
SECONDARY SCHOOL CHEMISTRY TEACHERS' ATTITUDES TOWARDS THE RECOMMENDED CHEMISTRY TEXTBOOKS

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Abstract

The study sought to ascertain secondary school chemistry teachers' attitudes towards the recommended chemistry textbooks. It has examined the status of the adopted chemistry textbooks for scientific literacy themes among some categories. It made use of descriptive survey and inferential design with a sample size of two hundred (200) chemistry teachers from both private and public secondary schools in Education District 1. Teachers Attitude Inventory on Recommended Chemistry Textbooks (TAIRCT) $r = 0.75$ was, used in data collection. Data analysis involved the use of simple percentages and two-way ANOVA. The findings showed a significant gender gap in the teaching of chemistry with the recommended chemistry textbooks, with the males (52.5 %) having more favourable attitude than the females (47.5%). The experienced chemistry teachers have less favourable attitude to the recommended texts (10 %); public school chemistry teachers have more favourable attitude (52 %) than the private teachers (48 %) towards the state recommended textbooks. The recommended chemistry textbooks devoted their intents only to category 1 (the fundamental knowledge of science) and the non recommended textbook had the most balanced profile among the four categories of scientific themes. The article suggested that any chosen textbook must reflect the interaction of chemistry in solving everyday problems. It has concluded that recommended chemistry textbooks should prove that their contents convey science as more than knowledge about the world and should prepare teachers and students for personal, academic growth, social relevance and general education for life. It was concluded that all the recommended texts should portray personal academic growth and social relevance for curriculum balance.

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Studies on the status of science education in the United States have consistently revealed that teaching is still textbook bound, inquiry-oriented strategies are scarcely used and that there is crisis in science learning (Adesoji, 2008)). Textbooks are integral part of instruction which can provide messages about science and society, as well as science career (Okafor, 1992). Researchers in the natural science have ignored a fundamental question - what is a good book (Okafor, 1992). If textbooks lack scientific images, teachers and students perception of scientific enterprises would be affected (Okafor, 2001). Unfortunately, many science teachers rely too much on the prescribed textbooks which probably give students false impression of the nature of science (Adesoji, 2008). Many commercial textbooks stress facts and present science as a complete body of information that was arrived at in an errorless manner (Okafor, 1992). She explained further that most textbooks place too much emphasis on terminology and vocabulary which result in students memorizing large amount of information and giving it back during test, thinking this is what science is all about. Ruin (1988) pointed out that chemistry textbooks often do inadequate jobs of explaining important concepts and principles because of the authors' shallow knowledge of the subject matter. Science textbook publishers have gone to the extreme of providing many coloured pictures to lure curricular developers and teachers into adopting their textbooks. Ironically, most of the chemistry textbooks adopted by the Education districts have little or nothing in the content to interest students in studying chemistry at the senior secondary school (Okafor, 1992). Ruin (1988) investigated on the integration of the societal issues in the textbooks and found that textbook publishers have not responded to the integration of science and technology principles that are related to the societal and global issues He further, criticized science textbooks that lack philosophical validity with respect to the nature of science. Jegede (1986) evaluated Nigeria Integrated Science Project (NISP) to ascertain the teachers' performance and students' attitude towards integrated science. The result showed that integrated science teachers are not favourably disposed towards the project due to lack of appropriate training and difficulty level of NISP textbook. Nzewi, (1988) investigated the difficulty levels of chemistry textbooks recommended for use in Lagos State secondary schools using three readability formulae - Flesch, Fry and Rix with their respective interpretation charts. The result revealed that only two of the examined textbooks are suitable for form four students, three for form five and the state recommended chemistry textbooks are not readable for the target class. She expressed that production and selection of chemistry textbooks work against the production of the best written materials for students to learn chemistry. More so, some recommended chemistry textbooks have failed to ensure that their contents convey science as more than knowledge about the world. Some of these chemistry textbooks have failed to prepare teachers and students for personal, academic growth, social relevance and general education (Okafor, 1992). These deficiencies have been suggested as some of

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the reasons why majority of teachers and students believe that what they learn with the recommended textbooks are dull and boring and have little relevance to the real world. No matter how good or bad the recommended textbooks may be, the science teachers are to take appropriate decision during the adoption since they still remain the "key" put into the "lock". It is assumed that teachers' attitude concerning curricular materials must be considered if successful implementation of the materials is to be achieved.

