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IN-SERVICE NEEDS OF JUNIOR HIGH SCHOOL INTEGRATED SCIENCE TEACHERS IN THE CENTRAL REGION OF GHANA

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ABSTRACT

The purpose of the study was to identify the prevalent in-service needs of Junior High School integrated science teachers in the Central region of Ghana. An adapted Science Inventory of Needs (STIN) was distributed to teachers to seek their prevalent in-service needs. The instrument had six dimensions, namely management of science instruction, diagnosing and evaluating students, generic pedagogical knowledge and skills, knowledge and skills in science subjects, administrating science instructional facilities and equipment and planning science instruction. Descriptive statistics and Chi square test were used to analyse the data. The results indicated that the highest rated prevalent in-service needs were generic pedagogical knowledge and skills and planning science instruction with diagnosing and evaluating students as the least. The Chi square tests, conducted at the 0.05 level of significance, showed that there were statistical differences between integrated science teachers' in-service needs in favour of the Junior High school science teachers from rural schools for knowledge and skills in science subjects, administering science instructional facilities and equipment, planning activities in science instruction and school location. The study recommended among others that for an effective in-service training, the organisers assess prevalent in-service needs of the teachers before planning to solicit the teachers' participation and for meaningful in-service training programme.

INTRODUCTION

Ghana as a developing country considers science and technology education as the bedrock for economic stability and growth hence, subscribes to the goal "science for all" (Ministry of Education, [MoE], 2010). This "science for all" movement has brought about innovations in the 2007 science curricula at all levels of education to address the needs of the individual, society and the nation. As a result, teaching of science has become a complex task in that teachers are expected to master new skills and content, take on new responsibilities, and change their practice (Rasku-Puttonen, Etelapelto, Lehtonen, Nummila & Hakkinen, 2004). Such reform-driven expectations require teachers not only to learn new ways of teaching, but also be given opportunities to acquire and practice the new knowledge and skills needed to implement these innovations. It is therefore pertinent to ensure that new knowledge is instilled into science teachers to make them competent and ready to meet current challenges in the subject they teach, because teachers are the link between policy and practice (Cohen & Hill, 2000). Educators, policy makers and reformers have identified professional development as the vehicle for teachers to acquire growth in knowledge, skills and judgment (Guskey, 2000). While this short term 'skills and knowledge' approach can be valuable and efficient in disseminating information and ideas, it has been shown to be quite ineffective in challenging and supporting more fundamental aspects of teaching practice and beliefs practices (Treagust, 2006). This is because majority of teacher professional development training programmes use defective model: a top-down, one-shot, lecture approach (Adsit, 2004). This mostly does not reflect teachers' needs, interests, experiences, knowledge bases, or instructional realities. This does not encourage most teachers to attend or participate because they consider it to be ineffective and time wasting (Boyle, White, & Boyle, 2004). Amir (1993) advised that an effective in-service training programme should aim at meeting the stated needs of the teachers' concern. Parkinson (2004) consented by stating that the first step in designing a curriculum for continuous professional development is assessment of teachers' needs. If teacher needs are assessed planning and implementing of in-service training programmes by the organisers will be systematic and teachers will respond and benefit from the programme. Careful planning and implementation of professional development can build strong correlations between teacher knowledge and student achievement (Darling-Hammond, Chung Wei, Andree, Richardson, & Orphanos, 2009). Despite the consensus that teachers' needs, interests, and preferences should drive the planning and implementation of in-service training programmes, research has consistently pointed to the fact that in-service experiences rarely consider teachers' needs, interests, or preferences (Conkle, 1994). Lubben (1994) argued that in-service activities are usually structured on the basis of the observations of in-service providers and the requests of educational administrators, without consulting teachers to identify their priority needs. There is therefore the need to assess science teacher's needs for in-service training. A needs assessment is one means of determining areas in which teachers desire help (Rossett, 1997) and what training they will need (Che Omar, 2014).

It has been argued that professional development training programmes in the form of in-service training can improve teachers' competence (Sandholtz, 2002). The Government of Ghana therefore with the Japan International Cooperation and Agency (JICA) introduced a five-year Science, Technology and Mathematic (STM) project in March 2000 under the free Compulsory Universal Basic Education (FCUBE) policy to improve the teaching of science and mathematics in terms of contents and instructional practices at upper primary and JHS levels through in-service training programmes. It has however been observed that, this intervention did not have the desired impact on teachers' work output especially in instructional practices at the classroom level (Ghana Education Service [GES], 2007). This observation may be attributed to the poor way in-service training of teachers was conducted. Even though some training needs have been identified for effective in-service training of teachers in some areas in Ghana and other countries, it is however not clear which needs would be relevant for the development of JHS integrated science teachers' competencies in the Central Region of Ghana. The Central Region was chosen because of the poor academic performance of learners in the Basic Education Certificate Examination (BECE) in the region over the years.

Information gathered from the Regional Education Office Statistics Department (personal communication) indicated that majority of the candidates who passed science obtained grade 5 and 6 with very few of them making grade 1 and 2. This is supported by the fact that only three out of the 17 Districts in the Central Region, scored above 70% in the 2010 BECE (Yarboi-Tetteh, 2011). It is therefore essential to enhance teacher's skills through effective in-service training programme so that they can face the challenges confronting science teaching and learning. This will eventually strengthen learners' performance in science. However, for an effective in-service training programme, the in-service needs of the science teachers have to be identified and addressed. Despite the general consensus that teachers' needs, interests, and preferences should drive the planning and implementation of in-service training programmes, research has consistently pointed to the fact that in-service planners rarely consider teachers' needs, interests, or preferences (Conkle, 1994; Lubben, 1994). It is in line with that Ngman-Wara, Young and Mawuse (2015) intimate that identification This study aimed to identify in-service needs of Junior High School (JHS)Integrated Science teachers and it also sought to ascertain the integrated science teachers' needs across school location (rural and the urban) and gender for effective in-service programmes that would equip JHS science teachers with appropriate teaching skills.

Purpose of the Study

The purpose of the study was to identify the in-service needs of Junior High School Integrated Science teachers in the Central Region of Ghana. The study also sought to ascertain the integrated science teachers' needs across school location (rural and the urban).

