UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF SCIENCE EDUCATION

PERCEPTION OF ABETIFI COLLEGE OF EDUCATION PRE-SERVICE TEACHERS ON MENTORING FOR DEVELOPING EFFECTIVE PRIMARY SCIENCE TEACHING

CYNTHIA MAWUSE GYAMPEH

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CYNTHIA MAWUSE GYAMPEH

A thesis in the Department of Science Education, Faculty of Science Education, submitted to the School of Graduate Studies, University of Education, Winneba in partial fulfillment of the requirements for award of Master of Education (Science Education) degree.

2011

DECLARATION

STUDENT'S DECLARATION

I, Cynthia Mawuse Gyampeh, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature:……..

Date:……..

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Name of Supervisor: DR. K.D. TAALE

Signature:……..

Date:……..

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Signature:……..

Date:……..

DEDICATION

This work is dedicated to the memory of my late brother, Winfred Kojo Dzampeh for his encouragement and moral support.

ACKNOWLEDGEMENTS

I am greatly indebted in a very special way to Dr. K. D. Taale, my supervisor, who patiently spent endless hours to direct, correct and finally put me on the right way. I owe my gratitude to all lecturers of the University of Education Winneba, more especially to the Lecturers of Science Education Department.

ABSTRACT

This study was aimed at finding out the importance of mentoring practices on Pre-service teachers for developing effective primary science teaching. The main purpose for this study therefore, was to identify and describe the perception of the final year pre-service teachers of Abetifi College of Education (ABETICOE) on their mentoring in primary science education and the extent to which they received the range of mentoring practices that would assist them in developing their primary science teaching based on five factors (i.e., Personal Attribute, System Requirement, Pedagogical Content Knowledge, Modeling and Feedback). The design used to conduct this study was a descriptive survey. The main data collection instrument for the study was questionnaire for pre–service teachers (mentees) adapted from the Mentoring for Effective Primary Science Teaching (MEPST) instrument. Data was collected from 20 basic schools in the Kwahu East, Kwahu South and Birim North of the Eastern Region of Ghana. One hundred (100) mentees were sampled for this study comprising 65 males and 35 females. Descriptive statistics (i.e. percentages, mean scores, and standard deviations) were derived using SPSS for each variable. It was found out among other things that majority of mentees perceived that their mentors did not provide mentoring practices associated with the System Requirements items and that the mentees were mentored using the five-factor model . It was recommended that adequate mentoring in primary science teaching should be included in mentors' practices. The study argues that mentors may require further education to learn how to mentor specifically in primary science teaching and proposed a specific mentoring intervention as a way forward for developing the mentors' mentoring skills in the teaching of primary science.

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CHAPTER ONE

INTRODUCTION

This chapter deals with the background to the study, statement of the problem, purpose of the study, research questions, the significance of the study, limitation and the delimitation and the organization of the stud**y.**

Background of the study

According to Shirley and Nafsiah (2004), the role of science teachers is changing due to changes in science curricula and media. As a result of the curriculum changes, science teachers face the realization that there are certain cognitive and psychomotor needs which limit their effectiveness as science teachers. In view of these science teacher needs, it seems essential that attention be directed towards mentoring and supervision especially, of pre-service teachers.

Mentoring, as a field of practice, has the goal of ensuring quality teaching for beginning teachers (Glanz, 1998). In its current context, mentoring can be seen as a tool for fostering improvement in instruction, enhancing learning outcomes for all students, and promoting professional development for educators (Breeding & Whitworth, 1999). However, the situation in most primary schools in Ghana is that majority of the teachers are not confident in teaching primary school science let alone mentoring beginning science teachers. This is evident in the numerous complaints received from mentees assigned to mentors in the ongoing OUT program in Abetifi College of Education (ABETICOE) where the researcher was a tutor. The IN-IN-OUT Programme is expected to be an effective and more efficient way of preparing

pre-service teachers for basic schools in Ghana. This is because the programme, according to the Handbook on mentoring and supervision of teacher trainees on school attachment (2003), is to:

- offer teacher trainees the opportunities for more exposure to the realities of the school and classroom situations and reduce the superficial nature of formal teaching practice, which lasts for only a short period (12 weeks) spread out over a one-year period (usually in 4 weeks each, of 3 terms, in each year).

- commit classroom teachers to support trainees using a "mentoring" approach rather than abandoning them to their fate when these trainees are posted to the schools.

- emphasize the importance of the concept of a foundation period, followed by deepening of the principles in methodology and prolong cycle/period of practice (school attachment) and reflection which leads to a dynamic developmental concept of "professional competence"

- ensure that trainees' school experiences and college training experiences are mutually supportive and complementary.

Mentoring can be a way to develop teaching practices as it provides opportunities for mentors and mentees to engage in pedagogical discourse and reflective thinking (Crowther & Cannon, 1998). Mentoring therefore has become more prominent in teacher education (Power, Clark, & Hine, 2002). According to (Sinclair, 1997), mentoring increases the responsibilities assigned to mentors. This however has implication for the primary teacher as there are several key learning areas in the primary school that generalist primary teachers are expected to teach, and it is probable that these teachers will not have expertise in all areas. Goodrum, Hackling

and Rennie (2001), indicated that many generalist primary teachers either teach science inadequately or not at all. It therefore implies that primary teachers who become mentors may not have mentoring expertise to effectively guide the mentee's learning across all key learning areas such as English, mathematics, social studies and primary science of the teacher-training programme (Anderson 1997). Not surprisingly, student teachers often rate teaching practices much higher than other components. Hewson, Tabachnick, and Lemberg (1999) are of the view that a sound basis is necessary for making a student teacher an inquirer and a reflective practitioner who is capable of learning with and from others in a lifelong process and of moving smoothly from pre-service teacher education to on-going professional development in the course of his or her career.

