INVESTIGATING CHEMISTRY TEACHER'S PERCEPTION AND ATTITUDE TOWARDS INTEGRATION OF GREEN CHEMISTRY PRINCIPLES INTO SECONDARY SCHOOL CHEMISTRY CURRICULUM: A CASE STUDY OF LAGOS STATE.

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Abstract

All over the world today, it is expedient to educate individuals who would also become responsible citizens who make decisions that involve applications of chemistry to solve pressing environmental problems through the knowledge of Green Chemistry. The important of integrating green chemistry throughout the different levels of education cannot be over-emphasised, as it is essential for creating a workforce and public that is well informed on the importance and the benefits of sustainable development. This study investigated chemistry teachers' perception and attitude towards integrating green chemistry into Nigerian senior school chemistry curriculum using Lagos State as a case study. 150 chemistry teachers selected from some secondary schools in Lagos State using convenience sampling technique formed the sample for the study. The study adopted descriptive survey research design using Perception and Attitude of Chemistry Teachers towards Integrating Green Chemistry Principles Questionnaire (PACTIGCPQ) to obtained information to answer and test research questions raised and the formulated hypotheses respectively. The data collected were analysed using mean, standard deviation, simple percentage and T-test statistical tools. The study revealed that the chemistry teachers are of the view that GC should be integrated into chemistry curriculum and they also indicated positive attitude towards its integration. The findings also show that their perception and attitude are not influenced by gender. Based on these findings, it was recommended that green chemistry concepts should be incorporated into secondary school chemistry curriculum. And in-service training, seminars/workshops/conferences should be organised for chemistry teachers for capacity building on Green Chemistry education while it is also necessary to incorporate GC into teacher education curricula so as to prepare the pre-service chemistry teachers for the future teaching with environmental sustainability consciousness.

Introduction

Nigeria represents a unique demographic situation: on one hand, the country has a high rate of population growth typical of developing countries, while on the other, it is characterised by different lifestyles, consumption patterns, solid wastes disposal, and domestic wastewater discharges, economic and industrial development characteristic of the developed world. Consequently, Nigeria faces huge challenges regarding environmental sustainability development, which makes educating people about new approach to treat the environment is very important and a tool for achieving environmental sustainability. With the glaring threat of global climate change, environmental pollution and decreasing resources, a call for a movement toward more sustainable practices emerged. It is imperative that the inhabitants of the globe change the way they live and strive to be more aware of our personal actions towards our environment and sustaining the future for our children (Klingshirn & Spessard, 2009).

Over the past centuries, chemistry as a subject has played a major role in improving our welfare. Meanwhile, some of the designed molecules in chemistry have polluted the environment either in some stages of their regular life-cycle or as a result of accidents. Interestingly, chemistry is also an important discipline that contributes to the design and implementation of sustainable development strategies. That is, it a good course through which sustainable concepts and principles can be integrated into teaching/learning process so as to equip the future scientists with the required knowledge of how to tackle complex environmental problems (Grassian, Meyer, Abruña, Coates, Achenie, Allison, Wood-Black, 2007). According to Ware (2001a), chemistry has the potential to solve problems faced by societies as they struggle to achieve sustainable development, as the people constantly interacts with chemistry and industry. Salta & Tzougraki (2004) also, reported that chemistry could solve environmental problems and improve the quality of lives.

Despite the importance of chemistry in education for sustainability, studies in some parts of the world revealed that both in-service and pre-service teachers struggled to apply the ideas of Education for Sustainable Development (ESD) and Green Chemistry (GC) in their teaching through chemistry (Burmeister & Eilks, 2013). This is why Agbayewa, Oloruntegbe and Alake (2013) opined that there is a need to incorporate the GC principles into lower level chemistry so as to catch them young and, also make green chemistry concepts available in all teachers training curriculum so as to prepare the teachers for sustainability consciousness.

In response to growing advert effect caused to the environment through chemistry activities, the concept of green chemistry was developed and introduced in the 1990s by Paul V. Anasta and John Warner and their definition of GC has been universally accepted. According to them "*Green chemistry is the utilisation of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products"* (p. 11) (Anastas & Warner, 1998).

