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Most Prevalent In-Service Needs Of Senior High School Science Teachers By Location In Central Region, Ghana

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***Abstract:** The purpose of this study was to identify Senior High School science teachers' perceived needs and compare those needs across location. The research design employed in this study was a survey using a questionnaire as the instrument. This study was descriptive in nature. A total of 23 schools were obtained out of which 2 were used for the study. The instrument used to collect data was a questionnaire, the 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 to reduce mistakes and prevent threat to validity of the research, through the use of Cronbach alpha. It was also realised from the data that the topmost priority of science teachers' in-service needs was the integration of multimedia technology into science instruction. 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 provides meaningful empirical evidences of effective in-service programmes in the process of upgrading Senior High School science teachers' professionalism in the Central Region of Ghana.*

***Keywords:** science teachers, in-service needs, school location, most prevalent needs, senior high school*

I. INTRODUCTION

In this ever-changing globalized world, the disciplines in science (Biology, Physics, Chemistry, Integrated Science and other science related subjects) are continuously evolving. Similarly, instructional techniques used to teach these subjects are also developing at the same pace, both as a result of new developments in Information and Communication Technology (ICT) and research in science teaching and learning (Kamisah, Lilia & Subahan, 2006). Consequently, practicing science teachers need to update their knowledge in both content and pedagogy. It is a well-known phenomenon that, in some countries, specialists of some non-science subject areas are often made to teach science subjects that they are not trained for. The need to continuously develop professional science teachers is critical in science teaching. Even though these teachers might have used various kinds of coping strategies and safety net in their teaching, they still need in-service training courses to teach science meaningfully and effectively.

For science teaching professionals, to continue functioning efficiently, productively and contribute meaningfully towards quality science education, they must be given training opportunities to keep them up-to-date. This will enable them face new professional, academic, and global societal challenges. In this regard, quality teacher professional development programmes are meant to empower teachers in line with changes taking place in the world. The late Julius Kambarage Nyerere once said that any educational policy needs well-trained professional cadres who are continually updated for the educational policy to succeed (Nyerere, 1988). Consequently, teacher professional development programmes must be geared towards keeping teachers in all capacities abreast of new professional, academic, pedagogical and global societal challenges.

Analysis of the historical panorama of Science education in Ghana leads to the conclusion that science curriculum innovation is continuously in the state of flux. The lessons of 1987, 1997 and 2007 education reforms in Ghana are particularly important at a time when the international community is pressing and supporting African states to improve access to basic education as a strategy for poverty alleviation (World Bank, 2002a). To date, continuous modification of Science curriculum innovation in Ghana has been planned and hence implemented to suit the nation due to changes in globalisation. More to that, all the educational reforms implemented in Ghana since September 1975, (the beginning of the implementation of the Dzobo Education Reforms of 1974), were aimed at providing well-trained citizens (Dzobo, 1975) as cited by MOE (1975). This involved the acquisition of the requisite skills and knowledge needed to meet the needs of the nation. At secondary level, the emphasis in science teaching will be on innovation and problem solving. There had been problems with the implementation of all these reforms. The current reform, the Anamuah-Mensah Reforms, is facing certain challenges that need to be surmounted. According to the new educational reforms, Continuous teacher development will be undertaken to upgrade and update the competencies and skills of serving teachers. Also Open universities and distance learning colleges shall be established to train and retrain teachers with regards to the reforms. These needs are to be addressed urgently to make the reforms succeed which augments this research.

With regards to this study, developing quality teacher professionals is about empowering them in affective, cognitive and psychomotor domains. Quality teachers in schools, colleges or universities are products of quality teacher education and re-education programme. These domains are reflected in science teachers' inventory of needs identified by Kamariah, Rubba, Tomera and Zurub (1988) as: generic pedagogical knowledge and skills, knowledge and skills in science subjects, managing and delivering science instruction, diagnosing and evaluating students, planning science instruction, administering science instructional facilities and equipment and integration of multimedia technology as adapted by the researcher.

