlier cherished values in Nigerian society in all ramifications such as cultural, socio-economic, political, religious, educational and family values. Values refer to what represents the quality of worth which people place on what they have in mind (Okoh, 2012). Values influence peoples' behaviour

and serves as a yardstick for evaluating the actions of other people in the society. Enu and Esu (2011) also opined that values are basic tenets and attitudes in a society either individual values or that of a group of persons or organization which are considered worthwhile and serve as a guide to individual preference and attitudes in our day -to- day life.

The Nigerian society is defined by high level of mistrust and misplaced value. corruption and lack of piety for human life have increased as murder, kidnapping as well as suicide have become daily occurrence that pervade the society in pursuit of materialism.

The factors that promote the emergence of negative values in Nigeria need to be properly explained to the youths as basis of negativity in value system in Nigeria (Njoku, 2015). In education, values are paramount as they are tightly bound to the general idea of education and the operation of schools. Education must be something worthwhile and being worthwhile, has value implication. Corruption is referred as the bane of development in Nigeria, but people often forget that corruption does not exist by itself. What the nation lacks is a system of values and nothing else. Education is central in the development of any economy and nation, a contemporary and thriving educational system constitute a wide-range of activities that would facilitate an effective and quantitative education of eminent standard at primary, secondary and tertiary levels of education (Davidson, 2012).

Chemistry is the study of matter and its properties, the changes that matter undergoes and the energy associated with these changes (Ojokuku, 2012). Chemistry is the central science that is imperative to the understanding of the other sciences such as the physical, biological, material, and the environmental sciences etc. It is central in its usefulness in all facets of the economy for national growth and development, Education through chemistry distinctively qualifies an individual to provide solution to the numerous societal issues prevalent in both developed and developing nations at different levels (Biswatjit, 2012). Chemistry content is tailored towards to enriching learning in the cognitive, personal and social domains.

Concept of Value and Value Re-orientation

The issue of value system in Nigeria had hindered the growth and development of the society leading to the high propensity of materialistic tendencies of our youth. This quest for materialism has permeated government institutions, political institutions and has ravaged both the traditional and

cultural institutions. The feebleness of value crisis has presupposed Nigeria as open society in which anything goes. This misplacement of value has led to misapprehension of the purpose of human life. For the Nigerian, gain with little or no labour at all is ideal. He usually shuns creative labour which promises values other than material. His sole ambition is largely centred on being rich overnight. Oluwagbohunmi (2017) observed that self-discipline, humility, hard work among others are societal values required by youth and the lack of value based leadership, parents' failure to inculcate values in children at early stage and impunity are factors militating against youth development of societal values.

Consequently, it is no surprise to anyone to realize that drug-peddling, armed robbery, knapping and the like evils are rife among Nigerians and by some twist of fate, have become values in themselves as sure means to instantaneous wealth. With reference to the Nigerian society, ignorance is heavily at work. Non-objectivity, wrong values, wrong priorities, false assumptions, disordered and disoriented ambitions and goals are manifestations of ignorance; which results in deceptive opinions in life and distorted ideology of life. The new relevant education and its philosophy ought to make the Nigerian appreciate some higher goals and values. Any nation that desires to be great must be founded upon timeless national values that bind every citizen. National culture must be revisited as it influences national character and image. Darrell, Allan and David (2002) opined that laboratory activities are employed as a means to verify scientific laws and principles, practicing process skills which influences manipulative skills that makes the learner appreciate scientific values.

Values of Chemistry

- According to Dipti (2011), the utilization value of Chemistry includes:
- **Democratic Value:** It develops the capacity of clear thinking and unbiased to new ideas, intellectual uprightness, service to mankind and regard for the opinion of others which are the hallmark of chemistry. Pitafi and Farooq (2012) opined that developing scientific attitude and value is a potential means of eliminating intolerance, gullibility and superstition.
 - **Practical Value:** We are in an age of science and everything around us concerns science. Some knowledge of the present position and progress of chemistry is necessary for adequate understanding of the world