Green Chemistry (GC), also known as Sustainable Chemistry (SC), is a idea related to the making of chemical products and processes that aims at reducing or totally eliminate the use and production of hazardous substances. According to Clark and Macquarrie

(2002), GC represents two components; efficient utilisation of raw materials and the elimination of waste, and health, safety and environmental features of chemicals and their manufacturing processes. It has been accepted that green chemistry is the way to allow chemists to design a safer, healthier and more sustainable world (Sheldon, 2008). Also, International Pure and Apply Chemistry (IUPAC) defines green chemistry as "*the invention, design, and application of chemical products and processes to reduce or to eliminate the use and generation of hazardous substances*" (IUPAC, 2013, P: 23)

GC is a way to make less risky chemical products and processes, where hazardous substances are absent or formed only in negligible amounts. The smaller risk means reducing or eliminating the hazards (Poliakoff, Fitzpatrick & Anastas; 2002). It prevents environmental pollution already in the design phase of a molecule or chemical reaction. With knowledge of GC, Chemists can manipulate the molecular characteristics of a substance so that it possesses a reduced hazard or no hazard at all. Therefore, considering the safety of a substance in the very beginning, that is, in the molecular design phase, affects the whole life-cycle of the substance. This is also most often the economically efficient way to design a molecule or reaction (Böschen, Lenoir & Scheringer, 2003).

The knowledge of GC is important to scientists/educators and students, as it helps to address the environmental and sustainability issues through: the development of renewable energy sources that are more environmentally friendly; the use of reagents derived from renewable materials; and replacing pollution-generating technologies with clean alternatives. Green chemistry tackles complex global issues, such as climate change, energy supply, and environmental quality. Central to this is an emphasis on design, specifically systematic human interventions to promote advancement toward sustainability (Lozano & Warson, 2013). As stated in the report on Unleashing Green Chemistry and Engineering in Service of a Sustainable Future Workshop held in September 23, 2011, in New York City, GC offers some benefits to scientists, educators, businesses, policymakers, and the public. For scientists, it provides a platform for not only eliminating hazards and waste, but also for creating new, innovative, and efficient methodologies that brings about production of new sustainable substances. For educators, it is a tool for inspiring students to pursue scientific careers, providing context to a subject that is often abstract in this case, chemistry, and preparing the students for the future sustainability challenges. Green chemistry makes it possible for people to understand many issues that threaten the sustainability of the planet, such as the mechanisms behind climate change and the potential side effects on our personal lives caused by the production of goods and alternative energy production (Burmeister, Rauch, & Eilks, 2012).

Students of today would also become responsible citizens in the nearest future, making decisions that involve applications of chemistry to solve pressing problems in the society. Thus, understanding Green Chemistry principles will provide informed support for making such decisions when deem necessary (De Vos, Bulte, & Pilot, 2002). Hjeresen *et al*., (2000) also mentioned that Green chemistry learning will ensure the creation of a new generation of chemists possessing the skill and knowledge to practice environmentally friendly chemistry.

The important of integrating green chemistry throughout the different levels of education cannot be over-emphasised, as it is essential for creating a workforce and public that is well educated in the importance and the benefits of sustainable development. Through integration of GC into school curriculum, the following benefits can be realised: "healthier, safer schools; a well-informed public; higher student retention and engagement; and better preparation for the workforce". To buttress this point, Anasta, Levy & Parent (2009) submit that the infusion of Green Chemistry principles at the undergraduate level curriculum is said to be a proven key to adopting more sustainable practices and therefore a more sustainable society. Hjeresen & Bose (2000) further established that students can benefit directly from having encountering these concepts of GC in the process of learning. They opined that students can learn the importance of sustainable practice and become aware of positive everyday habits. Although, the chemical industry has contributed largely to environmental degradation, students can also learn how it could become a solution to the environmental problems currently seen if its activities are well harnessed.