The issue of improving the quality of science teachers is fast becoming a key concern in the search for ways to improve science education at all levels especially at the Senior High Schools (MOEYS, 2003). Within the framework of the Free Compulsory Universal Basic Education (FCUBE) reform programme, new teacher education policy has been put forward in an attempt to improve the quality of trained science teachers to effect positive changes in the school system (MOEYS, 2003). There is the belief that recently trained teachers often lack important skills and qualities that would make them better prepared to handle the new directions of curriculum reform and practice (MOE, 1995). In fact, some heads of Senior High Schools have questioned the calibre of science teachers recently produced from the country's teacher training colleges and universities, arguing that they lack the commitment and skills that would otherwise make them successful science teachers (Awuku, 2000). In order to improve professional development, learning communities need to be established between schools and tertiary education institutions and also between experienced mentor teachers (in-service teachers) as well as between teacher educators and in-service teachers (Agbo, 2003). Agbo (2003) argues that collaboration within professional development communities and learning communities alike could be seen as "learning about teaching and teaching about learning". This learning from one another could only be possible when one of the parties/participants is an experienced teacher/mentor or teacher educator. This symbiotic collaboration also provides solutions for concurrent effective teacher education and therefore the improvement of the preparation of teachers.

Many countries report that teachers express a strong preference for urban postings. In Ghana, for example, over 80% of teachers said they preferred to teach in urban schools (Akyeampong & Lewin, 2002). There are a number of rational reasons why teachers may prefer urban postings. One of the concerns about working in rural areas is that the quality of life may not be as good. Teachers have expressed concerns about the quality of accommodation (Akyeampong & Stephens, 2000), the classroom facilities, the school resources and the access to leisure activities (Towse, Kent, Osaki & Kirua, 2002).

Teachers may also see rural areas as offering fewer opportunities for professional advancement. Urban areas offer easier access to further education (Hedges, 2000). In addition, teachers in rural areas are less likely to have opportunities to engage other developmental activities, or in national consultation or representative organisations. Teachers in rural areas may even find it more difficult to secure their entitlements from regional educational administrations.

It also appears that, for quite some time now, schools and colleges have been places of individuals not professionally fit to undertake teaching. So often, the problem or fear of unemployment has pushed even non-education graduates into the teaching sector. Such people come from various fields of specialisation inter alia engineering, agriculture, sociology, forestry, and home economics (Berenson, IIodgin, Ward, Andrews and Rudin, 1991). Therefore, teachers with various subject majors' or background are often required to teach science subjects which they were not trained for. Though these teachers might use various kinds of coping strategies in their teaching, they are in dire need for in-service training programme in order to teach meaningfully and effectively. This in-service training will help to fill the gaps of content knowledge as well as pedagogical content knowledge in the subjects that they are required to teach. It is essential to re-train science teachers in order for them to keep the best interest of their students and maintain that lifelong learning at the heart of teacher development.

In this study the researchers' aim is to investigate Senior High School science teachers perceived in-service needs across school location. Often the experiences and views of those who are the direct beneficiaries of science are seldomly 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 teacher education in Senior High Schools in Ghana.

RESEARCH QUESTIONS

The research questions that guided the study were;

- ✓ What are the most prevalent in-service needs of Senior High School science teachers?
- ✓ What are the in-service needs of Senior High School science teachers' with regard to school location?

II. METHODOLOGY

The research design employed in this study was a survey research design using a questionnaire as the instrument. The survey design was chosen so that generalizations could be made from the samples representing the population (Creswell, 2005; Kerlinger & Lee, 2000).

Many a time survey study intends to understand and explain the phenomena in a natural setting or provide information to government / other organization(s) or compare different demographic groups or see the cause and effect relationship to make predictions. 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' most prevalent in-service needs based on school location. The nature of such data justifies the suitability of the survey design employed.

POPULATION AND SAMPLE

A population is any group of individuals that have one or more characteristics in common that is of interest to the researcher (Best, 1993). 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 offered 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

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. Section A involved the demographics or bio data of the respondents. Section B was made up of 72 items distributed among seven dimensions of science teachers perceived needs.