Nath and Tellez (1995) argued that teachers in training need to have some exposure to what goes on in the field before they embark on their training. They further indicated that teacher education has not taken advantage of those teachers who are operating well in the field. They therefore suggested that the best way to educate prospective teachers is to place them with experienced teachers. According to them, beginning teachers who are learning to teach should see evidence of a reflective practitioner in the midst of experimentation, discovery and change.

Goodman (1985) also contended that assisting a pre-service teacher will make him/her gain rich experiential learning. Monitoring has therefore become more prominent in teacher education since it increases the responsibilities assigned to the mentors.

In Ghana the current situation where final year students of colleges of education embark on internship for a year demands that the primary school teachers who

become their mentors have mentoring expertise to guide the mentees' learning across all learning areas and this include primary science. The aim is to equip these students with what and how to teach. The content component of the programme currently involves areas including human development, students' teaching processes, curriculum design, developmental pedagogy and the observation and assessment of learning. All these components are expected to lay a solid foundation for the students' clinical experiences. Abetifi College of Education has generally built a closer relationship with schools in the Kwahu-East, Kwahu South and Birim-North Districts that serve as professional-practice sites called on-school attachment. The programme of professional teacher development, therefore gradually transforms a student to a science-teacher trainee and eventually to a teacher. The transition from a student to science teacher-trainee has proven very challenging in the cultural and socio-economic environment of Ghana. It is in the light of this that Colleges of Education of which Abetifi is of no exception, engaged in field experience of the in-in-out programme in which teaching science is meant to serve as a catalyst for this transformation. This research reports the mentoring practices of teaching science from teacher trainees' perspectives derived from their field experiences.

Statement of problem

As a science tutor in Abetifi College of Education, I detected through teaching practice supervision of trainees that most of them are not interested in primary science teaching. This is evident in the numerous complaints received from mentees assigned to mentors in the ongoing OUT programme in Abetifi College of Education (ABETICOE) where the researcher was a tutor. It also came to light through a workshop held at the college for primary school teachers from Kwahu South, Kwahu

East and Birim North districts where science inspectors indicated that most primary school teachers are not teaching science and those who teach at all teach only just selected topics that interest them.

Gross, Giacquinta, and Bernstein (1971) contend that many promising educational innovations are reported as ineffective when they had, in effect not been properly implemented in the classroom level. Onwu and Asuzu (1987) and Ogunniyi (1982) in their studies in Nigeria also report that there is a large gap between intentions and practice in science class.

The study has been motivated by the fact that pre-service teacher education programme is criticized as being abstract, theoretical and remote from the real world of the classroom (Barone, Breliner, Blanchard, Cassanovalli, & McGowan (1996). What is therefore required is to equip these teachers with the necessary knowledge and skills needed to teach science through professional development.

This study has therefore been designed to find out whether mentoring is done for mentees on internship and the extent to which mentoring practices help in developing effective primary science teaching among pre-service teachers.

Purpose of the Study

This study sought to assess the importance of mentoring practices on final year pre-service teachers of Abetifi College of Education for developing effective primary science teaching. It was also intended to find out the extent to which the pre-service teachers received the range of mentoring practices that would assist them in developing their primary science teaching based on five factors namely; personal

attributes, system requirement, pedagogical, modeling and feedback link to literature based instrument.

Research objectives

The objectives of the study were to:

1. identify the personal attributes exhibited by mentors for mentoring primary science teaching
2. find out the system requirement practices provided by mentors for mentoring primary science teaching
3. investigate pedagogical knowledge exhibited by mentors for mentoring primary science teaching
4. determine modeling skills exhibited by mentors for mentoring primary science teaching
5. find out feedback techniques exhibited by mentors for mentoring primary science teaching

Research questions

The study in order to achieve the stated objectives was being guided by the following research questions:

1. What personal attributes are exhibited by mentors for mentoring primary science teaching?
2. What system requirements practices are provided by mentors for mentoring primary science teaching?

3. What pedagogical knowledge are exhibited by mentors for mentoring primary science teaching

4. What modeling skills are exhibited by mentors for mentoring primary science teaching?

5. What feedback techniques are exhibited by mentors for mentoring primary science teaching

Significance of the Study

It is expected that players in the management of the school attachment component of the IN-IN-OUT programme, especially in the primary schools, could benefit tremendously from the findings of this research work since it would provide mentoring and supervisory intervention as a way forward for developing the mentors' skills of mentoring and mentees developing effective primary science teaching practices. It would also serve as a handy reference for teacher trainees (pre-service teachers) and for all persons who would be engaged in the job of supporting teacher trainees through mentoring and supervisory activities.

Delimitations

The study involved only final year pre-service teachers from Abetifi College of Education. It also involved pre-service teachers who teach science in primary classes 4, 5 and 6 in selected primary schools in the Kwahu South, Kwahu East and Birim North Districts in the Eastern Region of Ghana.

Limitation

The use of purposive sampling procedures, intact classes and only twenty (20) schools are likely to place a restriction on the extent to which the findings of the study may be generalized to schools in similar settings. The above-mentioned restrictions notwithstanding, the results of the study would be a useful indicator for identifying monitoring practices for developing effective primary science teaching. In addition, further investigation on both mentees and mentors' perception would provide a clearer picture of mentoring practices in primary science. Questionnaire approach may restrict the teacher's responses and may have missed some important data which was handled in this study as much as possible. Since the survey questionnaire tends to be impersonal (Cummings & Worley, 1997), respondents may not answer the questions honestly in the survey which may have skewed the study results. The use of techniques such as interview and observation would have enhanced the richness of the findings. Another limitation is that I did not solicit the headteachers, teachers and circuit supervisor's views, or those of the district science organizers.

