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Senior High School Science Teachers' In-Service Needs Across Gender And Area Of Specialization In The Central Region, Ghana

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Abstract: ***The purpose of this study was to identify Senior High School science teachers' perceived needs and to compare those needs across gender and area of specialization. The research design employed in this study was a survey research design using a questionnaire as the instrument. This study was descriptive in nature. This had been designed to identify and establish Ghanaian Senior High School Science Teachers' In-service Needs' across Gender and Area of Specialisation. The instrument used to collect data was a questionnaire on Science Teachers Inventory of Needs (STIN), which was adapted to suite the Ghanaian context. The target population was made up of all Senior High School science teachers in Ghana. Teachers in certain parts of the Central Region of Ghana which comprised of the Komenda Edina Eguafo Abrem, Cape Coast, Abura Asebu Kwamankese, Assin South and Assin North districts, municipal and metropolitan assemblies (MMDA'S). The reliability of the science teachers' needs assessment instrument was ascertained using the internal consistency approach. This was to reduce costly mistakes and prevent threat to validity of the research through the use of Cronbach alpha. Based on the findings, it was recommended among others that frequent in-service training should be organised for Senior High School science teachers to update and refresh their knowledge in science. This study therefore provided meaningful empirical evidences of effective in-service programmes in the process of upgrading science teachers' professionalism in Ghana. These recommendations when put into action will assist Senior High School science teachers in their lessons.***

Keywords: science teachers, gender, area of specialization, senior high school, in-service needs

I. INTRODUCTION

Underpinning all the concern and remarks about teacher quality in Ghana is perhaps the important question: "What kind of science teacher does the school system produce''? International evidence suggests that the "quality of secondary education, especially in maths and science, has a stronger impact on economic growth than years of schooling. Equitable access to secondary education for poor students, and especially girls is an additional factor enhancing countries' economic growth performance" (World Bank, 2002). But this also depends on an adequate supply of qualified teachers who can generate interest in science and mathematics through innovative teaching. Ghana's progress against these international benchmarks reveals that developments in secondary education still have a long way to go. Of all approximately 14,000 secondary teachers in public schools, about a fifth are not professionally qualified, and for science and mathematics subjects this is even less - 19 percent and 13 percent approximately (NPT/GHA PRACTICAL project, 2007) cited by Akyeampong, Djangmah, Oduro, Seidu and Hunt (2007). The general science stream in secondary schools currently stands between 13 to 15 percent of all students, although elective science and mathematics subjects can be selected in other more practical streams. Overall participation in physics has declined to 18 percent of examination candidates, in chemistry to 21 percent, 24 percent in biology and in elective mathematics to 28 percent. Education in general, and science education, for that matter, is a battle to contend with for all Ghanaians.

Effective in-service training programme should include programme development and orientation geared towards meeting the stated needs of the teachers' concern (Amir, 1993). In this regard, a study conducted by Kamariah (1984) on the perceived needs of secondary school science teachers in Malaysia concluded that the most prevalent need of science teachers then was providing for students' safety in the science laboratory. It could therefore be argued that science teachers' perceived in-service needs, is in contrast to the current accepted view of priority needs which lead to effective science teaching, namely developing students' understanding and creating meaningful learning (Harlen, 1997). Ghana is no exception since organisers of in-service training programme do not consider the priority of the curriculum implementers thus the needs of teachers. The approach in Ghana, for the organisation of in-service training can be likened to a top-bottom approach where the aim of the training is not realised because the specific and immediate needs of teachers are not met.

In a similar vein, Baird and Rowsey (1989), based on their survey of Senior High School science teachers needs concluded that without accurate data on teachers' needs, planning is not only difficult, but results generated are likely to be disappointing to both teachers and those who offer in-service courses. Baird and Rowsey (1989) also highlighted teachers' complaints that much time spent during in-service programme and activities had been wasted where such programme were not applicable in meeting their respective classroom needs. Thus, it is timely that another comprehensive assessment of the perception of the professional needs of Senior High School science teacher's be conducted here in Ghana.

The factor of gender disparity, which is also significant in teacher recruitment, needs to be considered. Female teachers make up 84%, 33%, 23% and 20% of pre-primary, primary, lower secondary (Junior Secondary School) and upper secondary (Senior High School) teachers respectively United Nations Educational Scientific and Cultural Organisation (UNESCO, 2010).

Misconceptions of females' participation in science and technology related subjects and careers are well documented in STME reports and other sources (Anamuah-Mensah). The studies revealed that negative misconceptions and stereotyped attitudes are the major factors contributing to the negative attitudes on the part of girls towards the study of science.