- around us. We are becoming more dependent on scientific discoveries and their daily applications such as science revolutionized means of transportation which has brought the world together, the medicinal value of science has brought about some medical miracles, curing diseases, prolonging life and preserving health.
- **Cultural Value:** Chemistry has a cultural value because it now forms an essential part of our social heritage. It has a literature of its own which is no less appealing than that of more humanistic studies. The history of scientific discoveries, the advantages, their mode of living, their spirit of sacrifice places science in the first rank of humanistic studies. A knowledge imparted by the study of different branches of science develops in the learner a logical mind, a critical judgement and a capacity for scientific organization. It produces in the learner the breath of imagination which is essential for a proper solution of societal problems.
 - **Disciplinary Value:** The teaching of chemistry has peculiar disciplines popularly known as scientific attitudes to develop among the learners. These attitudes or disciplines include open mindedness, sharp observation, critical thinking, suspended judgment, free from bias, desire for accurate knowledge which once developed, proves beneficial in life later on.
 - **Moral Value:** Chemistry develops morally by teaching truthfulness and reasoning. Every scientist is a seeker of truth. Although in modern materialist world, truth may not always succeed. A business man earns millions by false ways and means, a successful politician may not draw the real picture of things to attract followers, a lawyer may flourish only by lying. But that does not mean that living in truthfulness is bad. Actually a student of chemistry aims at a different type of success which weight down to the view that everything must be tested on the touch stone of reason and truthfulness, which are developed by the learning of science.
 - **Vocational Value:** Chemistry forms the basis of many of the studies of a purely vocational nature and thus prepares learners for various professions like medicine, engineering, agriculture etc. thus it is quite clear that chemistry as a subject which is closely associated with own daily life and the world which surrounds us and is so useful to an individual as well as the community as a whole, cannot be neglected

from the school curriculum. Steel(2010) observed that cognitive values defined the shared commitment of science that is the standard assessment that characterize the scientific approach as a whole.

- **Aesthetic Value:** Every man of science has passion for truth. In nature everything we find is beautiful and the discovery of the mysteries of nature is the concern of chemistry. Moreover, science is an art. Every man of science is an artist, an artist aims more deliberately at beauty, while a scientist ultimately comes to beauty through reasoning and truthfulness. Every scientist relishes the aesthetic aspect of his discovery and inventions and feels an intense charm in unfolding the pleasure of nature and natural phenomenon. He manifests his aesthetic impulse when he undertakes a probe for universal laws and comprehensive theories.
- **Psychological Value:** The entire teaching and learning process of chemistry is based on basic ideology of psychology. The principle of learning by doing method, learning by observing, concrete and living specimens are the primary things in psychology.

Re-orientation Through Scientific Attitude and Scientific Method

The major contributions of chemistry education are imbedded in the submersion of scientific attitude in the learners. The credit of development of scientific attitudes however, goes to the scientific methods adopted by sciences both in its development and application. A subject can be named as science provided it encompasses the two essential features as scientific attitude and scientific method. Both aspects are given important place in the curriculum of the teaching of sciences at any stage of teacher preparation.

Ibraheem and Badius (2017) opined that science laboratory is an essential instrument that chemistry teachers can manipulate on the learner for value re-orientation as the laboratory experience enhances meaningful learning and laboratory skills.

The developing countries are faced with the issues of population explosion, poverty and corruption. The efforts of these nations towards developments with Nigeria inclusive are hindered by value misplacement which has generated value crisis crushing the citizens. The greatest worry is that some of the value systems pursued by many Nigerians especially the leaders, do not promote national unity and development, hence the need for a new value order or a better value re-orientation education at all levels of the

system. Education can be one of the prominent tools for socio-economic growth of any nation if given the attention it deserves. Kattari (2014) opined that chemistry education is geared towards preparing learners to undertake specific task essential to the transformation of the society for value re-orientation

Chemistry education thus can perform a vital role in checking and solving these problems through development of knowledge, understanding, skills, abilities and attitudes of the citizens of a country. The study of chemistry has its special importance both in the personal and social life of an individual. The value of chemistry education in the development of scientific attitudes which are transferable, strives to strip the deceptive beliefs or notions spread in the society and embrace the habits of proper reasoning, observation and experimentation, leading to a firm belief in testing and verification of facts which creates a spirit of inquiry for new things, learning about their environment, the nature of things and events surrounding them. Talisayon (2004) observed that the transferability of skills and values to many areas of life are crucial for sustainable societal development.

One of the chief and essential aims of chemistry education is the emergence of scientific attitude among its learners. Thus, it is imperative for chemistry teachers and educators to understand the meaning, significance and process of the development of such attitude. Scientific attitude can be said to include open mindedness; a drive for accurate knowledge, confidence in process of seeking knowledge and the expectation that the solution of the problem will come through the use of verified knowledge. Through chemistry education, the student can acquire scientific attitudes characterized by open-mindedness, curiosity, tolerance, honest doubt, respect for others' point of view, critical observation and thought, freedom, judgement made on scientific facts, faith in cause and effect relationship and a planned procedure in solving problems (Joshi, 2005).