Research Questions

The following research questions were formulated to guide the study:

1. What are the prevalent in-service needs of the Junior High School (JHS) integrated science teachers in Central Region of Ghana??
2. What are the differences between the in-service needs of JHS integrated science teachers from urban area and their colleagues from rural areas.

LITERATURE REVIEW

Theoretical Framework

A need can be a desire to improve current performance or to correct a deficiency. The individual or group that falls short of the desirable standard is said to be in need (Monetter, 1997), Thus, a needs assessment is one means of determining areas in which the individual desires help (Rossett, 1987). The logic behind identifying educational needs stems from the desire to design and implement relevant educational programmes which are based on measurable and achievable goals and objectives. Over the past decades, there has been a proliferation of models for needs assessment in educational research. Kaufman (1972) developed a model which he called System Model and Organizational Needs Model. Kaufman argued that an actual need can only be identified independent of premature selection of a solution. Borich (1980) defined a training need as "a discrepancy between an educational goal and trainee performance in relation to this goal" (p.40). Hence he proposed another needs assessment model known as Borich Needs Assessment Model. This model primarily focuses on four steps (i) underlining the competencies, (ii) surveying the in-service teachers, (iii) ranking competencies, and (iv) comparing high priority competencies with training programme content. The assumption underlying the needs model is that the individual (for example, science teacher) can best judge his or her own performance and, when explicitly asked to do so, can make an objective judgment.

Although Borich's model is widely used in determining science teachers' needs, Witkins (1984) contends that there is no "best" or single universally accepted model of needs assessment in the educational field since its choices, procedures as well as instrument used to gauge the needs would depend on the purpose and context of the assessment study. Therefore the model for the study would be evaluated against the context of the study. A conscious drive or desire on the part of the science teacher which is necessary for the improvement of science teaching is what Moore (1977) called in-service need. He developed a science teachers in-service need model called Moore Assessment Profile. The Moore Assessment Profile ushered in the evolution of science teachers' need model. Moore's model was further refined by Blakenship and Moore (1977) and Rubba (1981). Eleven years later, Kamariah, Rubba, Tomera and Zurub (1988) established the Science Teacher Inventory of Needs (STIN) out of Moore Assessment Profile as cited by Osman, Halim & Meerah (2006). Since the evolution of science teachers' need model, the STIN have continuously been refined to assess science teacher's in-service needs in some developed and developing countries over the years to establish empirical evidence on teachers' in-service needs and to improve science education. The revised STIN (Osman, Halim & Meerah, 2006) used to assess in-service needs of science and mathematics teachers in some developed and developing countries showed different in-service needs. Ghana being a developing country the STIN would be adapted for the study. It could be synthesized that from all the needs assessment models highlighted, the major outcome is the identification of contextualized, science teachers' needs and to establish empirical evidence of the science teachers' needs in meeting the challenges of science education. These studies therefore served as basis for this study which specifically focused on the identification of Junior High school science teachers' needs in the Central Region of Ghana.

Junior High School Science Curriculum

The Junior High School (JHS) integrated science syllabus (MoE, 2010) has undergone amendments in contents, teaching and learning activities to meet the needs of the pupils and to make science and technology relevant to the society. The contents in the JHS syllabus are organised into five themes namely, Diversity of matter (living and non-living things), Cycles, Systems, Energy and Interactions of matter (living and non-living things). The topics under each theme are similar and related to each other to facilitate teaching and learning. Additionally, new topics have been introduced into the syllabus to meet the challenges of science and technology in the 21st century. For instance, the addition of basic electronics is to equip pupils with skills to understand and to function properly in the Information and Communication Technology (ICT) era. Concerning instructional approach, the syllabus emphasises inquiry and problem solving methods of teaching to provide opportunity for students to enhance their curiosity and to develop creativity and keenness in them as they explore their environment. These methods are likely to develop in pupils' process skills such as observation, classification, drawing, measurement, interpretation, recording, reporting, and scientific investigation that are necessary to function appropriately in the scientific and technological environment. The role of teachers in the inquiry method is that of a facilitator who provides guided opportunities instead of transmission of knowledge. This approach of teaching orientates students mind in solving problems.

The School Based Assessments (SBA) in the JHS science syllabus is designed to standardize the practice of internal school-based assessment in all schools. The SBA replaces the continuous assessment system and it is based on three profile dimensions (knowledge and Comprehension 20%, application of Knowledge 40% and experimental and it Process Skills 40%). The SBA also spells out the guidelines for constructing assessment items and other assessment tasks, how often teachers are to assess their students as well as the marking and grading system to use. This is to ensure that pupils master the instruction and behaviours implied in the specific objectives of each unit. These innovations in the JHS science syllabus place a demand on the teachers' knowledge and skills to teach science effectively. The teachers are expected to master new skills, take on new responsibilities, and to change their classroom practice (Rasku-Puttonen, Etelapelto, Lehtonen, Nummila & Hakkinen, 2004). Such reform-driven expectations would require teachers not only to learn new ways of teaching, but also to be given opportunities to acquire and practice the new knowledge and skills needed to implement these reforms. Educators, policy makers and reformers have identified professional development as the vehicle for teachers to acquire growth in knowledge, skills and judgment (Guskey, 2000). It is also to help teachers improve their practices and to bring about the needed change (Shaha, Lewis, O'Donnell & Brown, 2004). There is therefore the need to organise effective in-service training for JHS science teachers to competently deliver their lessons. For an effective in-service training, teacher's in-service needs should be assessed and addressed.

Training of Teachers in Ghana

A sound knowledge base and a repertoire of teaching strategies are fundamental to the challenges of producing an effective teacher (Darling-Hammond, 1996). Currently in Ghana there are levels of teacher training. The training takes place at the Colleges of Education and the Universities. Two universities in Ghana, University of Education Winneba and the University of Cape Coast are involved in the training of teachers. While all the courses at the undergraduate level at the University of Education, Winneba are geared towards the training of professional teachers, the University of Cape Coast has a faculty of Education training professional teachers. Additionally each of the Universities has an institute responsible for Distance and Sandwich Education programmes for training professional teachers. Teacher trainees in both Universities and Colleges of Education are equipped with basic pedagogical content knowledge, curriculum knowledge, subject content knowledge, knowledge of learners and their characteristics (Anamuah-Mensah & Asabere-Ameyaw, 2004) to teach all the subjects at both the primary and Junior High School (JHS) level. In other words they train generalist teachers who are not specialised in science teaching. Often these skills are taught through separated courses, where theory is presented without much connection to practice (Korthagen & Kessels, 1999).