Organisation of the study

The study is divided into five main chapters. Each chapter starts with a brief introduction which highlights on what the chapter entails followed by the main content of the chapter.

Chapter One being the introduction begins with the background of the study followed by the statement of the problem and the purpose of the study. It also includes the research questions for the study, the significance of the study, delimitation and limitations of the study. The chapter ends with organisation of the study.

Chapter Two deals with the review of related literature. It covers the topical issues raised in the research questions and the purpose of the study. A summary of literature review ends the chapter.

Chapter Three deals with the methodology of the study. Under this are the research design, population and sample selection, research instruments, pilot testing, and administering and finally, the data analysis plan.

Chapter Four, deals with the presentation of the results, findings discussions and evaluation of the interventional process as a whole.

The Fifth chapter outlines the summary, conclusion, recommendation and suggestions for further research work on the topic.

Definition of Terms

Lead Mentors - Head Teachers who were appointed by the Ghana Education Service as the administrators of the basic schools.

Mentees – The teacher trainees on the out-segment teaching practice programme.

Mentors – the classroom teachers assigned to mentor the teacher trainees assigned to their class.

Pre-service teachers – The final year teacher trainees who are on the out segment of the teacher education programme.

IN-IN-OUT Programme- two years on campus and one year internship programme.

Abbreviations

MEPST - Mentoring for Effective Primary Science Teaching

AARE- Australian Association of Research in Education

COE- Colleges of Education

CHAPTER TWO

LITERATURE REVIEW

In this chapter, existing studies on mentoring practices and their effects on teaching and learning science in the primary school were reviewed. It included summary of the writings of recognized authorities and previous research works. Documents both published and unpublished including books, journals and newspapers that had relevant information on the topic were reviewed.

The concept of mentoring

Teacher mentoring can be viewed as the professional practice that occurs in the context of teaching whenever an experienced teacher supports, challenges, and guides pre-service or beginning teachers in their teaching practice (Odell & Huling, 2000). Mentors are key players in teacher preparation. They are those experienced teachers who have as a part of their professional assignment an important role in developing beginning teachers as they learn to teach (Frykholm & Meyer, 1999; Odell & Huling, 2000). The purpose of mentoring is to provide guidance and support, promote professional development, and to increase teacher retention (Odell & Ferraro, 1992).

In most pre-service teacher-preparation programs, students are mentored by cooperating teachers during their practice teaching assignment (Odell & Huling, 2000). Once a teacher has accepted a teaching assignment, mentoring may occur formally for an official period of time, such as the teacher's first year, or for a longer period of time as dictated by the school district (Rudney & Guillaume, 2003). Some school district mentoring programs will include teachers who are not new to teaching but who are in their first year of teaching in the school district. According to Ganser, Marchione, and Fleischmann,(1999),experienced teachers may benefit from mentoring when they have specific areas of need. Informal teacher mentoring can occur when one teacher seeks out another co-worker for "every teacher needs a critical friend, and that is a mentor" (Heller, 2004, p. 29). Mentors serve as confidants and are a main source of support to the new teacher. In a successful relationship, the mentee feels free to ask for help, expose insecurities, take risks, and celebrate successes. It allows both mentor and mentee to discuss, accept, and work through teaching dilemmas with the ultimate shared goal of improving learning experiences for students" (Udelhofen & Larson, 2003). Mentoring from an experienced master teacher can help ensure that a new teacher moves quickly through the typical phases of a first-year teacher, reaching the ultimate goal of meeting the needs of all students in his/her care (Reiman & Thies-Sprinthall, 1998). Without support from a mentor, pre-service teachers may have difficulty meeting with success, thereby affecting the success of their students.

The following section describes some of the problems and challenges faced by pre-service teachers.

Problems and challenges for pre-service teachers

Research on pre-service teachers seems to come up with a consistent list of findings concerning problems pre-service teachers have (Huberman, 1995; Veenman, 1984; Mullen, 2005). One of the common problems encountered by pre-service teachers is classroom management (Veenman, 1984), while another common problem is the pre-service teachers' lack of teaching resources (Mullen, 2005; Veenman, 1984). The third most common issue is the general lack of support from other experienced teachers, including the head teacher.

According to Mullen's (2005) study of beginning primary teachers in New Zealand, stress and tiredness can set in when pre-service teachers are left on their own. Similar studies of pre-service teachers' learning and development in the United States indicate that making the transition from being students of teaching to teachers of students is difficult for many teachers and often considerably influences their next career stages (Darling-Hammond, 1998; Gold, 1996).

Many pre-service teachers experience challenges in their first year of teaching experience (Gold, 1996; Mullen, 2005; Veenman, 1984). For instance, pre-service teachers may be given some of the most difficult classes in terms of discipline. They may also teach subjects in which they were not trained or educated (Veenman, 1984). Furthermore, according to Mullen (2005), novice teachers confront a wide range of non-academic duties they may have had little prior experience of. These include disciplining students, collecting money and forms, completing administrative paperwork, and serving as surrogate parents. For example, pre-service teachers from the Colleges of Education in Ghana are required to take up the same teaching loads, including the extra curricula duties, as their experienced colleagues and their performance appraisal is based on that.