The modus operandi the scientist uses in the pursuit of science is termed scientific method. It is a way of solving problems scientifically. Training in scientific method is important to students than mere acquisition of knowledge. By this method, students of chemistry are trained in the use of scientific methods by performing experiments themselves in the laboratory and by observing experimental demonstrations arranged by the teacher. Once the students are trained in the method, they will approach all problems in the same way, even if they are put in a situation which they are ignorant and unaware of.

The scientific method is endowed with the following features; objectivity, definiteness, verifiability, generality, predictability, modification and dynamicity. The scientific method involves, the appreciation of the existence of a problem and a drive to solve it, the gathering of facts and data relevant to the problem, statement of hypotheses, testing the acceptance or rejection of the hypotheses as well as rational interpretation of data based on valid evidence. Through chemistry education, students are naturally inclined to skillfully employ rational critical thinking habits in solving problems in their day- to - day lives and by extension, the society. They are able to adopt the following steps in solving a problem in any sphere of his life; identifying the problem, formulating the hypothesis, gathering relevant evidence, testing its validity and accuracy, organizing and interpreting the data, and drawing rational conclusions (Dipti, 2011).

Benefit of Chemistry Education for Socio-economic Development

According to the Constitution of the Federal Republic of Nigeria, (1999); dignity of labour, discipline, integrity, religious tolerance and self-reliance amongst others are attributes that are considered as values in national ethics or character. The National Policy on Education (2004) also specified value system acceptable in the country that should be inculcated in the learners through the quality of educational instruction.

The sole responsibility of developing scientific attitudes among students lies in the teacher who can manipulate all the situations to instill in students the characteristic features of scientific attitude. At the same time, the teacher presents himself to the students as an example for his intellectual honesty, respect for others' points of view, unbiased and impartial behaviour in his dealings, open mindedness and the like. The students in turn, emulate the teacher for his qualities and values which leaves a favourable and permanent impression in the students to adopt the same attitude and values. Ibraheem (2016), opined that science teachers are the nucleus for technological advancement in any society, chemistry education serves as a focal point for value re-orientation in the society and teachers can accomplish this, by being motivators, facilitators, role models to the learners who are active participant in the teaching and learning process and in the attainment of educational goals and objectives (Omadivi, 2011).

An enthusiastic teacher can help in developing the scientific attitude through the curriculum by providing opportunities in problem solving.

Students who engage in extensive reading in general science are believed to cultivate scientific attitudes more than those who read only one text book. Democratic atmosphere in the classroom infuses a spirit of healthy criticism and this minimizes wishful or biased thinking on the part of the students. They undertake free discussion which helps them to remove difficulties and prejudices as well as develop open mindedness, rational thinking and learn to accept only what is verifiable. The students are taught to investigate the truth and to suspend judgement till sufficient evidence is found, observing critically and accurately, and to report actual observation while being discouraged from the habit of concocting and copying. According to Joshi (2005) an individual can be described as a man of scientific attitude if he possesses the following;

1. Has spirit of curiosity.
2. Believes in cause and effect relationship.
3. Believes in the theory of evidence.
4. Is open minded.
5. Has love for truth.
6. Adopts scientific method in his thinking and working.
7. Is unbiased and impartial
8. Is free from superstitions and prejudice
9. Is clear and precise in doing and saying.

A person possessing scientific attitude is found to be very curious by nature and is always curious to know more and more about things, persons and events surrounding him. He continues to explore till he gets proper explanation and satisfactory response to the queries. A man of scientific attitude holds firm a belief that nothing happens without a valid cause and does not believe in misfortune and superstitions but thinks that behind every event there is some definite physical force, and the events occur in a definite pattern following the scientific laws and principles and in no case are they governed by the supernatural.

A man of scientific attitude is in the habit of accepting only those things that prove true on the basis of collected evidences and he accepts the facts in their true colour and form. He rejects all biased and prejudiced statements which are not grounded on sufficient evidence and consequently reports what he actually experiences in exactly the same degree and amount without exaggeration. The person having scientific attitude is not narrow minded, he does not consider his own opinion as final but always ready to

modify them on the basis of correct reasoning and valid proofs. He has the patience to listen to others' point of view and considers them meticulously.

A person having scientific attitude does not accept wrong and false statements or views, he is always honest in the application of his real pursuit for truth and honest in the application of his knowledge and does not allow it to be diverted in the wrong and undesirable direction. A person of scientific attitude does not react irrationally and instinctively and is quite scientific in his reasoning and thinking. He ponders well before deriving conclusions, behaving in a particular way. He always uses scientific procedure and methods in solving a problem.

Scientific attitude is thus, a particular set of mind characterized to involve the personality traits like open mindedness, freedom from biases, prejudices and superstitions, honesty, truthfulness, clarity and critical mindedness in one's approach, clarity and precision in saying and doing, desire for reaching the truth on the basis of sufficient evidence following scientific method. Chemistry teachers ought utilize innovational approaches to teaching chemistry that will inspire students to be active participant in the lessons, acquire skills, nurture ideas and cultivate rational thinking to improve ingenuity that brings about innovations.