Gender studies have shown that society in general and girls in particular, consider science as a male domain - that science is either too mechanical or too technical for girls. Girls are also considered as not being able to think or work scientifically (Agholor, 1993, Jegede, & Okebukula, 1993, Nkani, 1992, Eshun, 1991) as cited by Quasie (1999). Technical subjects are considered suitable for boys only and girls who study them are considered un-ladylike. Gender related issues are now being incorporated into in-service and pre-service training for teachers. Ways of presenting the sciences to make girls feel comfortable with them are focused on teachers' language and teacher-student classroom interaction should be devoid of gender bias. Gender balanced curriculum materials call for curriculum developers and textbook writers to be sensitised on the use of examples, (particularly tools and machines) charts and equipment, which emphasize the male image of science.

In many developing countries, like Ghana, there are teacher shortages and as such in some places unqualified teachers take up science subjects teaching. This can affect the quality of science teaching and learning as well as student achievement. A teacher is required to possess a requisite professional qualification to teach a particular subject. A teacher who has not completed a prescribed programme of study in science education including practicum is not considered professionally qualified, but is nonetheless offered teaching positions due to the shortage of science teachers. Ghana, like many other countries in the world is confronted with the problem of inadequate trained science teachers especially in the teaching of Physics, Chemistry, Biology and Integrated Science. This is problematic because these educators have limited knowledge of science content. Subahan, Lilia, Khalijah and Ruhizan, (2001) found that 60% to 68% of non-option physics teachers believed they needed to increase their understanding of physics content.

In this study the researchers' aim is to investigate Senior High School science teachers perceived needs across gender and areas of specialisation, in terms of undergoing in-service training programmes to enhance teaching and learning science. Often the experiences and views of those who are the direct beneficiaries of science are barely given voice in the consideration of programme restructuring or reform. The intention of the study is to use such findings to reflect on the current ways, of improving science education in Senior High Schools in Ghana.

RESEARCH OBJECTIVES

- ✓ Identify how gender influences Senior High Schools science teachers' in-service needs.
- ✓ Identify how Senior High School science teachers' in-service needs influence their subject areas of specialization.

RESEARCH QUESTIONS

The research questions that guided the study included the following;

- ✓ What are the gender differences in Senior High School science teachers' in-service needs?
- ✓ What are the in-service needs of Senior High School science teachers with regards to their subject area specialisation?

II. METHODOLOGY

The research design employed in this study was a survey research design using a questionnaire as the instrument. The

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survey design was chosen so that generalizations could be made from the samples representing the population (Creswell, 2005; Kerlinger & Lee, 2000).

Neuman (2000) argues that such an approach can be justified in terms of the nature of information gathered. This study gathered information on Ghanaian Senior High School science teachers' in-service needs across gender and area of specialization. The nature of such data justifies the suitability of the survey design employed.

POPULATION AND SAMPLING

The target population was made up of all Senior High School science teachers in Ghana. The accessible population were all science teachers in Senior High Schools in the Central Region of Ghana. Reasons for the selection of the accessible population were that smaller populations gives an in depth view of a research. Also the accessible population offers more detailed information and a high degree of accuracy because of their relatively small number(s). Finally in many cases, a complete coverage of the entire population is not possible. Sampling enabled the researcher to study a relatively small number of units in place of the target population because inferences were been made about the population with data collected from the sample. Appropriate sample size was needed for the credibility of the results because it addresses the survey population in a short period of time by producing comparable and equally valid results. Also the larger the sample the better the results of the study. All this, was to obtain data that was representative of the whole target population of 418 science teachers in the Central region of Ghana. A total sample of 156 science teachers comprising 132 males and 24 female were used for the study.

INSTRUMENTATION AND SCORING

The instrument Science Teacher Inventory of Needs (STIN) developed by Zurub and Rubba (1983) was adapted for this study. The instrument is made up of two sections (A and B), where section A involves the demographics or bio data of the respondents. Section B was made up of 72 items distributed among seven dimensions followed by a five-point Likert scale.

Since the instrument is adapted for use by the researcher some pertinent changes in the questionnaire was made to suit the Ghanaian context. For instance in the demographic section, items on ethnicity was dropped and highest level of education with regards to SPM and STPM were changed. Another change was the current status as teacher (probation and temporary), subjects that the teacher is teaching now with regards to lower and upper secondary were changed to suit the Ghanaian context. In ending the demographic section, subjects taught with number of years teaching were also changed to fit into our system.

Some statements in the questionnaire were also rephrased like inculcating spiritual values in science teaching was modified to read, inculcating cultural values in science teaching this is because cultural values is identified in the science curriculum. The drafted version of the adapted instrument also consisted of two sections. Section one was seeking information on the demographic characteristics of the respondents, whiles section two consisted of 70 items pertaining to in-service needs of science teachers.

Some unsuitable statements identified in the original questionnaire include;

- ✓ Inculcating spiritual values in science teaching. (Item, 23).
- ✓ Implementing PEKA (Assessing students' laboratory skills) as required. (Item, 28).
- ✓ Managing the budget for science teaching. (Item, 36).

These statements were corrected to read;

- ✓ Inculcating cultural values in science teaching.
- ✓ Assessing students' laboratory skills as required.
- ✓ Managing the laboratory for science teaching.