Some changes were made in the questionnaire to suit the Ghanaian context. For instance, in the demographic section, items such as ethnicity and highest level of education with regards to SPM and STPM was dropped. 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 in lower and upper secondary were also changed to fit into our system.

Some statements in the questionnaire were also rephrased, for instance, inculcating spiritual values in science teaching was modified to read, inculcating cultural values in science teaching since cultural values are identified in the Ghanaian 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 (Appendix B).

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.

Table 1, compares the reliability coefficients of the Science Teachers Inventory of Needs of the authors and the researcher. However, the dimension on the use of English language in science teaching was removed from the questionnaire because the Cronbach alpha values generated was unacceptable. It also appears that, since the medium of instruction in Senior High Schools in Ghana was English it accounted for the low Cronbach alpha values generated. In summary, the application of all those procedures finally generated seven dimensions (factors).

Dimension	No. of Items	Cronbach's Alpha Coefficient by Authors	Cronbach's Alpha Coefficient of Study
Management of Science Instruction	16	0.953	0.942
Diagnosing and Evaluating Students	11	0.909	0.904
Generic Pedagogical	14	0.861	0.951

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knowledge and skills			
Knowledge and skills in science subjects	7	0.900	0.880
Administering Science Instructional facilities and equipment	10	0.878	0.864
Planning activities in science instruction	8	0.902	0.903
Integration of Multimedia technology in science teaching	4	0.830	0.749

Table 1: The reliability Coefficients of Science Teachers Needs Assessment Instrument

DATA COLLECTION PROCEDURE

The researcher collected an introductory letter from the school of Graduate studies which was sent to the Heads of Senior High schools to enable the researcher undertake the study. Respondents' consent were sought to participate in the study before the questionnaire was administered. The questionnaire was personally delivered to the respondents. The respondents were required to write the names of only their schools and not their own names, this was to ensure confidentiality. Since the items are easily comprehensible; it did not take so much time to answer. The maximum period was about thirty-five minutes.

Also respondents', who were not willing to answer instantly, were given the right to do so at their own will but within a time frame of one week. In order to ensure reliability in an uncontrolled environment, the respondents were informed that the questionnaire was not a test and that their responses would not be used to change their status or affect their promotion(s). The researcher by making appointments collected the questionnaires on a later date with teacher respondents who could not submit their questionnaires immediately.

DATA ANALYSIS

Both descriptive and inferential statistics were used to analyse the data. The Statistical Package for Social Sciences (SPSS version 16.0) was used by the researcher to analyse the data. The means, frequencies and standard deviations were calculated using the descriptive statistics function of the software and presented on tables.

The inferential statistics function in the software was also used by the researcher to draw conclusions, inferences or generalisations from the sample to the population or participants of the research. The chi square test for independence served as an alternative to the independent-measures T- test (or ANOVA) in situations where the dependent variable involved classifying individuals into distinct categories. The reasons for using chi square test for independence is that it is used to test whether or not there is a relationship between two variables. The test determines how well the obtained sample proportions fit the population proportions specified.

With regards to research question 1, data was analysed using Z-test for proportional difference which relies on the mean and standard deviation within a distribution. This enabled the researcher to compare the various dimensions with regards to science teachers' in-service needs.

Research questions' 2, data was analysed using inferential statistics. Chi square analysis revealed significant associations existing between science teachers' most prevalent needs and school location.

III. RESULTS

Dimension	Level of Needs N (%)					
	Not Needed		Moderately Needed		Greatly Needed	
Management of Science Instruction	58	**(37.2)**	46	(29.5)	52	(33.3)
Diagnosing and Evaluating Students	60	(38.5)	61	**(39.1)**	35	(22.4)
Generic Pedagogical Knowledge and Skills	113	**(72.4)**	27	(17.3)	16	(10.3)
Knowledge and Skills in Science Subject	54	(34.6)	56	**(35.9)**	46	(29.5)
Administering science Instructional Facilities and Equipment	50	(32.1)	48	(30.8)	58	**(37.2)**
Planning Activities in Science Instruction	45	(28.8)	59	**(37.8)**	52	(33.3)
Integration of Multimedia Technology in Science Teaching	43	(27.6)	51	(32.7)	62	**(39.7)**