This is because methodology is taught without student practising the theories and principles of teaching learnt. Training of generalist teacher is to maximise benefits from the high unit cost of training teachers. It also provides opportunity to train teachers who can handle all subject areas covered at the basic level. According to Aboagye (2009) this policy of training a generalist teacher has faced some criticism by some educationist including Principals of training colleges. They are of the view that generalist teachers might possess shallow knowledge in both the content and the methodology of the subjects studied leading to poor lesson delivery whilst some teachers shy away from teaching subjects they are not comfortable with, for example mathematics and science. Again, they argued that the generalist teacher might not bring about the quality teaching and learning for the country's development. Anamuah-Mensah and Asabere-Ameyaw agreed to this assertion and stated that the basic skills given in science and mathematics to trainees are taught in isolation and with less emphasis placed on the subject content knowledge.

Hence, the Ghana Education service (GES) seems to be sacrificing quality at the expense of cost. Again, the three years spent in formal training does not produce the kind of changes expected or necessary for effective teaching (Akyeampong, 2003), more especially when the colleges of education do not attract the best students in terms of academic qualifications. This has implications for developing deep conceptual understanding of school subjects (Akyeampong, 2003). Raising the academic entry qualification may seem like the appropriate action to improve this situation, but this could also threaten enrolment in Colleges of Education. Teaching as a profession in Ghana does not seem to enjoy the prestige attached to other professions like Law and Medicine. Therefore, Colleges of Education are not able to attract best candidates (Anamuah-Mensah & Benneh, 2006). Furthermore, the college curriculum does not differentiate sufficiently between primary and JHS methodology (Ministry of Education, 2005). There is overriding evidence that teacher quality in terms of teacher preparation and qualification strongly influence students' level of achievement (Darling-Hammond, Berry & Thoreson, 2001; Hill, Rowan & Ball, 2005). Therefore, there is the need to invest in quality teacher education and professional development programmes to ensure that they have these skills required to realise in the classroom the outlined curriculum. One of such ways of developing teachers professionally is to assess and address their in-service needs to make them competent in their lesson delivery especially, in science instruction.

In-service Training, Purpose and Type

In-service training of teachers has generally been considered as the variety of activities and practices, in which teachers become involved in order to enrich their knowledge, improve their skills in teaching and also enable them to become more efficient on the job (GES 2007). Tripathi (1991) considered training as the act of increasing the knowledge and skills of an employee for doing a particular job. He further argued that specific skills are imparted for particular purposes during training. Relating this argument by Tripathi (1991) to in-service training of teachers, it is expected that the knowledge and skills of teachers for teaching will increase by in-service training. Since it is job related, the content of in-service training should therefore be carefully selected to match the needs of the changing knowledge and pedagogy of teaching. This view is in line with Harris' (2000) assertion that training should be structured to meet the changing need of the workplace and the workforce. Such training is necessary to re-orientate teachers to changes in the educational transaction (Conco, 2004). Hamilton and Richardson cited in Wight and Buston (2003) observed that in-service training is generally one of the main ways in which teachers continue to acquire knowledge and skills in the course of their jobs. The researcher agrees with the above authors on the definition of in-service training but thinks that the in-service training should be need based (Conco, 2004).

GES (2007) and Conco (2004) asserted that in-service training helps teachers to expand their knowledge of a subject, develop new knowledge and engage with colleagues at their current school and other schools. Since many teachers enter the profession without having received specific training for curriculum development, in service training become a matter of necessity as argued by Carl cited in Conco (2004). GES (2007) identified the objectives of in-service training as to:

- "Improve and increase teachers' knowledge on the content of academic subjects in order to become more competent
- Introduce new ideas, policies and new curriculum content to teachers
- Enable teachers to acquire new teaching methods and materials for specific subject content areas
- Improve the professional status of teachers and enhance their self-confidence in their lesson practice
- Train teachers in class management and in school administration
- Help teachers develop skills in human relations management
- Encourage team work among teachers" (pp. 3)

It could be deduced from above that in-service training has the potential of improving teacher's competencies in the classroom.

In schools, two major types of in-service training can be used. These are School-Based (SBI) and Cluster-Based (CBI) in-service training. SBI is a type of in-service training which is organised at the school level by the teachers in a particular school to resolve some special needs or deficiencies identified in the school (GES, 2007). CBI is in-service training for teachers from a number of schools that come together once in a while for training. Whether the in-service training is SBI or CBI, it is necessary to assess the training needs of the teachers which bother around the teacher, the pupil and the teaching content (GES, 2007). In Ghana, it is observed that past in-service training programmes were organised along the lines of CBI in-service training, where both experienced and new teachers were trained like teacher trainees regardless of the specific training needs of each individual teacher (GES, 2007). These in-service training programmes therefore did not have much impact on the performance of the teachers (GES, 2007). As school curriculum changes, teachers also had to change in terms of pedagogy and subject content knowledge to cope with such changes. Consequently teachers have to undergo in-service training to prepare them to cope with curriculum change, pedagogical skills, and to provide them with the knowledge and skills to improve teaching and learning in the classroom (Guskey & Sparks, 2002). The purpose of in-service training therefore is to help in the professional development of teachers.

Although, professional development programmes are valuable and efficient in disseminating information and ideas, there are some barriers that harm professional development programmes. Zimmerman and May (2003) identified some of these as lack of time, money and support for teachers. Also, Bredeson (2002) and Lee (2005) suggested that when professional development is designed and delivered without a clear purpose or consideration of teachers' interests and needs, it most often results in teachers who become resistant, cynical, and frustrated. It is therefore imperative to consider teachers in-service training needs if teachers are to participate and benefit from such programmes. Professional development in the field of science education is considered to be any intentional sustained activity in which teachers engaged for the express purpose of improving their knowledge and skills to teach students science (Banilower, Boyd, Pasley, & Weiss, 2006). In a study by Boyle, White, and Boyle (2004), science teachers were the least likely to attend professional development programmes.