Each item constituted a statement, which was followed by a five-point Likert scale ranging from (0) not sure of requirement (1) strongly not required (2) not required because has experience, (3) not required because not practiced (4) moderately required and (5) strongly required. The science teachers' perceived needs of this study are categorized into seven distinct dimensions whereas the original had eight dimensions.

Further analysis of the science teachers' needs with respect to independent variables that characterised them would enhance the conclusion that was to be generated from the analysis. Consequently, the proposed in-service programmes could be tailored according to the science teachers' characteristics.

DATA COLLECTION PROCEDURE

The researcher collected an introductory letter from the School of Graduate Studies which was sent to the Regional, Metropolitan or District Directors of Education as well as Heads of Senior High schools to enable the researcher undertake the study. Teachers' and students' consent were sought to participate in the study before the tools were be administered. In order to ensure reliability in an uncontrolled environment, the respondents will be informed that the questionnaire and questions are not tests and that their responses will not be used to change their status or affect their promotion(s). The researcher by making appointment with the respondents will collect the questionnaires on a later date.

III. RESULTS

The following tables are detailed analysis of perceived science teachers' needs of each dimension according to gender and area of specialisation. Based on the aims and objectives of the study and the consideration of the type of data generated from it, the analyses used were mainly cross tab procedures followed by subsequent Chi Square measures of association [12].

Dimensions	Variables		Not Needed		Moderately Needed		Greatly Needed		Chi-Square (χ^2)	P-value
			Freq.	%	Freq.	%	Freq.	%		
Management of Science Instruction	Gender of Respondents	Male	48	(36.4)	39	(29.5)	45	(34.1)	.302	.860
		Female	10	(41.7)	7	(29.2)	7	(29.2)		
Diagnosing & Evaluating Students	Gender of Respondents	Male	48	(36.4)	51	(38.6)	33	(25.0)	3.544	.170
		Female	12	(50.0)	10	(41.7)	2	(8.3)		
Generic Pedagogical Knowledge and Skills	Gender of Respondents	Male	96	(72.7)	21	(15.9)	15	(11.4)	2.005	.367
		Female	17	(70.8)	6	(25.0)	1	(4.2)		
Knowledge and Skills in Science Subject	Gender of Respondents	Male	45	(34.1)	45	(34.1)	42	(31.8)	2.429	.297
		Female	9	(37.5)	11	(45.8)	4	(16.7)		
Administering science Instructional Facilities and Equipment	Gender of Respondents	Male	41	(31.1)	38	(28.8)	53	(40.2)	3.396	.183
		Female	9	(37.5)	10	(41.7)	5	(20.8)		
Planning Activities in Science Instruction	Gender of Respondents	Male	36	(27.3)	50	(37.9)	46	(34.8)	1.328	.515
		Female	9	(37.5)	9	(37.5)	6	(25.0)		
Integration of Multimedia Technology in Science Teaching	Gender of Respondents	Male	36	(27.3)	47	(35.6)	49	(37.1)	3.739	.154
		Female	7	(29.2)	4	(16.7)	13	(54.2)		