In developed countries like USA, the concept of GC has received a laudable research attention at university and industrial levels for sometimes now. But more effort is needed to popularise the concept, as many scholars, academics and university leaders and curricula developers are still ingnorance of the concepts of green chemistry, especially, in the developing countries like Nigeria. In addition, Auliah & Mulyadi (2018) believed that teachers' perception and integration of GC concepts into the curriculum to achieve sustainable development in the field of chemistry need to be promoted among educators for proper spreading of the information to their students. Therefore, Lozano and Warson (2013) suggested four approaches through which green chemistry concepts can be successfully incorporated into the existing curriculum, and make it easy for the teachers who are the stakeholders abreast of this important concept. These approaches are: "infusing some environmental issues which green chemistry can help to solve into an existing syllabus; a specific sustainability course should be added to the curriculum; connecting green chemistry and sustainability activities with every course available and link these concepts to the environments of the learners, and offer environmental sustainability as a specialisation within the framework of particular faculty" in an attempt to better the state of the environment, the economic and the society.

Despite the numerous important of green chemistry and its incorporation into specific or the whole school curriculum, the attitude, perception and knowledge of the teachers who are major agents in bringing about any significant change in education are not well known. According to Tuncer, Tekkaya, Sungur, Cakiroglu, Ertepinar, and Kaplowitz (2009), teachers produce students who are environmentally responsible when they are themselves environmentally knowledgeable, have positive attitudes towards the environment and show concern for environmental problems. Also, finding from the research conducted by Owoyemi & Adesina (2018) on promoting environmental sustainability through green chemistry, it was revealed that chemistry teachers possess low knowledge of the green chemistry concepts.

However, reform in chemistry education is desperately needed so as to address the issue of sustainability through chemistry teaching (Ware, 2001). This might start with innovations in teacher education that aim at creating awareness(Owoyemi and Umanah, 2019) and preparing the teachers for the teaching of sustainability concepts in the classroom, as it is widely recognised that the most important stakeholder in the effective innovation of changes in teaching practices are the teachers themselves (Anderson & Helms, 2001). It has also be established in the literature that, taking into account teachers' perception, beliefs, prior knowledge and attitudes, are necessary preconditions for any success in educational reform (Haney, Czerniak & Lumpe, 1996).

For example, Auliah & Mulyadi (2018) investigated the Indonesian teacher's perceptions on GC principles and found that only 31.38% of the teachers think that green chemistry concepts are needed to be incorporated into the chemistry curriculum; 47.42% of the teachers perceived that it does not matter while 21.20% were neutral in their opinion. They therefore opined that teacher's perception and integration of GC concepts into the curriculum to achieve sustainable development in the field of chemistry need to be promoted among educators for proper spreading of the information to their students. Also, Mario (2015) study on the reaction of Maltese sixth form students to the incorporation of green chemistry concepts into the curriculum. The study showed that GC raised the students' environmental awareness and their interest in chemistry, and may also influence their motivation to follow a chemistry-related career. And he concluded that students strongly supported the inclusion of green chemistry in future A-level chemistry curricula. Surprisingly, little or no similar study has been done in this part of the world, hence, the need for this kind of study in Nigeria.

Some researchers have also shown that environmental problems affect women and men in different ways and that women and men have different attitude towards environmental issues owing to their physiological differences and gender- role differences, therefore, it is expedient in these circumstances to approach every environmental issue from gender perspectives. Organisation for Security and Co-operation (2009) noted that the goal of gender mainstreaming for environmental protection is to promote equal opportunities for men and women as participants and beneficiaries of environmental protection by considering their different positions and knowledge in regard to the environment. This includes producing and disseminating information about environmental protection, reaching out to both women and men, and recognising their different roles and priorities in relation to the environment. In the light of this, it is therefore a worthy course to examine how female and male chemistry teachers view the integration of GC into the curriculum and their attitude towards the integration.

Recognising the importance of knowledge of green chemistry on environmental sustainability, and the fact that solving the environmental problems of the planet will one day become the responsibility of future scientists and science educators (Ridley, 2011), this study is therefore intend to investigate the chemistry teachers' perception and attitude towards integrating green chemistry principles into Nigeria senior school chemistry curriculum.