Because professional development programmes are generalised without consideration of the science teacher's needs. These needs are to be looked at in order to ensure science is being taught effectively in schools. A study by Akerson and Hanuscin, (2007) found that effective professional development programmes increase teachers' understanding of science content and increase their confidence and their ability to teach science in their classrooms. When teachers are confident in the subject matter they teach, it leads to quality instruction, which leads to higher student achievement (Banilower, Heck, & Weiss, 2007). For science teachers, professional development should be on-going and should relate directly to their field in order to get the most benefit from the material being learned and to keep teachers updated on new teaching strategies and content to improve learner's performance. Concerning the needs of training one area that needs to be discussed is whether it is school location related.

Training of Junior High School Integrated Science Teachers

Parker (2004) and Hill, Rowan and Ball (2005) identified that a good mix of teachers' subject content knowledge, pedagogical content knowledge, curriculum knowledge and assessment skills in their subject areas are acknowledged as strong basis for teacher's competency and effectiveness in the classroom. The competency of a classroom teacher is an important factor in the success of students. Shulman (1986) argued that subject content knowledge is the comprehension of the subject appropriate to a content specialist in domain and it is one of the factors that make a teacher competent. Currently in Ghana, teachers are trained professionally for the basic schools (primary and JHS) in the Colleges of Education. In 2000 a policy decision was made to adopt an “In-in-out” model of initial training to replace the three-year full-time “In” programme in the Colleges of Education. Under the “In-in-out” model students spend two years in college training, while the whole of the third year is spent learning to teach in a school. The first year is devoted entirely to learning the subject matter. Second and third years focus on curriculum studies and methodology. Trainees are therefore, equipped with basic pedagogical content knowledge, curriculum knowledge, subject content knowledge, knowledge of learners and their characteristics through curriculum studies (Anamuah-Mensah & Asabere-Ameyaw, 2004; Ngman-Wara, 2011) to teach all the subjects at both primary and Junior High School (JHS) level. The introduction of the one year out programme of teaching practice is therefore seen as an opportunity to apply the knowledge of teaching acquired during college training in the classroom.

When properly conceptualised, it is expected to narrow the gap between theory (in-college learning of teaching theory and methods) and practice (school-based application of theory). In other words, they will develop practical knowledge of teaching from a deep understanding of local teaching settings and contexts (Akyeampong, 2003). Thus, teacher trainees would have a fair experience of teaching in the classroom and applying the theory learnt before graduation. However, the one year internship programme may not be enough for teacher trainees to develop the skills of an experienced teacher. There is therefore the need for in-service training for teachers to upgrade their knowledge and skills. In-service training affords the teacher the opportunity to advance professionally.

School Location and Science Teachers’ In-Service Needs

The relationship between school location and student academic achievement in science has been widely reported. Adepoju (2001) found that students in urban schools manifest more brilliant performance than their rural counterparts. This may be because schools in rural areas have unequal access to qualified teachers, textbooks and laboratory materials and equipment for science activities as compared to urban schools. It is argued that lack of these resources has a demoralizing effect on teachers to teach science (Fredua-Kwarteng & Ahia, 2005) hence affecting academic performance of students. Another school environmental factor is the class size. Generally small class sizes have been associated with rural areas while large class size has been ascribed to schools in the urban areas (Robinson cited in Adesoji & Olatunbosun, 2008). The argument whether large classes perform better than smaller classes have been inconclusive (Robinson cited in Adesoji & Olatunbosun, 2008).

He argued that research does not support the expectation that class size will of themselves result in greater academic gains for students. He further argued that the effects of class size on students’ learning vary by grade level, pupil characteristics, subject areas, teaching methods and other learning interventions. Afolabi cited in Adesoji and Olatunbosun (2008) did not establish any significant relationship among class size and students learning outcomes. However, Adeleye cited in Adesoji & Olatunbosun (2008) observed that large class size is not conducive for serious academic work. The researchers hypothesise that since there is association between teachers’ professional performance and student academic achievement, the professional development of the teacher through in-service training will influence student’s academic performance no matter the location of the school and class size.

METHODOLOGY

Descriptive survey research design was employed for the study because provides a meaningful picture of events and seeks to explain people's perceptions and behaviour on the basis of information obtained at a point in time which is of special interest and value to researchers (Fraenkel & Wallen, 2009). This study sought information on JHS integrated science teachers' in-service needs based on school location and gender in the Central Region of Ghana.

Sample

The target population was public JHS teachers teaching Integrated Science in the Central Region of Ghana. The teachers comprised professional science teachers and professional non science teachers. Five Municipal/Districts (Ewutu/Senya District Assembly, Gomoa East and Gomoa West District Assemblies, Agona East District Assembly and Agona West Municipal) were purposively chosen out of the seventeen (17) Metropolitan/Municipal /Districts Assemblies of the Central Region to form the accessible population. Schools in each of the selected five Municipal/Districts were stratified into urban and rural communities. Random sampling by replacement method was employed to select ten Junior High Schools from each stratum. This was to allow equal chances for any school being picked. One hundred JHS integrated science teachers, twenty from each selected school originally agreed to participate in the study. However, 11 of them were not at post at the time of collection of data. A total sample size of 89 teachers was therefore used for the study.