Table 2: Level of Needs for Each Dimension

To reiterate, the definition of perceived science teachers' need as measured in this study is referred to as an area for in-service help; a situation in which science teachers indicate more than a moderate need. Hence, it was then decided that science teachers' need be categorized as a priority when the percentage of respondents indicating a great need is 40 per cent or more. This was in line with Moore and Blankenship (1978) suggestion whereby a priority science teachers' need is defined as ''an area for in-service help when science teachers indicate more than a moderate need'' (page 514). Similarly, the 40 per cent cut-off point was also used in previous studies Baird and Rowsey (1989).

Table 2 summarizes the level of needs for each of the seven dimensions as perceived by the respondents. The respondents indicated that they would need to improve their knowledge and skills in all the seven dimensions of science teachers' needs. More than 60% of the science teachers echoed 'moderately and greatly needed' in all the dimensions except generic pedagogical knowledge and skills dimension.

With regards to Table 2, highlighted figures represent the 40% cut off point as cited by Baird and Rowsey (1989). A greater percentage of "greatly needed" scale is demonstrated on the integration of multimedia technology in science teaching dimension (39.7%). This was followed by the administering science instructional facilities and equipment dimension (37.2%). Surprisingly, a similar percentage was proved in management of science instruction dimension and

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planning activities in science instruction dimension as 33.3% of science teachers attested they greatly needed assistance in these two dimensions of science teachers' needs. It seems that a moderately needed skill is in diagnosing and evaluating students (39.1%).

In terms of science teachers' knowledge and skills in science subject, only 35.9% of the science teachers confirmed that they moderately needed assistance whereas 29.5% of them greatly needed assistance. This result suggested that most of the science teachers who took part in this study observed that their knowledge and skills in science is inadequate to ensure effectiveness and meaningfulness in science instruction. The slightest needed skill is in generic pedagogical knowledge and skills. Only 10.3% of the science teachers deemed that they needed to improve their knowledge and skills while 72.4% of them believed that their knowledge and skills was enough for effective science instruction.

THE CATEGORIZATION OF SCIENCE TEACHERS' NEEDS

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.

The following tables are detailed analysis of perceived science teachers' needs of each dimension according to school location. 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 Kerlinger and Lee (2000).

Dimensions	Variables		Not needed		Moderately needed		Greatly needed		Chi-square(x^2)	P-value
Management of Science Instruction	Location of schools	Urban	48	(44.9)	33	(30.8)	26	(24.3)	13.357	.001
		Rural	10	(20.4)	13	(26.5)	26	(53.1)		
	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)		
		Integrate science	10	(37.0)	10	(37.0)	7	(25.9)		
		Others	6	(30.0)	6	(25.0)	9	(45.0)		
Diagnosing& Evaluating Students	Location of schools	Urban	47	(43.9)	42	(39.3)	18	(16.8)	7.430	.024
		Rural	13	(26.5)	19	(38.8)	17	(34.7)		
	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)		
		Integrate science	13	(48.1)	7	(25.9)	7	(25.9)		
		Others	3	(15.0)	10	(50.0)	7	(35.0)		
Generic Pedagogical Knowledge and Skills	Location of schools	Urban	70	(65.4)	25	(23.4)	12	(11.2)	9.840	.007
		Rural	43	(87.8)	2	(4.1)	4	(8.2)		
		Physics	17	(68.0)	4	(16.0)	4	(16.0)		
	Major academic course	Chemistry	33	(84.6)	4	(10.3)	2	(5.0)	14.650	.066
		Biology	27	(60.0)	10	(22.2)	8	(17.8)		
		Integrate science	18	(66.7)	8	(29.6)	1	(3.7)		
		Others	18	(90.0)	1	(5.0)	1	(5.0)		
Knowledge and Skills in Science Subject	Location of schools	Urban	40	(37.4)	43	(40.2)	24	(22.4)	8.254	.016
		Rural	14	(28.6)	13	(26.5)	22	()44.9		
	Major academic course	Physics	10	()40.0	3	(36.0)	6	(24.0)	9.834	.277
		Chemistry	16	(41.0)	14	(35.9)	9	(23.1)		
		Biology	13	(28.9)	20	(44.4)	12	(26.7)		
		Integrate 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	Location of schools	Urban	36	(33.6)	38	(35.5)	33	(30.8)	6.443	0.040
		Rural	14	(28.6)	10	(20.4)	25	(51.0)		
	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)		
		Integrate science	7	(25.9)	9	(33.3)	11	(40.7)		
		Others	5	(25.0)	3	(15.0)	12	(60.0)		
Planning Activities in Science Instructions	Location of schools	Urban	39	(36.4)	37	(34.6)	31	(29.0)	9.716	.008
		Rural	6	(12.2)	22	(44.9)	21	(42.9)		
	Major academic course	Physics	9	(36.0)	6	(42.0)	10	(40.0)	9.973	.267
		Chemistry	14	(35.9)	16	(41.0)	9	(23.1)		
		Biology	12	(26.7)	16	(35.6)	17	(34.8)		
		Integrate 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	Location of schools	Urban	31	(29.0)	33	(30.8)	43	(40.2)	.619	.734
		Rural	12	(24.5)	18	(36.7)	19	(38.8)		
	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	(31.10		
		Integrate science	3	(11.1)	7	(25.9)	17	(63.0)		
		Others	4	(20.0)	8	(40.0)	8	(40.0)		