Williams (1993), in a study of beginning teachers in the United States, argued that beginning teachers have two roles: teaching effectively and learning to teach. Mentoring he believes, should recognize and support both roles. Daloz's (1986) study of a group of pre-service teachers in the United States indicated that school-specific questions of curriculum, instruction and classroom management are what concern new teachers most. Pre-service teachers need support and guidance in the initial stage of their career. School based induction, with mentoring support, can influence pre-service teachers' decision to remain in teaching or to leave.

These complex expectations are often experienced negatively, because pre-service teachers are not often supported to know what to do, and they may be afraid to show that they do not already know. Dyal and Sewell (2002) add that the ultimate effect of such negative experiences is that pre-service teachers leave teaching, contributing to teacher retention issues. Moreover, other studies point out that it is often the most promising pre-service teachers who leave teaching in the early years (Flynn & Nolan 2008). Nevertheless, other parallel studies such as Martin (2008) counter that when pre-service teachers are supported and guided by other experienced teachers during these 'turbulent' career phases, they can have rewarding and satisfying inductions. The views of various writers on mentoring pre-service teachers are discussed in the next session.

Mentoring pre-service primary science teachers

According to Hudson (2003), over the past years the preparation of primary science teachers has been of great concern to educators. This view was also echoed by others such as Bybee (1993), Wollman-Bonilla (1997), Crowther and Cannon (1998) and Goodrum, Hackling and Rennie (2001). In the United States, "*science for all"* has become a key goal of contemporary reform in science education (Gallangher, 2000),

as science for all aims at increasing scientific literacy, which has implications for economic gain and for empowering citizens (Chapman, 2005). At the forefront of ensuring a scientific literate public are up-to-date and capable science teachers. In Australia, attaining "science for all" is not happening, and there is a "considerable gap between the ideal or intended curriculum and the actual or implemented [science] curriculum, despite the fact that primary science as taught now, is more investigative and student-centered than in previous decades, (Goodrum, Hackling and Rennie, 2001). The views expressed by these people about science teaching in Australian schools are not different from what pertains in our Ghanaian basic schools today. Despite the indications by Goodrum et al. (2001), Bybee, (1993), Hill, Hurthworth and Rowe, (1998) as well as Lunn and Solomon (2000), are however of the view that effective science teaching practice is still not a regular occurrence in many primary classrooms around the world. Thus there is the need for mentoring of basic school trainee teachers for effective science teaching in their classrooms in Ghana.

The next section discusses the five-factor model for developing primary science teaching practices.

A five-factor model for developing primary teaching practices

Mentors need explicit education in mentoring in order to reflect on their actions for developing in mentees "higher levels of professional thinking" (Veenman, de Laat., & Staring, 1998), and this is also relevant for specific subject areas. To this end, Hudson, Skamp, and Brooks (2004) in a previous study on specific mentoring had identified a correlated and statistically significant five-factor model for effective mentoring. These factors are personal attributes, system requirements, pedagogical knowledge, modelling, and feedback. These factors are described below:

Personal Attributes.

Mentors need to exhibit a number of personal attributes to develop mentees' primary teaching (Ackley & Gall, 1992; Galbraith & Cohen, 1995). According to Hudson, Skamp, and Brooks, (2004), mentoring process may be strengthened with the inclusion of the Personal Attributes factor. This assertion was supported by Kerka, (1997) that this particularly takes place within a social context. Galbraith and Cohen (1995) and Ganser (1996) also indicated that a mentor's personal attributes aim to facilitate such learning. Indeed, the mentor's personal attributes are fundamental to the mentoring process.

In relation to Personal Attributes, mentors need to be: supportive (Ackley & Gall, 1992), attentive (Kennedy & Dorman, 2002), comfortable with talking about specific primary teaching practices (Jonson, 2002), instill positive attitudes in their mentees for teaching primary subjects (Feiman-Nemser & Parker, (1992), instill confidence in their mentees for teaching primary subjects (Enochs, Scharmann, & Riggs, 1995), and assist the mentee to reflect more positively on practices for improving the teaching of specific primary subject areas (Abell & Bryan, 1999; Upson, Koballa, & Gerber, 2002).

System Requirements

System requirements present quality control directions by providing a curriculum that focuses on achieving specific aims for teaching (Lenton & Turner, 1999; Peterson & Williams, 1998). System requirements are essential aspects for reforming primary education (Bybee, 1997). Mentors' provision of System Requirements may contribute to reforming primary education at the pr-eservice level. Indeed, when beginning

teachers commence employment in an education system, they will need an understanding of system requirements. Mentors can provide valuable assistance with mentees' understanding of key practices associated with the System Requirements factor (Hudson, Skamp, and Brooks 2004).

Three key mentoring practices may be associated with System Requirements, which focus on: aims for teaching a specific subject (Harlen, 1999), the specific primary curriculum (Bybee, 1997; Jarvis, McKeon, Coates & Vause, 2001) and school policies related to specific primary subject areas (Riggs & Sandlin, 2002). Hence, the mentoring of aims, curriculum, and policies in specific primary subject areas may advance the mentees' understanding of System Requirements, especially if this mentoring is connected with the other four factors.