Instrument

A questionnaire, Science Teacher Inventory of Needs (STIN) developed by Osman, Halim and Meerah, (2006) to assess science teacher's in-service needs in Malaysia was adapted and used to collect data for the study. The original version of the STIN contained 79 items arranged into two sections. Section one contained 13 items that related to the gender, professional background, years of teaching experience of the respondents and the location of the schools. Section two comprised 66 items pertaining to the in-service needs of the science teachers. The in-service needs were categorised into the following dimensions: (i) Management of science instruction, (ii) Diagnosing and evaluating students, (iii) Generic pedagogical knowledge and skills, (iv) Knowledge and skills in science subjects, (v) Administrating science instructional facilities and equipment and (vi) Planning science instruction, (vii) integration of multimedia technology in science education and (viii) using of English language in science teaching. Each item consisted of a statement followed by a five-point Likert type scale ranging from greatly not needed (1), not needed (2), not certain (3), moderately needed (4) and greatly needed (5). Seven dimensions were maintained. The dimension, integrating multimedia technology in science instruction was dropped because most public Junior High Schools do not have facilities such as electricity, computers as well as science software to be used. Some items were modified to suit the Ghanaian context and those which were not related to the Ghanaian context were dropped. For example, *assessing student's laboratory skills* was modified to read assessing student's process skills because the Ghanaian teachers are familiar with the term process skills which is used in the JHS science curriculum. Also *managing the budget for science teaching* was deleted because most JHS science teachers do not have a fund allocated for science practical. Again, *supervising laboratory assistants in preparing materials/apparatus and maintaining living organisms for teaching science* and *updating knowledge of appropriate requirements for specific title* were dropped. In the former case public Junior High schools do not science laboratories and laboratory assistants and in the latter case it is not applicable in the Ghanaian context.

Validity

Face validity of the instrument was enhanced by senior science educators and professors in the Faculty of Science Education in the University of Education, Winneba. First, they reviewed the items with respect to the dimensions of the STIN and the wording, clarity and ease of response of the items. Second, the instrument was field tested by administering it to 60 JHS integrated science teachers in Winneba Municipal with similar academic and professional qualifications as the sample. The construct validity of the instrument was established by employing the confirmatory factor analysis (Green & Salkin, 2008, Ngman-Wara, Tachie & Mawuse, 2015).

Reliability

Internal consistency (Cronbach Alpha) approach was employed to establish the reliability of the in-service needs instrument. The overall alpha value for the instrument was 0.94 while the values for the dimensions spanned between 0.34 and 0.95 (Appendix A). According to Fraenkel and Wallen (2009) a reliability figure should be at .70 and preferably higher. Except the *use of English language in science teaching* which registered alpha value of 0.34 all the other dimensions had alpha values greater than .70 indicating an acceptable range.

Data Collection Procedure

Data collection was done in the first term of the 2014/2015 academic year from October to November, a period the participants were not occupied with preparation of candidates for examination. Permission was obtained from District/Municipal Directors of Education of the selected District/Municipal Directorates of Ghana Education Service (GES) to carry out the study in the schools under their jurisdiction. The schools selected were visited at least twice. The first was to obtain the consent of the integrated science teachers sampled to participate in the study and to also explain to the latter what was expected of them. The questionnaire was administered if the respondents were ready to complete it on the first visit, if not a convenient date and time were agreed upon to administer the questionnaire. The questionnaire was administered and collected on the second visit. This was to ensure that the teachers responded independently to the items and also to clarify issues where necessary.

Data Analysis

The data collected for the study were analysed using descriptive and inferential statistics with Statistical Package for Social Sciences (SPSS) programme, version 16.0 for windows. The responses were categorised into three to ease analysis of the data. The responses 'greatly not needed', 'not needed' and 'uncertain' were merged as 'not needed', hence three categories namely, 'not needed', 'moderately needed' and 'greatly needed' were used for the analysis. The participants' responses were organised into frequency counts and converted into percentages. Chi square statistic was used to establish any association existing between the science teachers' in-service needs and school location and gender respectively using alpha < 0.05 level of significance. The science teachers' in-service needs were categorised as a priority when the percentage of respondents indicate more than a moderate need. Hence it was then decided that science teachers' in-service need would be categorised as a priority when the percentage of the respondents indicating a need is 40% or more. Previous studies (Moore & Blakenship 1978; Osman, et al., 2006) based their cut-off point on 40% when they defined science teachers' needs as an area for in-service help when science teachers indicate more than a moderate need.

RESULTS

The demographic characteristics of the participants are presented in Table 1

Table 1 Demographic characteristics of JHS science teachers

Variable	**Category**	**N**	**Percent**	**n**	**percent**
Gender	Male	75	**84.3**		
	Female	14	**15.7**		
	Total	89	**100**		
Location	**Rural**	**40**	**44.9**		
	Urban	**49**	**55.1**		
Professional status by location		**Rural**	**urban**		
	Professional science teacher	18	**45 .0**	30	**61.2**
	Professional non-science teacher	22	**55.0**	19	**38.8**
Years of teaching experience	< 3 years	18	**45.0**	26	**53.1**
	>3years	22	**55.0**	23	**46.9**
In-service training	In-service training	8	**20.0**	13	**26.5**
	No in-service training	32	**80.0**	36	**73.5**

Table 1 contains demographic summary of participants. Of the 89 participants 84.3 % were male teachers and 15.7% were female teachers. In terms of location, 44.9 % were from rural schools and 54.1 % were from urban schools. Additionally, in terms of years of experience, 45% and %53.1 % of the teachers from rural and urban schools respectively had less than 3 years of teaching experience while 55 % from rural schools and about 47% of teachers from urban schools had more than 3 years of teaching experience. Finally, 20% and 26.5 % of teachers from rural urban schools respectively had in-service training while 80 % and 73.5 % from rural and urban schools respectively had no in-service training.

Research Question 1: What are the prevalent in-service needs of Junior High School (JHS) integrated science teachers in Central Region of Ghana?

The question sought to identify the prevalent in-service needs of the JHs integrated science teachers who participated in the study. In the analysis, needs that were greatly not needed, not needed and uncertain were merged as not needed, hence three categories, namely "not needed", "moderately needed" and "greatly needed" were used for the analysis. The teachers' responses were organised into frequency counts and then converted into percentages. . Table 2 presents percentage needs for each dimension in descending order of need.