Statement of the Problem

Green chemistry has been advocated for as a new way to look at chemistry teaching. It is a new method of teaching chemistry that focuses on reducing risk, and preventing hazardous substances from being released into the environment (Anastas, Levy & Parent, 2009). Nigeria as a nation, is not exempted from the various environmental problems such as erosion, climate change, flood, water pollution, air pollution among others that are ravaging the whole world today. For instance, in 2012 Nigeria was raided with flood which created an indelible impact on about 12 states in the country (Jackson, 2013). These problems may be as a result of direct or indirect effect of upsurge population, and increase industrial activities, therefore, it is imperative to seek an alternative way with which these issues can be addressed. One of the ways is to integrate GC into Chemistry curriculum at all level starting from secondary school so as to empower students with adequate knowledge of how to make our environment becomes sustainable for the this generation and the next generation. Searching the literature further, it was gathered that graduate teachers from Universities and other Teacher Training Schools are with minimal exposure to sustainable education (Cutter-McKenzie & Smith, 2003). In Nigeria, research study conducted by Owoyemi & Adesina (2018), revealed that chemistry teachers possess a low knowledge of the Green Chemistry principles. In addition, Owoyemi and Umanah (2019), reported based on their findings that there are very low level of awareness/knowledge of the concept, principles and significance of GC among secondary school teachers regardless of their professional qualification. These findings indicate a serious challenge at hand, as the students' performance and transmission of environmental knowledge to favourable practices and actions dependent largely on their experiences and exposure to the principles of GC in school. At this juncture, it is pertinent to say that this study is imperative as the issue of the stakeholders' perception and attitudes towards the integration of GC into school chemistry curriculum is yet to receive much research attention in developing countries especially in Nigeria. Thus, this study investigated teachers' perception and attitude towards integration of Green Chemistry principles into secondary school chemistry curriculum.

Research Questions

i. What is the teachers' perception of integrating Green Chemistry principles into secondary school chemistry curriculum?

ii. What is the teachers' attitude towards integrating Green Chemistry principles into secondary school chemistry curriculum?

Research Hypotheses

Ho_1 There is no significant influence of gender on teachers' perception of integrating Green Chemistry principles into secondary school chemistry curriculum.

Ho_2 There is no significant influence of gender on teachers' attitude towards integrating Green Chemistry principles into secondary school chemistry curriculum.

Research Method

The descriptive survey research design was adopted for this study. The population for the study comprised all chemistry teachers in Lagos State while one hundred and fifty (65 male and 85 female) chemistry teachers selected using convenience sampling technique as the sample for the study. An instrument titled "Perception and Attitude of Teachers towards Integrating Green Chemistry Principles Questionnaire (PATIGCPQ)" was used for data collection. The instrument was developed by the researchers and is made up of three sections; the first section contains demographic information such as school and gender of the participants in the study, the second section is made up of 12 items on the participants' perception while the third section contains 10 items on their attitude towards integration of GC principles into secondary school chemistry curriculum. The response type used was the four Likert scale type of Strongly Disagree (SD), Disagree (D), and Agree (A) Strongly Agree (SA). The instrument was subjected to face and content validity by three experts in item development while its reliability($r = 0.80$) was established using Cronbach alpha. Thereafter, the researchers set out for data collection. Data collected were subjected to statistical analysis using frequency counts, mean and standard deviation in order to answer the research questions raised in the study and T-test to test the hypotheses formulated at 0.05 alpha level.

Results and Discussion of the findings

Research Question One: What is the teachers' perception of incorporating Green Chemistry into senior school chemistry curriculum?