Pedagogical Knowledge

According to Allsop and Benson (1996) and Hulshof and Verloop (1994), pedagogical knowledge is the science or profession of teaching and is developed within the school setting and is essential for supporting effective primary teaching (Roth, 1998). Mentors need to have pedagogical knowledge to guide their mentees' teaching practices (Kesselheim, 1998). The mentor's provision of the factor, Pedagogical Knowledge, is key to the mentoring process overall (Hudson et al, 2004). They further indicated that the omission of Pedagogical Knowledge in mentoring programs will limit or reduce the quality of experiences mentees can receive within the school setting. Eleven mentoring attributes with practices may be associated with pedagogical knowledge, namely: planning for teaching (Jarvis et al., 2001), time-tabling (Williams, 1993), preparation (Rosaen & Linquist, 1992), teaching strategies

(Fleer & Hardy, 2001), classroom management (Corcoran & Andrew, 1988), questioning skills (Fleer & Hardy, 2001), assisting with problem solving (Breeding & Whitworth, 1999), content knowledge (Lenton & Turner, 1999), implementation (Beck, Czerniak, & Lumpe, 2000), assessment (Jarvis et al., 2001), and providing viewpoints (e.g., Fleer & Hardy, 2001).

Modelling.

The mentees' skills for teaching are learned more effectively by observing their mentors' modelling of teaching practices (Barab, & Hay, 2001; Carlson, & Gooden, 1999). Modelling teaching practices according to Rodrigue and Tingle (1994), may be linked to implementing primary education reform, particularly as beginning teachers can introduce change into the education system. Eight attributes and practices are associated with modeling specific primary teaching. These are: enthusiasm (Long, 2002), teaching (Little, l990), effective teaching (Briscoe & Peters, 1997), a rapport with students (Ramirez- Smith, 1997), hands-on lessons (Raizen & Michelson, 1994), well-designed lessons (Asunta, 1997), classroom management (Little, 1990), and syllabus language ((Williams & McBride, 1989). Thus mentor modeling these specific mentoring practices may lead to developing their mentees' understanding of primary teaching practices in specific subject areas.

Feedback

Providing feedback allows pre-service teachers to reflect and improve teaching practices (Schön, 1987), and this includes primary teaching practices in specific subject areas (Jarvis et al., 2001). Six attributes and practices that may be associated with the feedback factor for developing mentee's primary teaching in specific subject

areas, requires a mentor to: articulate expectations (Ganser, 1996), review lesson plans (Monk, & Dillon, 1995), observe practice (Tomlinson, 1995), provide oral feedback (Ganser, 1995), provide written feedback (Rosean, & Linquist, 1992), and assist the mentee to evaluate teaching practices (Long, 1995). Thus the provision of feedback would be enhanced with the inclusion of these specific attributes and practices. Indeed, a mentor who articulates expectations may present a clear picture to the mentee for developing specific teaching practices.

Mentors can provide feedback on the formative stages of planning for teaching by reviewing lesson plans. Oral and written feedback requires observation of teaching practices. Mentors can provide feedback on the mentees' perceptions of their teaching by referring to their mentees' evaluations of their primary teaching practices. Indeed, this process of feedback should occur sequentially with expectations articulated each time a mentor provides feedback on articulate expectations, review lesson plans, observation of teaching, oral feedback, written feedback and feedback on evaluation.

Teacher Developmental Stages

The process of becoming and being a teacher has been extensively researched across a range of different theoretical stances. The general consensus is that beginning teaching is a complex issue (Calderhead, 1989; Pelletier 2006). Earlier studies on teacher development (e.g. Fuller, 1969) suggested that beginning teachers progress through developmental stages. The first is the initial stage of simply surviving the transition from student teacher to full-time instructional leader in a classroom these concerns included thoughts about one's adequacy as a teacher, class control, being liked, and being evaluated. Later stages are, according to Fuller (1969): confidence, autonomy, and commitment. During these stages, the concerns of new teachers shift

from the self to other teachers and later broaden to the profession as a whole. Subsequent studies (e.g. Calderhead, 1989; Feiman-Nemser, 1991; Gold, 1996) show that beginning teachers need professional and psychosocial support (Bubb, 2000) in their early stages of personal and professional development. Recognizing the different stages of teacher development is helpful when examining the relationship between mentors and pre-service teachers in induction programmes. Calderhead (1989) pointed out some of the various struggles faced by her participants. She identified the 'survival stage' as also appropriate to describe pre-service teachers' experiences in New Zealand primary schools. The 'survival stage' is critical, in which mentoring support from experienced colleagues, families and friends is required (Calderhead, 1989). The mentoring phase within the continuum of teacher development gets more attention from researchers than pre-service and in-service teacher education, because induction has important consequences for the teachers' later professional development and retention (Bubb, 2000; Feiman-Nemser, 1991). Following on, I discuss the significance of mentoring within the context of education changes in Ghana and elsewhere.

Education reform and professional development

A lot of countries, both developed and developing nations, are involved in some aspects of education reform at some time (Darling-Hammond, 1998) because of changes in technology, research into new teaching and learning approaches, economic and political imperatives, and globalization (Hargreaves & Fullan, 1992; Lieberman, 1995). In other words, technology, culture, students and educational organizations change at a remarkable pace. Schools must be able to keep up and plan for these changes within existing educational landscapes (Hargreaves & Fullan, 1992).

During the international educational reforms of the last two decades, teachers and the teaching profession have been under much scrutiny (Lieberman, 1995; Darling-Hammond, 1998). While reform initiatives may differ in their purposes and directions, one of the main themes is students' learning improvement (Lieberman, 1995). Often, it is assumed that the reform initiatives focus on teachers' professional development to enhance students' learning outcomes (Wollman-Bonilla, 1997). As well, literature findings indicate that reforms in schools cannot occur without reforms in teaching, and reform in teaching cannot occur without schools being reformed (Hargreaves & Fullan, 1992; Lieberman, 1995). This means that school cultures need to change, often from teacher isolation to more collaborative learning forms. For example, the schools cluster group in-service in Ghana supported by the District Teacher Support Team (DSTS) allows for teachers from schools in close proximity to share human and material resources and ideas to improve their teaching and student assessment practices.