Speculative Views of Attitude

The essential outcome of secondary school chemistry is attitude variable which is synonymous to academic achievement. Social psychologists have identified three view points about the nature of attitudes which include; the tri-component, the separate entities and the latent process perspectives (Salta & Tzougraki, 2004). They stated that the latent variable can only explain the connection between observable stimulus and behaviours. Cheng (2009) pointed out that attitude can be formed from affective behaviours expressed through affective responses. Effective teachers therefore, should consider the development of positive attitude towards chemistry as the hub of teaching responsibility (Cheng, 2009). Unfortunately teachers display nonchalant attitude when selecting chemistry textbooks that portray digital and scientific literacy (Okafor, 2001). Cheng (2009) is of the opinion that teachers attitude towards the recommended chemistry textbooks has significant direct effect on students' achievement in the subject. It is important to acknowledge the fact that chemistry is not a homogenous subject but has interactions with other science subjects. In view of that, it is necessary that the chemistry teachers take appropriate decision when adopting any recommended textbooks since they are the key that unlock any impediment in educational setting.

Statement of the Problem

The need to focus on the research that investigates the attitude of secondary school chemistry teachers towards the recommended chemistry textbooks is underscored. In spite of the growing efforts to make all sciences (Chemistry, physics and Biology) interesting through reviewing textbooks, problem still arises in the teaching and learning of chemistry due to the attitude of teachers towards the recommended textbooks. An in-depth survey on Chemistry teachers' attitude towards the recommended secondary school chemistry textbooks and the extent the adopted texts portray some scientific literacy themes showed a dearth of research in that direction.

Research Questions

This study therefore was designed to answer the following research questions.

1. Will there be a significant gender difference in the attitude towards the recommended chemistry textbooks?

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2. Does teacher's teaching experience affect his/her attitude towards the recommended chemistry textbooks?
3. What is the relative contribution of the type of school towards the recommended chemistry textbooks?
4. What is/are the status of the recommended chemistry textbooks for scientific literacy themes among the following categories:
 - i. The knowledge of science
 - ii. Investigative nature of science
 - iii. Science as a way of thinking
 - iv. The interactions of Science, Technology and Society (STS)

Significance of the Study

It is hoped that the result obtained from the study will provide useful information to the science textbook authors and publishers towards producing relevant, interesting and understandable chemistry textbooks for teachers and students. It would also provide to the curriculum developers and States Ministries of Education with some criteria to be considered before recommending any chemistry textbooks to teachers and students. It would make readers of science textbooks more cognizant of the impact of science and technology on society.

Methods

Design:

This study is an ex-post facto which made use of descriptive survey and inferential design in obtaining desired information.

Sample

Simple random sampling was used to select teachers that were considered eligible to participate in the study. The sample consisted of 200 chemistry teachers (105 males and 95 females) drawn from five private schools that are registered and five public secondary schools in Education District 1 with teaching experience between 1-23 years. Only three recommended chemistry textbooks by the Lagos State Ministry of Education authored by Afolayan; Obidipe; STAN and one non-recommended text authored by Ababio were considered in this study.

Instrumentation

The instrument used for the study was Teacher Attitude Inventory on Recommended Chemistry Textbooks (TAIRCT) designed and validated by Chiappetta, Sethna and Fillman (1991). The researcher adopted it with some modifications since the

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instrument taps the same construct. The instrument has two sections. Section A contained background information of the chemistry teachers' while Section B consisted of 34 items. Items 1, 5, 15, 18, 19, 20, 30, 33, 34 were dropped because the discriminating indices of the items were not even. 25 items were then retained. The subjects were to respond to each item on a five point Likert scale: Strongly Agree (SA); Agree (A); No opinion (N); Disagree (D) and Strongly Disagree (SD). In scoring the responses, the item that reflected positive attitude was given a score of five for a "Strongly Agree" response, progressing downward to a score of one, for "Strongly Disagree". The scoring procedure was reversed when a response of "Strongly Disagree" indicated a positive attitude.

The instrument was then administered to the respondents that used the recommended chemistry textbooks. On the whole, the maximum score was 125.

Data Collection and Analysis

Teachers Attitude Inventory on Recommended Chemistry Textbooks (TAIRCT) $r=0.75$ was administered to the respondents by the researcher. Their responses were computer scored and the generated scores were subjected to simple percentages and two-ways ANOVA

Results and Discussions

The presentation of results and discussions are geared towards the research questions raised.

Research Questions 1-3

1. Will there be a significant gender difference in the attitude towards the recommended chemistry textbooks?
2. Does teacher's teaching experience affect his/her attitude towards the recommended chemistry textbooks?
3. What is the relative contribution of the type of school towards the recommended chemistry textbooks?

Table I: Distribution of Respondents According to Gender, Teaching Experience and Type of School

Group	Variable	Number of Teachers	Percentage mean
Gender	(i) Male	105	52.5
	(ii) Female	95	47.5
Teaching	(i) 1-7 years	105	52.5

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Experience	(ii) 8-14 years	45	22.5
	(iii) 15-21 years	30	15.0
	(iv) 22 years & above	20	10.0
Type of School	(i) Private	96	48.0
	(ii) Public	104	52.0

Table 1 above shows a significant gender difference in the teaching of chemistry with the recommended texts. All the males (52.5%) had higher positive attitude towards the recommended textbooks than the females (47.5%). This supports Oluwafemi (1991) statement that all the recommended textbooks maintain gender imbalance by favouring males. This also showed that gender difference cuts across every facet of human endeavours. The male teachers acclaimed that those textbooks had always provided them with every information they desire in chemistry though majority of the texts intent lack diagrams and pictorial illustrations.