Table 1: Chemistry Teachers' Perception of Incorporating Green Chemistry Principles

S/N	ITEMS	SA	A	D	SD	M	SD
1.	Green chemistry(GC) principles should be practiced in the laboratories	76(50.7%)	39(26.0%)	23(15.3%)	12(8%)	**3.19**	**0.974**
2.	It is better to prevent waste generation than to eliminate it after its generation	52(34.7%)	57(38.0%)	29(19.3%)	12(8.0%)	**2.99**	**0.930**
3.	Teachers are in the best place to promote green chemistry activities during teaching/learning process	59(39.3%)	60(40.0%)	24(16.0%)	7(4.7%)	**3.14**	**0.852**
4.	Teachers should remain at the center of any innovation in the chemistry curriculum	71(47.3%)	53(35.3%)	19(12.7%)	7(4.7%)	**3.25**	**0.853**
5.	As a chemistry teacher, I have a	59(39.3%)	60(40.0%)	21(14.0%)	10(6.7%)	**3.12**	**0.889**

	pivotal role in integrating green chemistry principles in my teaching						
6.	The curriculum planners should integrate GC into secondary chemistry curriculum	53(35.3%)	67(44.7%)	21(14.0%)	9(6.0%)	**3.09**	**0.854**
7.	Integrating GC into curriculum is not possible because the curriculum is already crowded	29(19.3%)	47(31.3%)	49(32.7%)	25(16.7%)	**2.53**	**0.988**
8.	Integrating GC principles in the chemistry curriculum can be a solution to the glaring environmental issues.	47(31.3%)	76(50.7%)	21(14.0%)	6(4.0%)	**3.09**	**0.780**
9.	Teachers are the best stakeholders in the implementation of green chemistry	44(29.3%)	66(44.0%)	30(20.0%)	10(6.7%)	**2.96**	**0.874**
10.	Green chemistry is another type of chemistry and its curriculum should be handled by an expert.	42(28.0%)	62(41.3%)	34(22.7%)	12(8.0%)	**2.89**	**0.906**
					Weighted mean=3.03		

Table 1 shows the descriptive statistics by percentages, mean and standard deviation of chemistry teachers' response to the integration of green chemistry into secondary school chemistry curriculum. From the Table, the items item 1(3.19), 2(2.99) and 8(3.09) respectively, show that the majority of the teachers were of the view that it is important to integrate GC principles into the curriculum so that they can practice it in their daily laboratories activities so as to solve our environmental issues. Items 3(3.14), 4(3.25), 5(3.12) and 9(2.96) showed theparticipants' view of how important is the role of the teachers in the implementation of curriculum intention and innovations. This implies that without teachers' acceptance in terms of awareness, knowledge and positive attitude towards integration of GC, it is likely impossible to achieve the objectives. However, item 6 (3.06) indicates that the teachers think integrating GC into the established curriculum is impossible because it is already crowded, and perceived (item 7: 2.53) that green chemistry should be the work of curriculum planners and experts.

Therefore, Table 1 shows that teachers agreed that GC should be integrated into chemistry curriculum based on the high weighted mean value (3.03). This implies that the teachers believed that incorporating GC into the chemistry curriculum can help to tackle the environmental issues.

Research Question Two: What is the teachers' attitude towards incorporating Green Chemistry into senior school chemistry curriculum?

Table 2: Chemistry Teacher' Attitude towards Integrating Green Chemistry Principles

S/N	ITEMS	SA	A	D	SD	M	SD
1.	I would like to know more about green chemistry	81(54.0%)	41(27.3%)	18(12.0%)	10(6.7%)	**3.29**	**0.920**
2.	I am ready to incorporate green chemistry principles in my laboratory practices.	64(42.7%)	57(38.0%)	21(14.0%)	8(5.3%)	**3.18**	**0.870**
3.	I have a responsibility to engage in green practices.	59(41.7%)	68(39.0%)	18(14.0%)	5(5.3%)	**3.21**	**0.780**
4.	As a teacher I have a pivotal role to incorporate green chemistry in the curriculum	45(30.0%)	67(44.7%)	32(21.3%)	6(4.0%)	**3.01**	**0.820**
5.	Green Chemistry concepts in the curriculum can help to correct the current environmental issues	50(33.3%)	78(52.0%)	15(10.0%)	7(4.7%)	**3.14**	**0.780**
6.	I need to be trained so as to be able to incorporate green chemistry in the curriculum	65(43.3%)	58(38.7%)	22(14.7%)	5(3.3%)	**3.22**	**0.820**
7.	As a teacher I can play an important role in solving environmental problems through	64(42.7%)	64(42.7%)	15(10.0%)	7(4.6%)	**3.23**	**0.860**

	green chemistry						
8.	As a teacher I believe that the knowledge of Green Chemistry is necessary for chemistry students	79(52.7%)	47(31.3%)	18(12.0%)	54.0%	**3.22**	**0.860**
					Weighted mean=3.19		