Conclusion

Value re-orientation in Nigeria through chemistry education could lead to redeeming and salvaging our national character and image as well as a vibrant economy. In order to nourish and embed values positively in children, chemistry teachers must act as role models, acquire the intellectual ability, emotional soundness and indisputable moral standards as well as commitments needs to embed in students these positive values. Making national character re-orientation an integral part of the curriculum of teacher education will enable teachers establish and internalize values they would cultivate in the learner. It is said that good teachers build enduring foundations that make good schools and a good nation.

The importance of chemistry education in contemporary society on re-orientation of pre-service and in-service science teachers in order to develop holistic concept of science education and to empower in-serving teachers to apply direct and indirect techniques in the development of values through inculcating scientific attitude. The re-orientation programmes for present and in-service teachers should be conducted by experts in the field of value

education and emphasis laid on production of multi-media resource materials on education in human values to produce education for tomorrow that would ensure character development and transformation, which result in socio-economic growth and development of a nation. Re-orientation of our value system through chemistry education would promote patriotism, respect for human life and national values.

Recommendations

1. There is need to shift the spotlight in the teaching of chemistry from learning chemistry as a body of knowledge to promoting the educational skills and values to be acquired through chemistry education.
2. Chemistry teachers should insure relevance of the conceptual learning within chemistry for social issues. There is need for a shift from an introduction of the issue followed by the conceptual learning towards the interaction with the issue in a social context and the application of the conceptual chemistry that is being learned, to arrive at a socio-scientific decision.
3. Chemistry teaching should be geared towards the attainment national goals of education that covers a wide range of intended values in the intellectual, personal and social domains
4. Relevance of some theoretical and practical chemical knowledge to day-to-day activities and entrepreneurial opportunities should be pointed out when implementing the chemistry curriculum.

References

- Biswajit, R. (2012). *Modern Methods of Teaching Chemistry*. New Delhi: A P H Publishing Corporation. Constitution of the Federal Republic of Nigeria, Act No.24 5 May 1999
- Davidson, A. (2012). Current Educational Issues in Computer Science Education: Problems and Prospects. *The Multidisciplinary Journal of Research Development*, 20(2), 155-162.
- Darrell, F., Allan, H. & David, H. (2002). Practical tasks in senior secondary school classes. Curtin University of Technology. Avi-Hofstein

- Dipti, P. B. (2011). *Teaching of Science*. New Delhi: A P H Publishing Corporation
- Enu, D. B., & Esu, A. E. (2011). Re-engineering Values Education in Nigeria Schools as Catalyst for National Development. *International Education Studies*, 4(1), 147-153
- Federal Republic of Nigeria (2004). *National Policy on Education*. Lagos: NERDC Press
- Ibraheem, A. O. (2015). Influence of Science Teachers' Competence on the Students' Performance in Secondary School Biology. *Academic Scholarship Journal*, 10(1), August.
- Ibraheem, A.O. & Badiu, B.(2017). Science education for value re-orientation, poverty eradication and national development. *Journal of Teacher Perspective*, 12(2)1-13
- Joshi, S. R. (2005). *Teaching of Science*. New Delhi: A P H Publishing Corporation.
- Kattari, D. S (2014). Re-engineering education for employment and self-productivity in Nigeria. A paper presented on the 14th annual national conference for advancement of knowledge (NAFAK), Auchi Polytechnic Auchi,4(1) 119-128)
- Njoku, D. I. (2015). Re-orientation of value system in Nigeria: A critic. *Global Journal of Arts, Humanities and Social Sciences*, 3(11), 25-32.
- Ojokuku, G. O. (2012). *Understanding Chemistry for Schools and Colleges*. Zaria: Press-on- Chemresources.
- Okoh, F. N. (2012). Reinforcing value re-orientation for national development. *The Nigerian Academic Forum*, 23(1), 1-9.

Oluwagbohunmi, M. F. (2017). Value Re-orientation for Youth: An Imperative for National Development. *European Journal of Education Studies*, 3(5), 705-714.

Omadivi, A. O. (2011). Critical Thinking Skills Approach to improving Science Education in Nigeria: The Role of Science Teachers. *Journal of Science and Vocational Education (JSVE)*, 5(1), 54-59.

Steel, D. (2010). "Epistemic values and the argument from inductive risk" *Philosophy of Science* 79(5), 893-904

Talisayon, V. M. (2004). Development of scientific skills and values in physics education. University of Philippines.