In addition, experience is very important in the teaching of chemistry when using any recommended text. As chemistry teachers gain more experience, they find it less difficult and more manageable in the mastery of the textbooks contents and the reasons for recommending a particular text. 52.5% of chemistry teachers had less than eight years teaching experience, 22.5% had about 14 years teaching experience, 15% had less than 22 years and 10% had 22 years and above teaching experience. This lesser percentage of teachers with 22 years and above teaching experience showed that majority of chemistry teachers are leaving teaching profession to other profession due to poor remuneration, poor incentives or rather had preferred to retire for other lucrative jobs.

Table 1 also presents responses of teachers from two types of schools. Public school teachers had most positive attitude towards adhering to the recommended textbooks with 52% while private school teachers had 48%. This showed the rigidity of the public school teachers towards the assigned texts.

Research Question 4

What is/are the status of the recommended chemistry textbooks for scientific literacy themes among the following categories?

- (1) The knowledge of science;
- (i i) Investigative nature of science;
- (iii) Science as a way of thinking;
- (iv) The interactions of Science, Technology and Society (STS).

Table 2: Percentage Rating of Scientific Literacy Themes for Various Categories Among the Textbook Authors

Textbook Authors	Percentage of various categories			
	(i)	(ii)	(iii)	(iv)
Afolayan, S	5.5	55.5	13.0	4.0
Obidipe, L	52.5	15.5	24.5	6.5
STAN	56.0	15.0	18.5	7.5
Ababio, O(non-recommended)	59.0	24.0	35.5	8.0

Table 2 gives the percentage rating of themes in various categories with respect to textbook authors. The theme of scientific Literacy that predominates among the four chemistry textbook written by the above four authors (in Table 2) is category I, (The fundamental knowledge of science) which ranges from 5.5% to 59%. Category II, (the investigative nature of science) ranges from 55.5% to 24%. Category III, (Science as a way of thinking) which includes historical development of ideas is rated from 13% to 35.5% among the textbook authors. Category IV, (the interaction of science and technology in the society) is rated lowest from 4% to 8% among the texts investigated. The implication of this is that some of these recommended textbooks had not given adequate attention to emphasizing the impact of science (Chemistry) in the society. Since category IV involves the teaching and learning of science in the context of human experience, it is observed that non of the texts made any attempt to inculcating chemistry as observed in the home, kitchen and playground. The rating of category IV should be the reason why students find it difficult to relate science in everyday activities.

**Table 3: Two way ANOVA
Source of Variation**

	DF	SS	MS	F _{Cal}	F. Critical
Between Textbook Authors	4	153.0	38.3	2.1278	3.2592
Between Categories	3	139.7	46.6	2.5889	3.4903
Errors	12	125.6	18.0	-	-
Total	19	508.3	-	-	-

F - Critical Between Textbooks = $F_{4, 12/5\%} = 3.2592$
F- Calculated Between Textbooks = 2.1278
F- Calculated Between Categories = $F_{3, 12/5\%} = 2.5889$
Therefore,

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If F calculated between text is less than ($<$) F critical between text: Accept.

If F calculated between category is less than ($<$) f -critical between category; Accept

The findings in Table 3 shows that the status of recommended texts among the various categories is not significant since the calculated values are less than the critical values.

Table 4: Percentage Response of Chemistry Teachers Attitude towards the Recommended Texts With Respect To Categories of Themes

Categories	Respondents	Percentage
(i)	101	50.5
(ii)	32	16.0
(iii)	17	8.5
(iv)	50	25.0
TOTAL	200	100.0

Table 4 shows that chemistry teachers have favourable attitude towards categories 1 and IV in the ratio of 50.5% and 25% respectively. The texts stress science as a body of knowledge by emphasizing on theoretical knowledge of science (concepts, facts laws and principles). The predominant positive attitude of teachers towards the recommended texts with reference to category I is very visible as it recorded 50.5%. The issue here is that no gap of an unnecessary sort should be created between theory and practical aspects of chemical education. According to Carr (1980), when there is gap between knowledge of science that gives factual information and investigative nature of science, the entire conceptual framework underlying science will be called to question and discarded Hence, all the recommended texts satisfy category 1 as indicated by items 4,6,7,8, 16,24). Category II, the investigative nature of science, recorded only 16.% and category III also recorded 8.5%. It is interesting to note that chemistry teachers have some reservations about categories II and III respectively. Majority of teachers had neutral opinion while some fall within Agree and Disagree. They stress that the intent of a text should investigate the nature of science for students to be able to embark on empirical nature of science and its objectivity as stated in items (2, 11, 14, 25). These would give students true impression of the nature of science and its empiricism.