A look at Table 2 reveals the attitude of teachers towards incorporation of Green Chemistry into senior chemistry curriculum. The first item with mean value 3.29 in the table, affirm that the teachers would like to know more about green chemistry. Item 4 with mean value 3.01, also indicates that the teachers agreed that they have a pivotal role to play in incorporating GC concepts into the curriculum while item 7(3.23) reveals the teachers' agreement to the importance of incorporating GC into the chemistry curriculum as a means of solving environmental problems. In fact, the participants' agreement to all the items exhibits positive attitude toward GC integration into the curriculum. This implies that teachers have positive and promising attitudes towards incorporating green chemistry concepts into senior chemistry curriculum.

Hypotheses Testing

Hypothesis One: There is no significant influence of gender on teachers' perception of integrating Green Chemistry principles into secondary school chemistry curriculum.

Table 3: T-Test Analysis of Chemistry Teachers' Perception based on Gender.

Gender	N	Mean	Std.	T	Sig.	Remarks
Male	65	18.52	3.95	0.014	0.90	Not Significant
Female	85	18.55	4.05			

Table 3 shows a significance value of 0.906 which is greater than 0.05 and this implies that here is no significance difference in the view of male and female chemistry teachers regarding incorporating GC into senior school chemistry curriculum.

Hypothesis Two: There is no significant influence of gender on teachers' attitude towards integrating Green Chemistry principles into secondary school chemistry curriculum.

Table 4: T-Test Analysis of Chemistry Teachers' Attitude based on Gender.

Gender	N	Mean	Std.	T	Sig.	Remarks
Male	65	3.22	.86	0.034	0.85	Not Significant
Female	85	3.13	.94			

Table 4 shows significance value of 0.85 which is greater than 0.05 and this implies that there is no significant influence of gender on chemistry teachers' attitudes towards incorporating green chemistry into senior school chemistry curriculum. Hence, the null hypothesis is retained.

Discussion of Findings

The findings of the study show that teachers were of the view that GC should be integrated into the chemistry curriculum; this is evidence in the high level of agreement displayed in their perception and positive attitude towards incorporating GC into chemistry curriculum through their ratings.

Specifically, Table 1 revealed that chemistry teachers are of view that GC should be incorporated into the school chemistry curriculum. This is welcome relief, that teachers in this part of the world are willing to see GC concepts integrated into the curriculum as depicted in the respective high level agreement to the different statements addressing their perception. This finding is in agreement with Endsley (1995) model of situation which showed that awareness of a situation which is a function of perception and comprehension of the situation influences decision and actions. The finding reflects the level of teachers' readiness to integrate the principles of GC in their future classroom practices. This finding is consistent with the findings of Schulte et al (2013) who observed that good perception of the environment encourages peoples' ability to make decisions that will foster its sustainability. Similarly, Hill et al (2013) emphasised that the vision of GC is holistically aligned with environmental sustainability and to achieve the overall goals of GC, the teachers must have positive interest in the teaching of it. The finding of this study also corroborates the findings of Sufi (2014) which maintained that GC is needed for sustainability and safety concepts for the world of physical and natural science; GC cannot be completed without emphasising its significance towards achieving environmental sustainability in school. The finding is in accordance with Adeoye (2012) who opined that the concept of GC when properly harness has the ability to shape future sustainability and development in Nigeria, and hence, called for strong GC chemistry initiative to be introduced into the curriculum so that the academia and the industry will work towards curbing the effects of the dangerous chemicals in the environment through teaching. However, this finding negates that of Auliah and Mulyadi (2018) who discovered in their own study that only 31.38% of teachers believed that principles of Green Chemistry should be integrated in chemistry teaching and learning process.