Note: Significant at 0.05

Table 1: Summary Statistics of Perceived Needs against Gender

Dimensions	Variables		Not needed		Moderately needed		Greatly needed		Chi-square (x^2)	P-value
			Freq.	%	Freq.	%	Freq.	%		
Management of science instruction	Major Academic Course	Physics	9	(36.0)	5	(20.0)	11	(44.0)	4.876	.771
		Chemistry	16	(41.0)	13	(33.3)	10	(25.6)		
		Biology	17	(37.8)	13	(28.9)	15	(33.3)		
		Integrated Science	10	(37.0)	10	(37.0)	7	(25.9)		
		Others	6	(30.0)	5	(25.0)	9	(45.0)		
Diagnosing & Evaluating Students	Major Academic Course	Physics	11	(44.0)	8	(32.0)	6	(24.0)	11.317	.184
		Chemistry	19	(48.7)	14	(35.9)	6	(15.4)		
		Biology	14	(31.1)	22	(48.9)	9	(20.0)		
		Integrated Science	13	(48.1)	7	(25.9)	7	(25.9)		
		Others	3	(15.0)	10	(50.0)	7	(35.0)		
Generic Pedagogical Knowledge and Skill	Major Academic Course	Physics	17	(68.0)	4	(16.0)	4	(16.0)	14.650	.066
		Chemistry	33	(84.6)	4	(10.3	2	(5.1)		
		Biology	17	(60.0)	10	(22.2)	8	(17.8)		
		Integrated Science	27	(66.7)	8	(29.6)	1	(3.7)		
		Others	18	(90.0)	1	(5.0)	1	(5.0)		
Knowledge and Skills in Science Subject	Major Academic Course	Physics	10	(40.0)	9	(36.0)	6	(24.0)	9.834	.277
		Chemistry	16	(41.0)	14	(35.3)	9	(23.1)		
		Biology	13	(28.9)	20	(44.4)	12	(26.7)		
		Integrated Science	11	(40.7)	8	(29.6)	8	(29.6)		
		Others	4	(20.0)	5	(25.0)	11	(55.0)		
Administering Science Instructional Facilities and Equipment	Major Academic Course	Physics	8	(32.0)	8	(32.0)	9	(36.0)	11.588	.171
		Chemistry	18	(46.2)	9	(23.1)	12	(30.8)		
		Biology	12	(26.7)	19	(42.2)	14	(31.1)		
		Integrated Science	7	(25.9)	9	(33.3)	11	(40.7)		
		Others	5	(25.0)	3	(15.0)	12	(60.0)		
Planning Activities in Science Instruction	Major Academic Course	Physics	9	(36.0)	6	(24.0)	10	(40.0)	9.973	.267
		Chemistry	14	(35.9)	16	(41.0)	9	(23.1)		
		Biology	12	(26.7)	16	(35.6)	17	(37.8		
		Integrated Science	7	(25.9)	14	(51.9)	6	(22.2)		
		Others	3	(15.0)	7	(35.0)	10	(50.0)		
Integration of Multimedia Technology in Science Teaching	Major Academic Course	Physics	6	(24.0)	6	(24.0)	13	(52.0)	14.998	.059
		Chemistry	16	(41.0)	13	(33.3)	10	(25.6)		
		Biology	14	(31.1)	17	(37.8)	14	(31.1)		
		Integrated Science	3	(11.1)	7	(25.9)	17	(63.0)		
		Others	4	(20.0)	8	(40.0)	8	(40.0)		

Note: Significant at 0.05

Table 2: Summary statistics of Perceived Needs against Area of Specialization

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RQ 1: What are the gender differences in Senior High School science teachers' in-service needs?

Dimensions	Variables		Not Needed		Moderately Needed		Greatly Needed		Chi-Square	P-value
			Freq.	%	Freq.	%	Freq.	%	(χ^2)	
Management of Science Instruction	Gender of Respondents	Male	48	(36.4)	39	(29.5)	45	(34.1)	.302	.860
		Female	10	(41.7)	7	(29.2)	7	(29.2)		
Diagnosing & Evaluating Students	Gender of Respondents	Male	48	(36.4)	51	(38.6)	33	(25.0)	3.544	.170
		Female	12	(50.0)	10	(41.7)	2	(8.3)		
Generic Pedagogical Knowledge and Skills	Gender of Respondents	Male	96	(72.7)	21	(15.9)	15	(11.4)	2.005	.367
		Female	17	(70.8)	6	(25.0)	1	(4.2)		
Knowledge and Skills in Science Subject	Gender of Respondents	Male	45	(34.1)	45	(34.1)	42	(31.8)	2.429	.297
		Female	9	(37.5)	11	(45.8)	4	(16.7)		
Administering science Instructional Facilities and Equipment	Gender of Respondents	Male	41	(31.1)	38	(28.8)	53	(40.2)	3.396	.183
		Female	9	(37.5)	10	(41.7)	5	(20.8)		
Planning Activities in Science Instruction	Gender of Respondents	Male	36	(27.3)	50	(37.9)	46	(34.8)	1.328	.515
		Female	9	(37.5)	9	(37.5)	6	(25.0)		
Integration of Multimedia Technology in Science Teaching	Gender of Respondents	Male	36	(27.3)	47	(35.6)	49	(37.1)	3.739	.154
		Female	7	(29.2)	4	(16.7)	13	(54.2)		

Note: Significant at 0.05

Table 1: Summary Statistics of Perceived Needs against Gender

From Table 1,with regard to the management of science instruction dimension, a greater percentage of male science teachers (34.1%) greatly needed assistance with respect to this aspect of science teachers perceived needs. On the other hand, 29.2% of their female counterparts deemed that their managerial skills in science instruction are inadequate. This result may be associated with the fact that most of the schools do not provide in-service training to science teachers in relation to managerial skills. Similarly, 29% of the male science teachers as well as their female counterparts expressed a moderately needed assistance in management of science instruction. The chi-square test yielded a test result of 0.30 and a highly insignificant probability value of 0.860>0.05 between gender and science teachers' perceived needs on management of science instruction dimension. Here, no evidence supported the association between gender and science teachers' perceived needs. Thus, there was no significant association between the perceived needs of female science teachers on management of science instruction and the perceived needs of their male counterparts.

The results shown in Table 1 reveal that 25.0% of the male science teachers greatly needed assistance in diagnosing and evaluating students as compared to 8.3% of their female counterparts. Specifically, most of the male science teachers constituting 38.6%, moderately needed support in diagnosing and evaluating students as half of the females (50%) confirmed that they do not need support in that aspect. Furthermore, there is no significant association between the perceived needs of female science teachers on diagnosing and evaluating students and that of their male counterparts. An evidence is when the chi-square test yielded a result of 3.54 with an insignificant value of 0.170>0.05. This proved that the perceived in-service needs' of male science teachers in diagnosing and evaluating students is not the same as their female counterparts. This however supported the descriptive analysis in the latter. Thus, there is insufficient evidence to support the association between gender and teachers' perceived needs.