Chemistry teachers equally had neutral opinion that the recommended texts did not explain chemistry as a way of thinking (category III). Teachers buttressed that they were-being lured into adopting specific texts that give superficial treatment of the

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chemistry topics. About 8.5% of teachers demonstrate little favourable attitude to the texts but strictly adhered that the texts did not provide for differences in students ability knowing fully that some students are concrete thinkers who cannot solve abstract problems/exercises in the recommended texts. Teachers also emphasized that any objective evaluation of the students achievement in chemistry would be impossible with the recommended chemistry textbooks (items, 12, 17, 22, 23). The teachers further narrated that the intent of all the texts did not emphasize any interactions of science and technology in the society since chemistry is basically thought as theoretical subject that do not have serious relation with practical life (Category IV).

Conclusion

Chemistry textbooks are dominant influence behind most secondary school instructions but little is known about teachers' attitudes to implementing any recommended textbook. Some chemistry teachers place high emphasis on the recommended textbooks as an important strategy in promoting chemistry learning which may be deficient in promoting scientific literacy that involves application in solving everyday problems. Generally, some chemistry teachers are reluctant in using textbooks that lacks practical examples but when they are being recommended, they have no option than to embrace them in order not to lose his/her job. In planning for instruction and providing adequately for individual differences require a good chemistry textbook that would serve as guide in the classroom situation. In conclusion, recommended chemistry textbooks should prove that their contents convey science as more than knowledge about the world and should prepare teachers and students for personal, academic growth, social relevance and general education for life.

Suggestion/Recommendation

In spite of the facts that chemistry teachers' are being lured into using the recommended chemistry textbooks, the following suggestions are made:

- i. Teachers' should emphasize in the use of any chemistry textbook that would enable them achieve the classroom objectives.
- ii. Any chosen textbook must reflect the interaction of chemistry in solving everyday problems.
- iii. Teachers who had been in the field for more than 25 years should partake in the recommendation of textbooks because of their years of experiences.
- iv. Textbook publishers should equally review the content of the texts to ensure that it cuts across human learning experiences.
- v. Recommended chemistry textbooks should indicate the relationship between theory and practical. Above all, science teachers should have natural affinity in choosing a good textbook.

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- vi. Textbook authors should provide texts that are gender fair by having gender equity when putting up illustrations and diagrams in the textbooks.
- vii. The content of the chemistry textbook should have adequate diagrams and pictorial illustrations to cater for the interest of the slow learners and concrete thinkers.
- viii. Every chemistry teacher should develop positive attitude towards chemistry as the hub of teaching responsibility since it provides literacy in the knowledge of the world around us.
- ix. Any chemistry textbook that does to reflect traces of fundamental knowledge of science, investigative nature of science, science as a way of thinking and interactions of Science, Technology and Society (STS) should not be published or even recommended by the States Ministry of Education.

References

- Adesoji, F. A. (2008). Managing students attitudes towards science through problem solving instructional strategies. *Anthropologist*. 10(1), 22-24.
- Cheng, D. (2009). *Students' attitude towards chemistry lessons. The interaction effect between grade level and gender*. <http://dx.doi.org/10.1007/s11165-007-9075-4>.
- Jegede, R. O. (1986). A Comparative Analysis of the old and revised editions of the STAN, Nigeria Integrated Science Project (ISP).
- Nzewi, J. U. (1988). *The readability of chemistry textbooks in use in Lagos State Secondary schools*. An Unpublished M.Ed. Thesis. University of Lagos.
- Okafor, N. (2001). Innovations in scientific and technological literacy for sustainable development in Africa. *Proceedings of 43rd Annual conference of Science Teacher Association of Nigeria (STAN)/Commonwealth Association of science, technology and mathematics Education(CASTME), Africa*. Ibadan: Heinemann Educational Books (Nigeria) Plc. 52-56.
- Okafor, N. (1992). *An analysis of senior secondary school chemistry textbooks, for scientific literacy themes and some expository learning aids*. An unpublished M. Ed. Thesis. University of Lagos.
- Olatunde, Y. P. (2009). Students' attitude towards mathematics and academic achievement in some selected secondary schools in south-western Nigeria. *European Journal of Scientific Research*. 36(3), 336-340.

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Salta, K. & Tzougraki, C. (2004). Attitude toward chemistry among 11th grade students in high schools in Greece. . 88(4), 535-547. <http://dx.doi.org/10.1002/sce.10134>.

Rui, S. P. (1988). Something is wrong with chemistry textbooks. *Journal of Chemical Education*. 65 (5), 720-721.