Although, the participants agreed that integration of GC into the curriculum is very important but they also believed that the chemistry curriculum is already crowded. This is an indication that the participants are yet to understand that GC is not another type of chemistry or topic, but rather, a strategy to design less risky chemical products and processes that reduce or eliminate the use and generation of hazardous substances or wastes. This finding corroborates that of Owoyemi and Adesina (2018) and Owoyemi and Umanah (2019) who found out that teachers possessed some level of awareness but low level of knowledge about GC,.

Table 2 revealed that teachers possess high and positive attitude towards incorporation of green chemistry into the curriculum. This is also a sort of relief as it is a known fact that teachers' attitude is key in any effort to incorporate any emergence issue into the curriculum so as to achieve environmental sustainability. This finding is in line with that of Owoyemi & Moju (2015) who found out that teachers have right attitude towards the teaching of education for environmental sustainability. This finding is also in agreement with Endsley (1995) who noted that a person's attitude towards relevant elements in the environment forms the basis for his or her situation awareness which ultimately leads to action. This finding corroborates the findings of Cieśla et al (2012) who asserted that positive attitude to practice of green chemistry in schools is a good sign for sustainable development. Similarly, the finding was in agreement with the reports of Hopkinson et al (2010) who after studying the attitude of staff, students and graduate employers, and areas for integration of environmental awareness, reported that students perceived green chemistry as an important initiative which can help to solve environmental problems and consequently were eager to change their current laboratory practices in order to incorporate green chemistry. The study further established that for future employees to be responsible, they require the knowledge of green chemistry because green chemistry will have a greater positive impact on making a key difference in environmental sustainability.

The results in Tables 3 and 4 reveal that gender does not have any significant influence on the perception and attitude of chemistry teachers towards integrating GC into school chemistry curriculum. This implies that both male and female teachers hold the same view and possess the same attitude towards integration of GC into the curriculum. This finding contradicts that of Sameena & Gowda (2015) who reported a significant difference in the awareness of GC between undergraduate male and female students, and according to the study, the female students' perception of green chemistry was better than that of the male students irrespective of the type of institutions. This finding is also in contrast with the findings of Organisation for Security and Co-operation in Europe (2009) submission that because physical environment affects women differently from men due to their different roles in the family, community and workforce; women are likely to have different attitudes, priorities and power over resources regarding environmental protection. They further reported that interaction between women and the environment differs from that of men and this gives both gender different opportunities for environmental protection. Similarly, the finding of this study was in contrast with the findings of Schultz et al, (2001) who stated that women show different environmental concerns, more awareness and more environmentally friendly behaviour because their specific situation and motivations are inclined towards consenting to sustainability plans. Considering the environmental awareness and conduct of men, they asserted that men are the biggest polluters and that their behaviour poses the most crucial obstacles to environmental sustainability.

Similarly, the result of gender influence on attitude of chemistry teachers towards incorporation of green chemistry into senior school chemistry curriculum showed that there is no significant gender influence on the teachers' attitude towards incorporation of green chemistry. This implied that, male and female teachers possess equal attitude towards incorporation of these concepts into secondary school curriculum. This finding supported the report of Woodhouse & Breyman (2004) who noted that the green chemistry activities do not consider the intensive public education efforts of feminist or civil rights movements,

which sought to transform common understandings of gender or racial justice. Instead, green chemistry advocates aim their educational efforts at their professional peers.

Conclusion

Here, based of the findings, we can conclude that the teachers are of the view that GC should be integrated into the curriculum and this opinion was supported by positive attitude indicated by the teachers regardless of their genders. This is an evidence that chemistry teachers are willing and ready to see green chemistry integrated into the curriculum. This calls for necessary review of chemistry curriculum to accommodate the Green Chemistry principles so as to address the issue of environmental sustainability.

It is therefore recommended that GC principles should be integrated to the curriculum at all levels, starting from secondary school, by so doing, the concept of environmental sustainability will gradually be acculturated into the youngsters who are the leaders/decision makers of tomorrow.

Also, in-service training, seminars/workshops/conferences should be organised for chemistry teachers for capacity building on Green Chemistry education while it is also necessary to incorporate GC into teacher education curricula so as to prepare the pre-service chemistry teachers for the future teaching with environmental sustainability consciousness.

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