Furthermore, the male science teachers' level of need in generic pedagogical knowledge and skills was compared with that of the female science teachers. Similarly, a greater percentage of both male and female science teachers perceived that their generic pedagogical skills and knowledge is adequate. 72.7% of the male science teachers felt it to be unnecessary to improve their generic pedagogical knowledge and skills as 70.8% of the females felt the same. A comparison between the male and female respondents proved that (11.4%) of male science teachers demonstrated a great need. Nevertheless, (25%) of the female science teachers (25%) demonstrated a moderately needed generic pedagogical skills and knowledge. There is no doubt that the chi-square test for association between gender and science teachers' perceived in-service needs on generic pedagogical knowledge and skills dimension yielded a result of 2.00 with an insignificant value of 0.367>0.05. This shows that there is no ample evidence to support the relationship between gender and science teachers' perceived needs. Thus, there is no significant association between the perceived needs of female science teachers on generic pedagogical knowledge and skills and that of their male counterparts.

With reference to knowledge and skills in science subject dimension, the percentage of female science teachers received on 'moderately needed' and 'not needed' is 45.8% and (37.5%) respectively. Nevertheless, most of the male counterpart demonstrated a moderately needed assistance as 34.1% of the male responded to this aspect. Male respondents in the greatly needed category generated 31.8% against 16.7% of females. Furthermore, a weak association was established between the perceived needs of male and female science teachers' knowledge and skills in science subject. In support of this association, the chi-square test yielded a result of 2.43 with a highly insignificant value of 0.297>0.05 for gender and teachers' perceived needs on knowledge and skills in science subject. Thus, enough evidence did not support the association between gender and teachers' perceived needs on knowledge and skills in science subjects, which shows that both male and female science teachers have similar perceived needs.

In the administering science instructional facilities and equipment, a greater percentage of the male science teachers (40.2%) greatly needed assistance to improve their knowledge and skills here. On the other hand, 41.7% of their female counterparts deemed that their skills in administering science instructional facilities and equipment are moderately inadequate. This result may be associated with the fact that most of the schools do not provide in-service training to science teachers in relation with handling science instructional facilities especially laboratory equipment. Similarly, 31.1% of the male science teachers expressed that they have adequate skills in administering science instructional facilities and equipment as 37.5% their female counterparts also expressed that they have adequate skills in administering science instructional facilities and equipment. Moreover, the chi-square test for testing the association between gender and science teachers' perceived needs in administering science instructional facilities and equipment dimension generated a result of 3.40 with an insignificant value of 0.183>0.05. This shows that there was inadequate evidence to support the association between gender and science teachers' perceived needs. Thus, there was an insignificant association between the perceived needs of female science teachers on administering science instructional facilities and equipment and that of their male counterparts.

With planning activities in science instruction dimension, a greater percentage of the male science teachers (34.8%) and (27.3%) was established in both 'not needed' and 'greatly needed' categories. In contrast, 34.8% of the male science teachers expressed a greatly needed assistance in planning science instruction activities while 25% of female science teachers' also expressed a great need. Likewise, the chi-square test yielded a test result of 1.33 with a highly insignificant value of 0.515>0.05 for gender and science teachers' perceived needs on planning activities in science instruction.

This shows that there was not enough evidence to support the association between gender and science teachers' perceived needs. Thus, there was no significant association between the perceived needs of female science teachers on planning activities in science instruction and that of their male counterparts.

With reference to the integration of multimedia technology in science teaching dimension, a greater percentage of both male and female science teachers were witnessed on the greatly needed column as they had a respective percentage of 37.1% and 54.2%. These high percentages indicated that both male and female science teachers felt that such skill was relevant and hence important. All the same, 35.6% of the male science teachers demonstrated a moderately needed assistance as they expressed their concern on having inadequate skills in integrating multimedia technology in science teaching. The male respondents who responded in the 'not needed' category generated 27.3% against 29.2% of the females. Moreover, the chi-square test yielded a test result of 3.74 with an insignificant value of 0.154>0.05 for gender and science teachers' perceived needs on integration of multimedia technology in science teaching. This shows that there is no satisfactory evidence to support the association between gender and science teachers' perceived needs. Thus, there was no significant association between the perceived needs of female science teachers on integration of multimedia technology in science teaching and that of their male counterparts.

RQ 2: What are the in-service needs of Senior High School science teachers' with regards to their areas of subject specialization?