Significant act at 0.05

Table 3: Summary Statistics of Teachers' Needs and Location

RQ 1: *What are the most prevalent in-service needs of Senior High School science teachers'?*

Z-test for proportion was used to test the significance of Senior High School science teachers' most prevalent need to that of other needs in keeping themselves abreast of the current demands in teaching and learning instruction. Table 3 revealed that most of the science teachers needed assistance in integrating multimedia in science teaching, which proved to be their most prevalent need. On this note, the proportion of science teachers who are in need of integrating multimedia assistance in science teaching was compared to the others.

Firstly, the proportion of science teachers who are in need of integrating multimedia assistance was compared with those in need of management of science instruction assistance. The procedure was as follows:

- ✓ Null hypothesis: the proportion of science teachers who are in need of integrating multimedia assistance (most prevalent in-service needs') is the same as those in need of management of science instruction assistance.
- ✓ Test statistic: $z = \frac{\hat{p}-p}{\sqrt{\frac{p(1-P)}{n}}}$, where;

$\hat{P}$ is the proportion of science teachers in need of management of science instruction assistance.

P is proportion of science teachers who are in need of integrating multimedia assistance

n is the sample size.

Now, $\hat{P} = \frac{52}{156} = 0.333, P = \frac{62}{156} = 0.397, n = 156$

Therefore, $z = \frac{0.333-0.397}{\sqrt{\frac{0.397(1-0.397)}{156}}} = -1.636$

- ✓ Decision Criteria: at significant level of 0.05, the decision rule is to reject the hypothesis if z-statistic is less than -1.96 or greater than 1.96. If z-statistic is between -1.96 and 1.96, then we fail to reject the null hypothesis.

Dimensions	Proportion of strongly needed (P)	Proportional difference (D)	z-test value	p-value
Management of Science Instruction	.333	.064	-1.636	0.051
Diagnosing and Evaluating of Students	.224	.173	-4.417	0.000
Generic Pedagogical Knowledge and Skills	.103	.294	-7.526	0.000
Knowledge and Skills in Science Subject	.294	.103	-2.618	0.004
Administering Science Instructional Facilities and Equipment	.372	.025	-0.654	0.258
Planning Activities in Science Instruction	.333	.064	-1.636	0.051

Note: D= 0.397- P, where 0.397 represents the proportion of science teachers most prevalent needs; Significant at 0.05.