Table 2: Ranking of JHS Integrated Science Teachers' Levels of in-service needs for each dimension

Ranking	Dimensions	Levels of in-service needs		
		Not needed % (freq)	**Moderately needed % (freq)**	**Greatly needed % (freq)**
1	Generic and pedagogical knowledge and skills	18.0 (16)*	48.3(43)	33.7 (30)
2	Planning activities in science instruction	20.2(18)	47.2(42)	32.6(29)
3	Administering science instructional facilities and equipment	25.8(23)	42.7(38)	31.5(28)
4	Knowledge and skills in science subject	28.1(25)	47.2(42)	24.7(22)
5	Management of science instruction	32.6(29)	42.7(38)	24.7(22)
6	Diagnosing and evaluating students	33.7(30)	45.0(40)	21.3(19)

*frequencies in parentheses N = 89

The levels not needed ranged between 18.0 % and 33.7 %, those moderately needed ranged between 42.7 and 48.3 while those greatly needed ranged between 21.3 % and 33.7 %. The higher percentages come under moderately needed category. From the table, all the six dimensions were considered as in-service needs by the JHS science teachers. This was because more than 60% of the teachers indicated 'moderately and greatly needed' in all dimensions. The highest percentage of the greatly needed category was indicated in generic and pedagogical knowledge and skills (33.71%). The second highest percentage of greatly needed category selected was related to planning activities in science instruction (32.58%) which then followed by administering science instructional facilities and equipment (31.30%). In terms of knowledge and skills in science subject, 25.07% of the teachers indicated greatly needed for this skill, whilst 47.14% of them expressed moderately needed. Table 2 also reveals that most of the science teachers who participated in this study perceived that their knowledge and skills in management of science instruction is inadequate to ensure effective and meaningful science instruction. This is because 25.01% of the respondents expressed that they greatly needed assistance in that particular skill, and about 42.66% expressed moderately needed for such skill. Finally, the least needed skill was diagnosing and evaluating students, whereby only 20.00% of the science teachers felt that they should upgrade their skills in that aspect.

Research Question 2: Do the in-Service needs of JHS integrated science teachers vary according to School Location?

The question sought to determine whether in-service needs of urban JHS integrated science teachers were different from those of rural teachers. The responses of the sample were categorised into not needed, moderately needed and greatly needed. The frequency counts of the participants' responses for each category were converted to percentages followed by subsequent Chi Square measure of association between the teachers' in-service needs and their school location. The results are of the analysis are presented in Table 3.

Table 3: Results of Chi square test for differences in the in-service needs of urban and rural JHS integrated science teachers

Dimensions/School location	Not Needed % (freq)	Moderately Needed % (freq)	Greatly Needed %(freq)	χ^2	P
Management of science instruction					
Urban	32.7 (16)*	42.8(21)	24.5(12)	1.560	.108
Rural	30.0(12)	42.5(17)	27.5(11)		
Diagnosing and evaluating students					
Urban	34.7(17)	40.8(20)	24.5(12)	0.099	.110
Rural	35.0(14)	40.0(16)	25.0(10)		
Generic pedagogical knowledge and skills					
Urban	20.4(10)	51.0(25)	28.6(14)	5.490	.117
Rural	22.5(9)	45.0(18)	32.5(13)		
Knowledge and skills in science subject					
Urban	28.6(14)	44.9(22)	26.5(13)	*12.423	.030
Rural	27.5(11)	37.5(15)	35.0(14)		
Administering science instructional facilities and equipment					
Urban	30.6(15)	46.9(23)	22.4(11) +	14.464	.041
Rural	25.0(10)	42.5(17)	32.5(13)		
Planning activities in science instructions					
Urban	22.5(11)	51.0(25)	26.5(13)	10.651	.015
Rural	27.5(11)	42.5(17)	30.0(12)		

*frequencies in parentheses *Degree of freedom = 2 *N = 89;
+ because of the runoff total is 99.9% and not 100 %

From Table 3 the levels of needs not needed ranged between 20.4 % and 34.7 %, those moderately needed ranged between 40.0 % and 51.0 % while those greatly needed ranged between 22.4% and 35.0 %. Over 60.0% of the teachers in urban and rural schools indicated 'moderate and great needs' in all the six in-service need dimensions. Their need for each dimension was ranked differently. The rural school teachers indicated more in-service needs for all the dimensions as compared to their colleagues in the urban schools. Especially, in knowledge and skills in science subject and administering science instructional facilities and equipment where 35.0% and 32.5% of the teachers in the rural schools expressed 'greatly needed' as opposed to 26.5% and 22.5% of their counterparts in the urban schools respectively. However, much variation did not show in the percentage frequencies in the remaining four dimensions. In management of science instruction, 24.5% of teachers in the urban schools indicated greatly needed and 42.8% of them indicated a moderately needed for the skill. On the other hand, 42.5% of teachers in the rural schools expressed moderately need in the said skill and 27.5% of them felt that such skill was crucially important. No association was established when further analysis was done (χ^2 (2) = 1.560; $p > 0$ .05). This means that the percentage rural school teachers indicating this need did not significantly from their urban counterparts. A comparison of the levels of need of the teachers indicated that 25.0% of teachers in the rural school expressed a great need for diagnosing and evaluating students as opposed to 24.5% of teachers in the urban school. More teachers from the rural (40.0%) and urban (40.8%) schools felt that they moderately needed assistance in this aspect. On the other hand, 35.0% of teachers in the rural schools and 34.7% of teachers in the urban schools expressed that such competency was not needed. Further analysis showed that there was no significant association between school location and diagnosing and evaluating students (χ^2 (2) =.099; $p > 0.05$). This means that the rural school teachers and their counterparts did not significantly differ in their need for skills in diagnosing and evaluating students.

In the acquisition of generic pedagogical knowledge and skills, 32.5% of teachers in the rural school expressed a great need for the skill as opposed to 28.6% of teachers in the urban school. More teachers from the urban schools felt that they moderately needed assistance in this aspect (urban = 51.0%; rural =45%). Further analysis showed that there was no significant association between school location and generic pedagogical knowledge and skills (χ^2 (2) = 5.49; $p > 0.05$). This means that the percentage rural school teachers indicating this need did not significantly from their urban counterparts. With reference to knowledge and skills in science subject, teachers in the rural schools (35.0%) demonstrated a higher percentage compared to their colleagues in the rural schools (26.5%), in expressing their great need for such support. Furthermore, 44.9% of teachers in the urban schools and 37.5% of teachers in the rural schools moderately needed assistance in this dimension. In contrast, 28.6% of teachers in the urban schools and 27.5% of teachers in the rural schools felt that acquiring skills in the said dimension is unimportant. Chi square analysis revealed that there was significant association between school location and knowledge and skills in science subject (χ^2 (2) = 12.42; $p <$ 05). This means that the percentage rural school teachers indicating this dimension as greatly needed differed significantly from their urban counterparts.