Dimensions	Variables		Not needed		Moderately needed		Greatly needed		Chi-square (x^2)	P-value
			Freq.	%	Freq.	%	Freq.	%		
Management of science instruction	Major Academic Course	Physics	9	(36.0)	5	(20.0)	11	(44.0)	4.876	.771
		Chemistry	16	(41.0)	13	(33.3)	10	(25.6)		
		Biology	17	(37.8)	13	(28.9)	15	(33.3)		
		Integrated Science	10	(37.0)	10	(37.0)	7	(25.9)		
		Others	6	(30.0)	5	(25.0)	9	(45.0)		
Diagnosing & Evaluating Students	Major Academic Course	Physics	11	(44.0)	8	(32.0)	6	(24.0)	11.317	.184
		Chemistry	19	(48.7)	14	(35.9)	6	(15.4)		
		Biology	14	(31.1)	22	(48.9)	9	(20.0)		
		Integrated Science	13	(48.1)	7	(25.9)	7	(25.9)		
		Others	3	(15.0)	10	(50.0)	7	(35.0)		
Generic Pedagogical Knowledge and Skill	Major Academic Course	Physics	17	(68.0)	4	(16.0)	4	(16.0)	14.650	.066
		Chemistry	33	(84.6)	4	(10.3	2	(5.1)		
		Biology	17	(60.0)	10	(22.2)	8	(17.8)		
		Integrated Science	27	(66.7)	8	(29.6)	1	(3.7)		
		Others	18	(90.0)	1	(5.0)	1	(5.0)		
Knowledge and Skills in Science Subject	Major Academic Course	Physics	10	(40.0)	9	(36.0)	6	(24.0)	9.834	.277
		Chemistry	16	(41.0)	14	(35.3)	9	(23.1)		
		Biology	13	(28.9)	20	(44.4)	12	(26.7)		
		Integrated Science	11	(40.7)	8	(29.6)	8	(29.6)		
		Others	4	(20.0)	5	(25.0)	11	(55.0)		
Administering Science Instructional Facilities and Equipment	Major Academic Course	Physics	8	(32.0)	8	(32.0)	9	(36.0)	11.588	.171
		Chemistry	18	(46.2)	9	(23.1)	12	(30.8)		
		Biology	12	(26.7)	19	(42.2)	14	(31.1)		
		Integrated Science	7	(25.9)	9	(33.3)	11	(40.7)		
		Others	5	(25.0)	3	(15.0)	12	(60.0)		
Planning Activities in Science Instruction	Major Academic Course	Physics	9	(36.0)	6	(24.0)	10	(40.0)	9.973	.267
		Chemistry	14	(35.9)	16	(41.0)	9	(23.1)		
		Biology	12	(26.7)	16	(35.6)	17	(37.8		
		Integrated Science	7	(25.9)	14	(51.9)	6	(22.2)		
		Others	3	(15.0)	7	(35.0)	10	(50.0)		
Integration of Multimedia Technology in Science Teaching	Major Academic Course	Physics	6	(24.0)	6	(24.0)	13	(52.0)	14.998	.059
		Chemistry	16	(41.0)	13	(33.3)	10	(25.6)		
		Biology	14	(31.1)	17	(37.8)	14	(31.1)		
		Integrated Science	3	(11.1)	7	(25.9)	17	(63.0)		
		Others	4	(20.0)	8	(40.0)	8	(40.0)		

Note: Significant at 0.05

Table 2: Summary statistics of Perceived Needs against Area of Specialization

From Table 2, the highest percentages were recorded in the greatly needed column on management skills in handling science instruction as 44.0%, 33.3% and 45.0% of science teachers who have respectively majored in physics, biology and non-science option subjects revealed that they greatly needed managerial skills in handling their respective subjects. More so, on the area of specialization variable, 37.0% of non-Science option teachers moderately needed the respective knowledge and skills. The science option teachers (chemistry and biology) on the other hand, expressed less concern on managerial skills and assistance except physics teachers. Nevertheless, the percentage of non-science option teachers who opted for 'moderately needed' and 'not needed' for such need is similar (37%). From the result in table 5 again, with regards to major academic course and teachers perceived needs on management of science instruction assistance, the chi-square test was 4.88 with a highly insignificant value of 0.771>0.05. This attested to the fact that the there was no ample evidence to deduce that science teachers perceived needs vary among major academic course.

More than a quarter of integrated science option teachers (25.9%) and non-science option teachers (35.0%) expressed concerns of assistance with reference to diagnosing and evaluating students, while less than a quarter of physics, chemistry and biology option teachers (24.0%, 15.4% and 20.0% respectively) also showed that such dimension of need was very crucial to them. Detailed analysis of the association between major academic course and perceived science teachers' needs shows that 48.7% of the chemistry option teachers perceived that they had acquired the necessary skills in assessing students. With reference to major academic course and science teachers perceived needs of diagnosing and evaluating students, again, the chi-square test of 11.32 with an insignificant value of 0.184>0.05 was detected. This proved that unsatisfactory evidence existed between the significant association of science teachers perceived needs and major academic course. Thus, among the major academic courses, the perceived needs of science teachers on how to diagnose and evaluate students were the same.