Table 4: Ranking of in- service science teachers' most prevalent needs (that is, integration of multimedia technology in science teaching) and other dimensions of science teachers needs

In relation to Table 4, we failed to reject the null hypothesis since z = -1.636 (-1.96< z < 1.96), thus, the test insignificant at 0.05. We therefore had insufficient evidence to believe that the proportion of science teachers who strongly required management skills in handling science instruction is different from those who strongly required assistance in integrating multimedia in science teaching. Also, there is weak evidence to infer that the proportion of science teachers who need assistance in integration of multimedia technology in science teaching is higher than those who need management skills in handling science instruction, since the p – value = 0.505 > 0.05 is insignificant. Thus, attention should be on both dimensions of science teachers' needs.

The computed value of z =-4.417 < -1.96 was in the rejection region, so the null hypothesis was rejected at the 0.05 level. The difference of 6.4 percentage points between science teachers who strongly required assistance in diagnosing and evaluating students and those who strongly required integration of multimedia technology in science teaching is statistically significant. The evidence here is clear that differences exist between the proportion of science teachers who are in need of assistance in multimedia integration in science teaching and those who are in need of assistance in diagnosing and evaluating students. The p – value = 0 < 0.05 (highly significant) shows that there is an overwhelming evidence to infer that the proportion of science teachers' who need assistance in multimedia technology integration in science teaching is/are higher than those who need assistance in diagnosing and evaluating students. Thus, attention should be on the former than the latter.

The calculated value of z = -7.526 < -1.96 indicated that the null hypothesis is rejected at the 0.05 level. The difference of 29.4 percentage points between science teachers who strongly required assistance in generic pedagogical knowledge and skills and those who strongly required integration of multimedia technology in science teaching is statistically significant. The evidence here is clear that differences exist between the proportion of science teachers who are in need of assistance in integrating multimedia in science teaching and those who are in need of assistance in generic pedagogical knowledge and skills. The p – value = 0 < 0.05 was highly significant. This shows that there is an overwhelming evidence to infer that the proportion of science teachers who need assistance in integration of multimedia technology in science teaching is higher than those who need assistance in diagnosing and evaluating students. Thus, attention should be on the former than the latter.

Moreover, the null hypothesis is rejected at the 0.05 level, since the calculated value of z = -2.618 < -1.96. Hence, the difference of 10.2 percentage points between science teachers who strongly required knowledge and skills in science subjects and those who strongly required integration of multimedia technology in science teaching is statistically significant. The evidence here is clear that differences exist between the proportion of science teachers who are in need of assistance in integrating multimedia technology in science teaching and those who are in need of knowledge and skills in science subjects. Also, the p – value = 0.004 < 0.05 was highly significant. This shows that there is an overwhelming evidence to infer that proportion of science teachers who need assistance in integration of multimedia technology in science teaching is higher than those who need knowledge and skills in science subjects. Thus, attention should be on the former than the latter.

RQ 2: *What are the in-service needs of Senior High School science teachers' with regards to school location?*

As shown in Table 3, 53.1% of science teachers from rural areas expressed their great need in management of science instruction as opposed to only 24.3% of science teachers from urban areas. Concomitantly, a higher percentage was displayed by science teachers in urban areas (44.9%) who perceived that such support was not needed, opposing those in the rural areas (20.4%). With regards to these findings, it seems that most science teachers in the rural areas require managerial skills and assistance in delivering science instruction. The management of science instruction dimension reveals a highly significant association between teachers perceived needs and school location. This was due to the fact that the result of the chi-square test was 13.96, with a highly significant value of 0.001<0.05. Thus, there was enough evidence to infer that the perceived needs of science teachers with respect to management of science instruction in urban areas was not the same as those in rural areas. These results however support generally that science teachers in the rural areas required management skills and assistance in handling science instruction than their urban colleagues.

Detailed analysis of association between school location and perceived science teachers' needs revealed that 34.7% of science teachers in the rural areas greatly needed assistance in assessing their students. More teachers from the urban areas felt that such assistance is unnecessary (rural = 26.5%; urban = 43.9%). Surprisingly, 39.3% of urban area science teachers compared to 38.8% of their rural area counterparts expressed a moderate need. The strongest association is established when the chi-square test reveals a moderate significant association between science teachers perceived needs of diagnosing and evaluating students and school location. Here, the chi-square tests yielded a result of 7.43 with a significant value of 0.024<0.05. Consequently, there was sufficient evidence to infer that in-service needs' of urban area science teachers in relation with diagnosing evaluating students was not the same as science teachers in rural areas.