In administering science instructional facilities and equipment, 32.5% of respondents in the rural schools expressed a higher percentage for the category 'greatly needed' for the dimension as opposed to 22.4% of respondents in the urban schools. A higher percentage was revealed by teachers in the urban schools (46.9%) who felt that they moderately needed refresher courses in this aspect, whereas 30.6% perceived that they had acquired the necessary skills in administering science instructional facilities and equipment and therefore they did not need that skill. Detailed analysis showed significant association between the school location and the said skill (χ^2 (2) = 14.46; $p < 0.05$). This means that the percentage rural school teachers indicating this need significantly differed from their urban counterparts. That is, they need skills to administer science instructional facilities and equipment. Table 3 further shows that 26.5% of teachers in the urban schools and 30.0% teachers in the rural schools portrayed that they greatly need support in upgrading their mastery of knowledge and skills in planning activities in science instructions. A little over half of the teachers in the urban schools (51.0%) felt that they moderately needed refresher courses in this aspect than their counterparts in the rural schools (42.6%). Further Chi Square analysis revealed that there was significant association between the school location and the dimension (χ^2 (2) = 10.65; p <.05). This denotes the fact that the rural school teachers' needs in knowledge and skills in planning activities in science instruction differed significantly from the needs of their urban counterparts for this dimension.

DISCUSSION

Integrated Science Teachers' Prevalent In-Service Need

The JHS science teachers called for in-service training in all the six dimensions of the STIN, however generic and pedagogical knowledge and skills (33.58%) was their most prevalent in-service need. Followed closely by planning activities in science instruction (32.58%) and the least was diagnosing and evaluating students (20%). In contrast, science teachers in Malaysia were found to have prevalent in-service need for planning activities in science instruction (39.0%) followed by generic and pedagogical knowledge and skills (38.7%) and administrating science instructional facilities and equipment (27.5%) as their least prevalent need (Osman, Halim & Meerah, 2006). The call of Malaysian science teachers for planning activities in science instruction over generic and pedagogical knowledge and skills as compared to their counterparts in Ghana was that the 82.9% of the Malaysian science teacher were professional trained science teachers to teach science at that level as compared to their Ghanaian counterparts where 41.6% of the teachers are professional trained science teachers and 58.4% of them are professional trained non-science teachers teaching science in the JHS.

In this study, teachers expressed in-service need for training in generic and pedagogical knowledge and skills could be in association with the innovations in the teaching and learning activities of the current integrated science syllabus. Inquiry activities and problem solving are emphasised to provide opportunity for students to develop their curiosity, creativity and keenness as they explore their environment and develop their process skills (observation, classification, drawing, measurement, interpretation, and recording, reporting, and expected scientific conduct in the laboratory/field). This innovation has shifted the role of the teachers from transmission of knowledge to that of a facilitator to provide guided opportunities for pupils to acquire as much knowledge and skills in science as possible through their own activities. This shift in role has placed huge demands on the teachers, therefore, teachers would need intense and supported learning experiences to change their teaching strategies to enable them play their new role effectively. This result is in consistent with the findings of Abu Bakar & Tarmizi (1995) and Idris (2002) were Malaysian science teachers focused more of self improvement such as 'being creative in science instruction', 'updating knowledge of science innovations in science instruction' and 'understanding the goals of the syllabus'.

Without mastering of generic and pedagogical knowledge and skills, the teachers' knowledge and understanding would remain tacit and unavailable for teaching, and hence would not be able to help students develop the desired understanding of science (Anderson, 1987). The second most prevalent in-service need of the teachers, planning activities in science instruction could be entrenched in the teacher's inclination to motivate their students to learn science. According to Ngman-Wara (2005), thorough planning of science lessons along with the use of instructional objectives, results in more student on-task behaviour, and lessens student disruptive behaviour. The existence of students' with different abilities levels could be typical in the Ghanaian classroom thus, creating a need for teachers to plan lessons that interest and attract especially students with low ability levels. The teacher's awareness of the importance of planning science lesson to attract learners by varying their pedagogical approaches and teaching learning materials to keep students attention and interest may have contributed to their call for in-service training in planning activities in science instruction. Given the current educational climate of "science for all", integrated science teachers echoing generic and pedagogical knowledge and skills and planning activities in science instruction as their most prevalent in-service needs seem appropriate. Therefore in-service training programme should be designed to address these demands. The teachers' least in-service need was diagnosing and evaluating students (20.0%). The possible reason for this concern could be associated with the introduction of the School Based Assessments (SBA) in the JHS science syllabus. The new SBA system was designed to standardize the practice of internal school-based assessment in all schools and to reduce assessment tasks for teachers. The new SBA formally referred to as continuous assessment system is designed to provide schools with an internal assessment system which is based on all three profile dimensions (knowledge and Comprehension 20%, application of Knowledge 40% and experimental and Process Skills 40%) is to raise students' school performance and to be used by WAEC for determining examination results at the Basic Education Certificate Examination (BECE) (MoESS, 2007).

The new SBA also spells out the guidelines for constructing assessment items or questions and other assessment tasks, how often teachers are to assess their students as well as the marking grading system to use. This is to ensure that pupils master the instruction and behaviours implied in the specific objectives of each unit. Apart from the SBA, teachers are expected to use class exercises and home work as processes for continually evaluating pupils' class performance, terminal examination, and as a means for encouraging improvements in learning performance. These timely and regular feedbacks motivate and aid students to assess their performance. Affirming the assertion, feedback from these assessments are vital components which enhances learning and retention because the information helps the learner to structure their learning and also guide them to self appraise their learning (Tierney & Charland, 2007). Teachers calling for in-service training for diagnosing and evaluation suggest some handicap in their new role. It is therefore important to adequately equip the teachers with knowledge and skills in diagnosing and assessing students for achieving the targeted instructional outcomes. Appropriate use of assessment in the science lessons improves teaching, students' learning and maintaining student interest in the science concepts with which they are engaged (Treagust, 2006).