In the context of this study, teachers' ongoing professional development is necessary to equip them with the necessary skills and knowledge of the new curriculum to confidently teach. Pre-service teachers in Ghana bring with them to schools new theoretical knowledge from pre-service education and the experienced teachers have practical knowledge acquired over many years of practice (Darling-Hammond, 1998). Thus sharing of such knowledge between pre-service tearchers and mentors through mentoring can be mutually beneficial (Bezzina, 2006). The need for teachers to be equipped with the content knowledge, pedagogical skills and experiences to work within changing school contexts is paramount to improve teachers' competency level (Darling-Hammond, 1998). Teachers, in some countries including Ghana are viewed as important change agents. For example, the United States federal legislation 'No

Child Left Behind' (NCLB) Act of 2001 requires that each classroom have a 'highly qualified' teacher by 2005-06. Guskey (1986) explained 'highly qualified' as having a state certification, a bachelor's degree and subject matter competency. However, literature findings show that new teachers graduating from teacher education programmes will still be under-prepared for their first year as teachers (Veenman, 1984; Gold, 1996). Therefore, beginning teacher development through mentoring is vital (Darling- Hammond, 1999; Liebermann 1995).

In this research, the pre-service teacher in Ghana graduates with a teaching diploma and spend longer time in college covering the new curriculum contents than their supervisors/mentors. The pre-service teacher's knowledge of the curriculum content may be new to experienced teachers, including the mentors/supervisors. By working collectively through mentoring practices, pre-service teachers and mentors/supervisors combine their skills, knowledge and expertise to be able to respond promptly to an ever-changing educational environment (Liebermann 1995). Both the pre-service teacher and their assigned mentors/supervisors have the opportunity to learn from each other when they work together, by observing each other's teaching, and in discussing common issues affecting their practices as teachers in schools (Youngs, 2007).

Pre-service Teacher Education Development in Ghana: Historical Overview

Teacher education in Ghana was started by the missionaries. The first teacher education institution and a systematic teacher training program in the Gold Coast (now Ghana) was started by the Basel mission in 1848 at Akropong Akwapim (MacWilliam, 1969; Graham, 1971). From 1845 to 1851, unsuccessful attempts were made at establishing a teacher training in Akrah (Graham, 1971). Initial teacher

education in Ghana is concerned mostly with the training of teachers for Basic schools (primary and junior secondary) education. Currently, it is a three-year program for high school graduates leading to the Diploma in Basic Education (DBE). The development of teacher education has had a checkered history sometimes calling for ad-hoc programs to meet emergencies (Acheampong, 2001). According to Anamuah-Mensah (1999), the institution has had not less than eight different models. The changes have been in response to changes and reforms in education.

Teacher education in Ghana started in 1930 with a four-year teacher training course which led to Certificate "A". This was meant for middle school graduates who were trained to teach at primary and middle schools. In 1937, a two-year Certificate "B" teacher training program was instituted to train more teachers to cope with the ever increasing number of schools (MacWilliam, 1969; Graham, 1971). The introduction of the Accelerated Development Plan in 1951 to expand and improve education in the country necessitated the introduction of a two-year post-B program to upgrade such teachers to Certificate "A" (Post-B Certificate "A") after teaching for some time.

After independence in 1957, there was increase in school enrolment which called for increase in demand for teachers. The nation reintroduced the four-year post middle Certificate "A" in 1961. This was because the Certificate "B" program was found to be ineffective. Along this Certificate "B" program, a three year post secondary training program was introduced to train teachers for the middle school and junior Secondary (JSS) levels. The three-year program was later abandoned and replaced with a two-year post secondary Certificate "A" which was later eliminated. In 1979, the three-year post secondary Certificate "A" was reintroduced. In 1982, the Modular Teacher Training Program (MTTP) was introduced. This program blended distance

education and conventional teacher training approach for pupil teachers (unqualified) to become trained teachers. These classroom teachers had two years sandwich courses and then enroll for two years in a teacher training institution for a four-year Certificate "A" to teach at the primary level after completion. Presently, all these models have been abandoned except the three-year post secondary Certificate "A" which has been upgraded into diploma programs called Diploma in Basic Education (DBE) in 2004. By 1967 Ghana had eighty-three initial teacher education institutions but now there are thirty-eight public and three private ones. Only seven of these are single-sex female institutions.

The Curriculum

The aims of pre-service teacher education as enshrined in the New Structure and Content of education (Dzobo, 1974) and have remained until this time are to:

1. Provide teachers with a sound content base of the courses at the levels at which they will function.

2. Provide teachers with sound professional skills to make them effective and efficient to guide their learners.

3. Inculcate the qualities of leadership into would-be teachers to make them able to integrate the school with the community, to create an ecosystem which will make children learn with pleasure, and to prove themselves acceptable in the society.

4. Train teachers in manual skills so that they motivate the children they teach in the acquisition of basic vocational skills.

These objectives have outlived their usefulness in an information and technological driven world but they continue to stand firm in the teacher education program in the country. The curriculum is tailored towards the achievement of these objectives.

The old curriculum

The initial pre-service teacher education curriculum had undergone constant changes as changes occurred in the structure. These were minor changes but the major change occurred in 1998. Before then the pre-service initial teacher education curriculum for basic education was as follows: general education (30%), academic education (30%), and professional studies (40%) (Acheampong, 2001). The general education encompasses core subjects: basic mathematics, English language, basic science, Ghanaian language, physical education, cultural studies, education, and agricultural science. The academic education is made up of two elective subject chosen by each student from group one or group two. The group one includes science-based subjects while the group two comprises vocational subjects. Some teacher institutions specialized in group one, others in group two while others engaged in both. Time allocation per week for the various subjects depends on emphasis given to it in the teacher education program. Each period consists of a forty-minute lesson. Each teacher institution has flexibility to organize its time schedule and time allocation per subject but has to inform the Teacher Education Division of the Ghana Education Service. The professional component part of the curriculum includes two weeks school observation and two weeks for on-campus practical teaching (micro-teaching) in year one, and a six week each in years two and three practical teaching in schools.