In the acquisition of generic pedagogical knowledge and skills dimension, weak associations exist in the major academic course of teachers. More than two-thirds of chemistry teachers (87.8%) and non-science option teachers (90.0%) felt that such skill is unnecessary. In respect to other subjects, more than half both integrated science, biology and physics teachers echoed that their assistance in acquisition of generic pedagogical knowledge and skills are irrelevant. A greater percentage of biology (17.8%) option teachers raised concerns on acquisition of generic pedagogical knowledge and skills as compared to other teachers. Generally, almost all the teachers felt that generic pedagogical knowledge and skills is irrelevant. In addition to the major academic course and science teachers perceived in-service needs' of generic pedagogical knowledge and skills, the chi-square test yielded a result of 14.65 with an insignificant value of 0.066>0.05. This confirmed that there was inadequate evidence to infer that science teachers perceived needs of generic pedagogical knowledge and skills differ among their major academic courses.

With regards to knowledge and skills in science subject, more than half of non-science option teachers portrayed that they greatly needed support in upgrading their mastery of knowledge and skills in science subjects (55.0%). Biology science teachers here felt that they moderately needed assistance in knowledge and skills in science subject (44.4%). Interestingly, it was also found that the highest percentage identified is in the 'not needed' scale, which was expressed by 40.0% and 41.0% of physics and chemistry option teachers respectively; viz. the percentage of not needed as expressed by this cohort of science teachers. Furthermore, the chi-square results of 9.83 with a highly insignificant value of 0.277>0.05 was detected in the testing of association between major academic course and teachers perceived needs of knowledge and skills in science subjects. This result established that the difference in science teachers perceived needs of knowledge and skills in mastery of science subjects among their major academic course were highly irrelevant.

The highest percentage of a great need for administering science instructional facilities and equipment competencies is demonstrated by non-science option teachers (60%), followed by integrated science teachers and those majoring in physics (40.7% and 36.0% respectively). On the other hand some of the biology teachers (42.2%) expressed only moderately needed assistance in this dimension, while some of the chemistry teachers (46.2%) uttered that they have the adequate skills and assistance in this dimension. Predictably, with regards to major academic course and teachers perceived needs on administering of science instructional facilities and equipment, the chi-square test was 11.59 with an insignificant value of 0.171>0.05. This result indicated that there was insufficient evidence to infer that science teachers perceived needs on administering of science instructional facilities and equipment assistance differ among major academic course.

In the planning activities of science instruction dimension, the highest percentage of a great need for planning science instruction competencies was demonstrated by half of non-science option teachers (50.0%), followed by teachers majoring in physics (40.0%), and those majoring in biology (37.8%). More than 50.0% of integrated science teachers (51.9%) felt that such skill was moderately needed. At the same time, 41.0% of chemistry teachers' echoed similar cries compared to 35.6% and 24.0% of biology and physics teachers respectively. Similarly, non-science option teachers (35%) also indicated a moderate need. Respondents majoring in physics, showed less concern for assistance and skill in this dimension as compared to other option teachers. As for the association between teachers perceived needs of planning activities in science instruction and their major academic course, the chi-square test yielded a result of 9.97 with an insignificant value of 0.267>0.05. Hence, there was no ample evidence to infer that science teachers perceived needs of planning activities in science instruction infer among major academic course.

With the integration of multimedia technology in science teaching dimension, more than 50.0% of physics and integrated science option teachers felt that such a skill was greatly needed. This was evident where 63.0% of integrated science option teachers and 52.0% of physics option teachers expressed their great need in this dimension. As expected, most of the chemistry teachers comprising 41.05% felt that assistance in integration of multimedia technology in teaching was unnecessary as compared to those in other course options. Interestingly, for non-science option teachers, the percentage of responses received on a 'moderate need' and 'greatly needed' scale is similar (40.0%).

With regards to major academic course and science teachers perceived needs of integration of multimedia technology in science teaching, the chi-square test was 14.998 with a insignificant value of 0.0.59>0.05. Here, the indication was that weak evidence exists in the association between major academic course and science teachers perceived needs of integration of multimedia technology in science teaching. Thus, the inference would be that teachers perceived needs of integration of multimedia technology in science teaching differ among their major academic course

IV. DISCUSSION

RESEARCH THEME 1: Gender differences in Senior High School science teachers' in-service needs.

Analysis of data also revealed that teachers' gender seems to be associated with their perception towards upgrading their knowledge and skills in science subjects, as well as generic pedagogical knowledge and skills required for effective science instruction. Such needs affect the respondents' perception of the importance of planning effective science instruction. Analysis across gender reveals that female teachers require more attention in equipping themselves with the skills in all the dimensions identified.