Differences in perceived In-service Needs of Rural and Urban Junior High School Science Teachers

Over 60.0% of the teachers in the urban and the rural schools demonstrated 'moderately needed and greatly needed' in all the six in-service need dimensions, however, their 'greatly need' for each dimension ranked differently. The teachers in the rural schools expressed their most prevalent in-service needs in knowledge and skills in science subject (35.0%) and generic pedagogical knowledge and skills (32.5%). On the other hand, teachers in the urban schools demonstrated their most prevalent in-service need in generic pedagogical knowledge and skills (28.6%) and planning activities in science instructions (26.5%). There was no significant association between school location and the dimensions when further analysis was run using Chi square analysis. However, from the results, the rural teachers expressed more need in all the dimensions than their counterparts in the urban schools. These findings are in consistent with the findings of Osman, Halim and Meerah, (2006) in their study what

Malaysian science teachers need to improve their science instruction: a comparison across gender, school location and area of specialization. The teachers in the rural schools expressed more in-service need in all the dimensions as compared to their counterparts in the urban schools. In this study, it appears that teachers in the urban schools have adequate content knowledge to teach science effectively as compared to teachers in the rural schools. This finding could be attributed to the academic and professional background of the teachers. This is shown as 61.2% of teachers in the urban schools are professional science trained as oppose to 55.0% of teachers in the rural school (See Table 3). This infers that urban school teachers are better qualified academically and professionally than their rural counterparts. This finding concurred with that of Rakumako and Laugksch (2010) when they assessed the demographic profile and perceived in-service needs of secondary Mathematics teachers in Limpopo province. They indicated that older, more experienced teachers of Mathematics are found in urban schools rather than in township or rural schools.

Urban teachers' calling for in-service training in generic pedagogical knowledge and skills is to equip them adequately to use teaching strategies that would enhance students thinking skills. More especially, with emphases placed on problem solving and inquiry teaching activities in the new science syllabus. This new teaching approach has place huge demands on the teachers. Thus, their call for this dimension seems expected when inadequate in-service training has been given to few teachers especially after the implementation of the 2007 science curriculum. This was shown when 26.5% respondents in the urban schools (see Table 3) were given one-shot in-service training on the JHS science curriculum after its implementation had begun. Therefore, teachers need updates on teaching approaches to implement the 2010 science curriculum. Finding the need to have adequate control on pedagogical approaches to help students develop the interest, understanding of scientific concepts and to improve their performance is in the right direction.

On the other hand, teachers in the rural schools call for in-service training in knowledge and skills in science subject and generic pedagogical knowledge and skills seem expected especially with addition of new topics for example, electronics and agricultural science and new teaching approaches (problem solving and inquiry) in the current syllabus. This innovations demand on the teachers the need to be updated on the new contents and new approaches to be competent to teach science effectively. Again, when some rural schools are recording zero percent in the Basic Education Certificate Examination results (BECE). This has placed anxiety on the teachers in the rural schools more especially with District Directors challenging them to be up and doing to help improve student's performance in the BECE results, thus, contributing to such feedback. Apart from the above 55 % of the rural school teachers are not professional science teachers and 80 % of them had not participated in any in-service training programme. It is therefore important that rural teachers knowledge and skills in science subject needs to be addressed immediately so as to make them competent enough to teach science effectively.

This finding also concurred with that Rakumako and Laugksch (2010) who reported that in-service programmes should aim at helping rural teachers by specifically upgrading their content knowledge and teaching skills (i.e. their greatest professional need). A study by Akerson and Hanuscin (2007) found that if professional development programmes increase teachers' understanding of science content, it could increase their confidence in their ability to teach science in their classrooms. When teachers are confident in the subject matter they are able to provide quality instruction, which also leads to higher student achievement

(Banilower, Heck, & Wiess, 2007; Darling-Hammond, Chung Wei, Andree, Richardson, & Orphanos, 2009).

CONCLUSIONS

Based on the findings of the study the following conclusions were drawn: The study established the fact that Junior High School science teachers in some schools in the Central Region of Ghana have various needs that require immediate action by those involved in drawing and implementing in-service training. The rural school JHS science teachers in some school in the Central Region of Ghana demonstrated higher demands for in-service training in the six dimensions investigated. It is of the known that the Ghana Education Service is aiming to establish an institutionalised structure for basic school teachers' continuous professional development (GES, 2007). It is therefore hoped that the results of this study facilitate these initiatives in a meaningful way so as to make the teachers adequately competent to improve science instructions hence, achieving the goal "science for all".

RECOMMENDATION

Based on findings of the study, the following recommendations were made:

1. The JHS science teachers indicated need for in-service training in all the six dimensions of the STIN with generic and pedagogical knowledge and skills and planning activities in science instruction emerging as greatly needed. It is therefore recommended that in-service organisers should consider these dimensions in future in-service training programme.
2. The fact that the rural school JHS science teachers expressed greater needs in the six dimensions compared to their urban counterparts suggests that there is a need for an effective in-service training programme based on school location. It is therefore recommended that in-service training programmes should be based on the context of school location.
3. About 46 % of the JHS science teachers in some schools in Central Region of Ghana are not professional science teachers. Such teachers require more assistance than their science professional counterparts. This calls for a pragmatic effort to organise in-service training with the view of bridging the gap between the professional science and non-professional science teachers.
4. The current situation where about 76 %of the JHS science teachers in the selected schools had no in-service training emphasise the need to carry out needs assessment among JHS science teachers so as to put interventional measures to address their needs (Ngman-Wara, Young & Mawuse, 2015).

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Appendix A
Reliability Coefficients of the Seven Dimensions of the STIN

Dimensions	Adapted STIN		Original STIN	
	No. of Items	Cronbach alpha	No. of Items	Cronbach's alpha
Management of science instruction	15	.94	15	.95
Diagnosing difficulties and Evaluating students learning	10	.94	10	.91
Generic pedagogical knowledge and skills	14	.94	15	.86
Knowledge and skills in science subject	9	.79	7	.90
Administering science instructional facilities and equipment	7	.90	10	.88
Planning activities in science instructions	9	.92	9	.90
Use of English language in science teaching	2	.34	2	.67