The new teacher education curriculum (In-In-Out model)

One problem leveled against the old curriculum in the Initial Teacher Training system was that it did not give much emphasis to practical training. This necessitated the

proposal of the new curriculum the *In-In-Out model* in 1999/2000 to be adopted. In *the In-In-Out model*, students spend the first two years in school for academic work and spend the whole of the third year teaching in a school for practical training. The essence of this model is to provide enough opportunities for relating theory into practice thus the need for a year's practice teaching. A feature of this program which is different from the old model is the role of District Assemblies in recruiting candidates and sponsoring them in their teacher training. These sponsored teachers are then bonded to teach in the district after their training. This proposal has been put on hold because of funding problems to some districts. Teacher institutions under this model offer either the general programme or specialized programmes which include science and mathematics, French, technical or early childhood education.

The model has a practice teaching (practicum) component. At the end of the first year there is school attachment for observation of teaching and work practice where student teachers observe regular teachers in the classroom teach. In the second year, students do on-campus practice teaching for practice in lesson designing and the development of specific skills in teaching. The third year is out of campus practice teaching where students spend a years teaching in a school. They are mentored by seasoned teachers in the schools they are practicing.

The Diploma in Basic Education Program (DBE)

In September 2004, the three-year postsecondary teacher program which had the *in-in-out* component added to it was upgraded to a three-year Diploma in Basic Education. This move is to ensure quality education delivery in the country's basic education system. The curriculum is based on the semester and course system. This idea was conceived as far back in 1992 as part of the regional colleges of Applied Arts, Science and Technology institutes program. This program has two basic

components; DBE “A” and DBE “B”. DBE program “A” is structured to produce teachers to teach all subjects in a primary school while program “B” teachers are trained to teach two or three subjects in the Junior Secondary School. The underlying principles of this program include demand, integration of theory and practice, school/classroom focus, competency and process assessment (ED/HED/TED, 2003).

There are five curriculum components to this program. These are foundation academic courses, specialized personal development, educational studies, curriculum studies and methodology, and practical training. The foundation studies course include all subjects studied at the basic education level while the specialized personal development studies encompasses communication and study skills in addition to socio-economic issues that underlie national development. The educational studies include studies focusing on the learner, the teaching-learning process, and assessment. Curriculum studies and methodology focuses on the teaching of content of either the primary school subjects or Junior Secondary school subjects whereas the practical training consists of school visits, school attachments, on-campus practical teaching, design and preparation of teaching learning materials, and external school-based teaching. The table below shows the courses pursued in this program (ED/HED/TED, 2003).

CHAPTER THREE

METHODOLODY

This chapter comprises the research design, population and method of sampling, the research instrument which is made up of test and questionnaire, the validation of the instrument, as well as the procedure for data collection.

Research Design

The design for this study was a descriptive survey and its fundamental aim was to investigate mentoring practices as perceived by pre-service teachers on the out – segment programme of Abetifi College of Education for effective primary science teaching. According to Osuala (1991), descriptive survey is the type of survey which specifies the nature of a given phenomena. It determines and reports the way things are in their natural set up. Descriptive survey design was used principally due to the large sample size that was sampled for the research work. The design has the potential of providing a lot of quantitative information from a large number of individuals (Fraenkel & Wallen, 2000).

The rationale for selecting descriptive design is that, it is considered to be the best design since it is basic for all types of research in assessing the situation as pre-requisite to inferences and a generalization. Besides, it assists the researcher to construct standardized questionnaire which provide data in the same form from all respondents. In addition, the use of descriptive survey enables the researcher to observe, describe and document aspects of the situation as they naturally occur rather than explaining them. Lastly, this method affords the opportunity to select sample from the population being studied and then make generalization from the study of the sample.

Notwithstanding the merits of the survey design, it has some weaknesses. Firstly, there is the tendency of careless response given in an offhand manner by respondents, that is, sometimes at variance with the more serious opinion that is expressed as actual decisions. It is again, not in itself sufficiently comprehensive to provide answers. Finally, descriptive design cannot deduce conclusively the cause of future phenomena or predict what the future phenomena would be.

In order to overcome the demerits associated with the descriptive design in this study, the purpose of the study was thoroughly explained to respondents and their confidentiality and safety assured. A pre-test of the instruments was conducted to help correct all ambiguities and questions which could pose problems to respondents. Also, to ensure hundred percent return rates, the researcher administered the questionnaire personally. In a situation where respondents were not ready to return questionnaire on the same day, an arrangement was made to collect them at another time.

Population

In any given research design, the concepts of population and sample are important. According to Muijs (2004), the population is the group that you generalise your findings to.

The target population for the study was all the final year students (mentees) of Abetifi College of Education who are on the out segment programme in the Birim –North, Kwahu-East and Kwahu South districts of the Eastern Region of Ghana. The accessible population however, comprised mentees of Abetifi College of Education who are having their out segment in 20 sampled basic schools located in the three districts where the mentees have been posted for their internship.

Sample and Sampling procedure

A sample consists of a carefully selected subset of the population and sampling refers to the process of selecting the subset of the population to represent the entire population. As pointed out by Patton (2002), sampling is an essential part of the whole exercise of data collection.