As for the generic pedagogical knowledge and skills dimension, less than two-thirds of science teachers in urban areas (urban=65.4% < 75%) felt that they had already acquired the necessary knowledge and skills needed in such aspect, whereas more than two-thirds of those in the rural areas (rural=87.8%>75%) felt the same. Surprisingly, most science teachers in the urban areas expressed a great need for the skill as opposed to those in the rural areas (rural = 8.2%; urban = 11.2%). Further chi-square test reveals a highly significant association between teachers perceived needs and school location. This was because the test yielded a result of 9.84 with a significant value of 0.007<0.05. Thus, there was sufficient evidence to infer that the perceived needs of science teachers in the urban areas with regards to generic pedagogical knowledge and skills are not the same as those in rural areas.

Furthermore, science teachers' in-service needs' on knowledge and skills in science subjects was compared within the geographical location of the schools. The comparison revealed that 44.9% of teachers in the rural areas expressed a great need for the skill as opposed to 22.4% of teachers in the urban areas. More teachers from the urban areas felt that they moderately needed such assistance in this aspect (rural = 26.5%; urban = 40.2%). In contrast, 37.4% of teachers in urban areas felt that they had already acquired such skills. It also appears, the knowledge and skills in science subject dimension reveals a significant association between science teachers perceived needs and school location. This was because the chi-square tests yielded a result of 8.25 with a significant value of 0.016<0.05. Hence, there was much evidence to infer that the perceived needs of teachers in the urban areas are not the same as those of rural areas.

Generally, more than half of science teachers in the rural areas require assistance in terms of administering science instructional facilities and equipment. This was evident where 51% of the science teachers in the rural areas from this geographical region expressed their great need in this dimension as opposed to only 30.8% of science teachers from urban areas. Thirty-three point six per cent (33.6%) of teachers in urban areas perceived that such skills and assistance are unnecessary, while 35.5% of them moderately need such skills. Teachers in the rural areas expressed similar views with 20.4% of them moderately need such skills and 28.6% of them felt that such skills are irrelevant. Furthermore, the administering science instructional facilities and equipment dimension; revealed a moderately significant association between teachers perceived needs and school location. This was for the reason that the chi-square test was 6.44 with a significant value of 0.040<0.05. Therefore, there was sufficient evidence to infer that the perceived needs of science teachers in the urban areas are not the same as those of the rural areas. This really supported the view that science teachers in the rural areas require assistance in terms of administering science instructional facilities and equipment than those in the urban areas.

In the planning of science instruction dimension, less than half of science teachers from both rural and urban schools felt that such skills are crucially important (rural=42.9%; urban=29%). Other findings revealed that only 12.2% of rural area science teachers felt that such competency was not needed as opposed to urban area science teachers who displayed a significantly higher percentage of 36.4%. Forty-four point nine per cent (44.9%) of those teaching in rural schools indicated a moderate need in planning science instruction compared to those in urban schools (34.6%). On the other hand, the planning activities in science instruction dimension revealed a vast significant association between teachers perceived needs and school location. This was because the chi-square tests yielded a result of 9.716 with a highly significant value of 0.008<0.05. Thus, there was adequate evidence to infer that the perceived needs of science teachers in the urban areas are not the same as those of rural areas.

In the integration of multimedia technology in science teaching dimension, 40.2% of urban area science teachers compared to 38.8% of their rural area counterparts surprisingly expressed a greatly needed assistance in such a dimension. Mostly teachers from rural areas expressed a moderate concern for this skill. 36.7% of them felt that such skill was moderately needed. For urban teachers, the percentage of those who expressed a less concern for such skills were (29%) and the percentage of those who demonstrated a moderate need were (30.8%) shows a little difference. Surprisingly, the integration of multimedia technology in science teaching dimension reveals a highly insignificant association between teachers perceived needs and school location. This was because the chi-square tests yielded a result of 0.619 with a significant value of 0.734>0.05. Therefore, there was no ample evidence to infer that the perceived needs of teachers in the urban areas are not the same as those of rural areas. This indication proved that science teachers in the rural areas need similar support, skills and assistance in integrating multimedia technology in science teaching as those in the urban areas.