Several interesting issues also emerged when association was gauged between gender and areas of specialization and science teachers' needs. As earlier mentioned the cohort of science teachers who require more training in all dimensions of science teachers' needs as measured in this study were female and non-science option teachers teaching in rural schools. Therefore in-service programmes should be organized regularly to constantly monitor students' progress and weakness for the necessary actions to be taken with regards to science teachers needs.

RESEARCH THEME 2: In-service needs of Senior High School science teachers' with regard to their areas of subject specialization.

In-service training is a process of staff development for the purpose of improving the performance of an incumbent holding a position with assigned job responsibilities. It promotes the professional growth of individuals. "It is a programme designed to strengthen the competencies of science teachers while they are on the job" (Malone, 1984). In-service training is a problem-centred, learner-oriented, and time-bound series of activities, which provide the opportunity to develop a sense of purpose, broaden perception of the clientele, and increase capacity to gain knowledge and mastery of techniques.

Science teachers' area of specialization seems to be associated with teachers' perceptions of the importance of specific skills pertaining to science teaching and learning such as administering science instructional facilities and equipment, diagnosing and evaluating students, generic pedagogical knowledge and skills, planning science instruction and the use of multimedia technology in science teaching. It was also detected that for almost all dimensions, non-option science teachers appear to be those who require more attention in all the dimensions of science teachers' needs as measured in this study. When all the analysis is integrated together, it could be synthesized that specifically, the cohort of science teachers who require more training in all dimensions of science teachers' needs are non-science option and some female teachers in rural areas.

Although teachers play a crucial role in the implementation of new/innovative curricula they are not duly informed about the organisation of orientation or professional development courses. The traditional top-down approach is what the central staff of the Curriculum Research Development Division (CRDD) use, in which most often teachers are blamed for the failure of new educational reforms or curriculum innovations. In this regard change is viewed as transmission of ideas from curriculum developers/researchers to teachers.

Professional development programmes should be designed to result in collaborative programme. This means that teachers, administrators, supervisors, non-teaching staff, students and laypersons should be involved. Such programmes should be grounded on the needs of the participants of the study, thus Senior High School science teachers'. That is, the plan should be developed from an assessment of the needs and interests of the persons to be served.

Also subject matter knowledge is widely acknowledged as a central component of what teachers need to know, research on teacher education has not, in the main, focused on the development of teachers' subject matter knowledge. Researchers specifically interested in how teachers develop and change have focused on other aspects of teaching and learning to teach. For example, changes in teachers' role conceptions, their beliefs about their work; their knowledge of students, curriculum, or of teaching strategies. Yet to ignore the development of teachers' subject matter knowledge seems to belie its importance in teaching and in learning to teach. Literature is however silent on the needs of science teachers with regards to their areas of specialisation. In addition to this, science teachers' needs vary with regards to their areas of subject specialisation. The need of the biology teacher is different from that of the chemistry, physics, integrated science and other science related areas. It is more likely that both professionally trained and untrained science teachers be given in-service training in their areas of subject specialisation.

V. CONCLUSION AND RECOMMENDATIONS

Meaningful empirical evidences of effective in-service programmes are provided in this study for the process of upgrading science teachers' professionalism in Ghana. Data gathered in this study provides vital information especially for those involved in designing and implementing INSET, so that all the programmes implemented will be tailored specifically to the immediate needs of science teachers. From this study, science teachers' needs identified revolves around upgrading oneself in meeting the current challenges of teaching and learning science. This as indicated, is determined mostly by socio-political scenario of the country.

Another important feature, which emerged from this study, was teachers' personal concern and awareness of the importance of self-improvement. Especially in making their lessons meaningful and attractive, this would subsequently lead to improvement in the students' achievement. It is apt to mention that Ghanaian Senior High School science teachers, as empirically indicated in this study, indulge in keeping the best interest of their students. Teachers also maintain that lifelong learning which is at the heart of teacher development.

There is therefore the need to change both what used to be taught a decade ago and how it was taught then. The information environment is being rapidly pushed. This means that the learning opportunities and modes/styles of learning are also changing. Therefore a new approach to the teaching and learning of science and technology needs to be cultivated. The ICTs that create this challenge also offers tools to face it, provided science teachers are adequately prepared to use those tools. The shift in curriculum emphasis is certainly expensive, but the benefits of such investments that gear towards improving teaching and learning outcomes are immense. The infusion of ICTs into the curriculum and the adoption of such tools to aid classroom interactions and activities are issues teachers can no longer overlook. For science and technology to make the expected positive impact on national development, the science and technology curriculum must not only be relevant to the needs of the nation. The science and technology teacher must be abreast with new ways of teaching the subject. Therefore educational policy makers and the government must provide an ICT enabled school environment that would make the flourishing of science and technology possible. Once schools are appropriately classified, their differences in gender and area of subject specialisation may emerge. Careful monitoring of these issues will help to keep the rural-urban divide on the policy agenda, and allow evaluation of the policy measures taken to alleviate the divide.

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