IV. DISCUSSION

RESEARCH THEME 1: Most prevalent in-service needs of Senior High School science teachers.

It should be reiterated that in this study, a particular need is considered a priority science teachers' need when the percentage of greatly needed scale selection is more than 40 percent. Based on Table 4, it could be inferred that the topmost priority need is the use and integration of multimedia technology in science teaching and learning. Additionally, science teachers also need support in administering science instructional facilities and equipment, management as well as planning and designing their science instruction. On the other hand, teachers only require a moderate need of assistance in diagnosing and evaluating students with regards to measuring students' performance. It was also apparent from the findings that science teachers do not have too much problems with updating their content knowledge as well as technical skills in science instruction. When such classification of science teachers' need is compared with that of about twenty four years ago, during the wake of the New Science Curriculum (of the then Senior Secondary School now Senior High School) implementation, the prominent needs of the Ghanaian science teachers then, mainly involved delivering and managing science instruction, as well as administering science instructional facilities and equipment, which as a whole contributed towards improving one's self competence as a science teacher in meeting new challenges in science teaching.

In furnishing science teachers with the necessary knowledge and skills required as a result of new policy implementation, many short courses have been inaugurated. The need for integrating ICT in science instruction as publicized in the media (written as well as electronic), has successfully instilled in the teachers cognizance of the importance of ICT in every niche of human activities. In this context, the teachers' main concern is how they could upgrade their knowledge of integrating ICT towards a more interesting yet meaningful science lesson.

Literature clearly shows that the teachers' concern on how to fully utilize ICT facilities effectively in science lessons was also a major problem in the United States and United Kingdom (Banilower, 2000; Dillion, Osborne, Fairbrother and Kurina, 2000; Smith, 2000). More to that, a wide dissemination of stand alone science teaching software, and organizing short courses on integrating ICT in their lessons, nonetheless, many science teachers still felt incompetent and hence need much support in this aspect.

RESEARCH THEME 2: In-service needs of Senior High School science teachers' with regard to location.

Based on data interpreted from Table 4, it could be synthesized that school location seems to be a detrimental factor in determining Senior High School science teachers' needs. Most of the rural teachers demonstrated a great need for all the dimensions highlighted.

Arguably, schools in urban areas offer a more conducive environment for the teaching of science particularly in the integration of ICT in teaching and learning Science. This is not surprising, as many support systems and infrastructure are made available in urban areas. In addition, these schools are located near Science Resource Centres as well as the Municipal/District Education Office, which provide avenues for exchange of ideas as well as keeping them well informed of the latest policy implementation in science teaching and learning. The needs of non-science option teachers on the other hand, revolve around updating knowledge and skills for effective science instruction.

The rural-urban disparity in living conditions is the major constraint on attracting teachers to rural areas. Many countries report that teachers express a strong preference for urban postings because living conditions in general are so much better in urban than in rural areas. Teachers often express concerns about the quality of accommodations; the working environment, including classroom facilities and school resources; and access to leisure activities and public facilities in rural areas.

Limited opportunities for professional advancement in rural areas also discourage teachers. Urban areas offer teachers easier access to further education and training, while rural areas offer limited opportunities to engage in developmental activities such as national consultations, including those with representative organizations. Teachers in rural areas may even find it more difficult to secure their entitlement to professional development from regional educational administrations and must overcome many obstacles, including corruption by officials.

V. CONCLUSION AND RECOMMENDATION

This study provided meaningful empirical evidences of effective in-service programmes in 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 would 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, is the 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.

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 at the national or regional level. Once schools are appropriately classified in terms of their geographical isolation, differences and area of subject specialisation may emerge. Careful monitoring of these issues would 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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