A lottery technique under simple random sampling was used to select the basic schools in each district for the study. Numbers were written against the names of all the basic schools in each district and then written on slips of paper. These slips of paper were then put into a container and shuffled to mix thoroughly. A selector was then asked to pick the slips without looking into the pool. This was done without replacement of slips until the desired number of schools for each district was selected. Once a number was selected it was recorded and set aside before a new one was picked. The container was reshuffled after each slip was picked. This was done until all the basic schools were selected for each district. Table 1 indicates the distribution of schools for each district.

Purposive sampling procedure was followed to select 100 mentees for the study. All mentees who taught primary one (1) to five (5) in the selected Basic Schools were purposively selected for the study and this comprised 100 mentees made up of 65 males and 35 females. Purposive sampling was employed since it deals with conscious selection of people of a particular set of attributes that have an effect on the problem or issue of interest and ensures comprehensive representativeness (Stringer, 1996; O' Lery, 1990). Frankfort-Nachmias and Nachmias (1996) also postulated that in purposive samples (occasionally referred to as judgmental samples), researchers select sampling units subjectively in an attempt to obtain a sample that appears to be representative of the population.

Table 1: Distribution of schools by district

District	Schools selected	Total
Birim-North District	Akoase D/A Primary School Akoase L/A Primary School Akoase Presby Primary School Akoase R/C Primary School Akoasi Methodist primary school	5
Kwahu-East District	Abetifi Demontration primary school Abetifi Presby Abetifi R/C Primay School Asakraka Presby Primary School Asakraka R/C Primary School Kwaku Tafo R/C Primary School Kwawu Tafo Presby Nteso D/A Primary School	8
Kwahu-South District	Bempong R/C Bepomg Presby Primary School Mpraeso Methodist Obimpong Methodist Obo Anglican Primary School Obomeng D/A Primay School Obomeng Pesby Primary School	7
Total		20

In other words the chances that a particular sampling unit be selected for the sample depend on the subjective judgement of the researcher. Despite the fact that this sampling procedure is subjective, its advantage in terms of richness of information gathered for the study cannot be oversimplified. The purpose of this was to gather rich information that illuminates the research questions for the study. As noted by Patton (2002), “the logic and power of purposeful sampling lie in selecting information-rich cases for the study. Information rich cases are those from which one can learn a great deal about issue of central importance to the purpose of the inquiry…” (p. 230).

The research instrument

Questionnaire was the only instrument used in collecting data for the study. The questionnaire was adapted form of the Mentoring for Effective Primary Science Teaching (MEPST) instrument (Skamp&Brook, 2004), to reflect the mentoring needs of primary school teachers who teach in Ghanaian basic schools.

The MEPST instrument consisted of three sections, 1, 2 and 3. Section 1 sought information on the demographic factors of the respondents while section 2 sought to find out the perception of the mentees about their mentors. Section 3 on the other hand comprised 35 items pertaining to mentoring attributes in primary science teaching. These attributes were categorized as (i) Personal attributes (ii) System Requirements (iii) Pedagogical Knowledge (iv) Modeling (v) Feedback. Each item in section 3 consisted of a stem follow by a five-point Likert type options ranging from (1) strongly agree to (5) strongly disagree.

Table 2 summarizes the distribution of items according to the dimensions identified.

Table 2: The distribution of items for each factor of mentoring for effective primary science teaching

Dimension	No. of Items	Item Distribution
Personal attributes	6	1, 17, 31, 26, 22, 23
System requirements	3	25, 11, 4
Pedagogical knowledge	11	3, 10, 6, 14, 24, 8, 21, 30, 18, 32, 27
Modeling	8	7, 9, 29, 5, 12, 15, 19, 2
Feedback	6	34, 16, 28, 13, 20, 33

Pilot Test

Pilot test, according to Polit and Hungler (1995), is a small-scale version or trial done by the investigator in preparation for the major study. In this study, pilot test was conducted by the researcher to establish internal consistency or reliability and validity of the instrument and to find out whether mentees understood the instructions and the statements (i.e. items) in the questionnaire. It was also done to test the applicability of the questionnaire for the mentees and its appropriateness to the primary school context. The pilot test was conducted in the Kwahu-East District. The pilot test was conducted in three circuits involving 20 mentees. The rationale for the pre-test was to validate the instrument for the main study. On the bases of the pre-test results, items under the models for primary science teaching, which respondents did not understand were revisited.

The final instrument comprised 34 items categorized under five (5) factors as indicated in Table 3

Table 3: Factors and number of items of the mentoring for effective primary science teaching instrument

Factor	No. of Items
Personal attributes	6
System requirements	3
Pedagogical knowledge	11
Modeling	8
Feedback	6
Total	34

Validity of the instrument

Face validity of the instrument was established by lecturers and colleagues. They reviewed the items with respect to wording, clarity and ease of response. Secondly, the instrument was field tested with forty mentees.

The construct validity of the instrument was established by employing the confirmatory factor analysis. The first step involved extraction of factors through principal component analysis. This resulted in the generation of fourteen (4) components with Eigen values exceeding one (1). According to Osman, Lilia and Subahan (2006), the eigen value represents a measure that attaches to the factors and indicates the amount of variance in the pool of original variables that the factors explain. Each construct (factor) is retained if its eigen value is more than 1. The second step involved factor rotation. In this study the Varimax rotation method was used due to its advantages in producing factors (constructs) that are free and independent of one another (Blakenship & Moore, 1977). A systematic conduction of these procedures stated, led to the extraction of four factors, which as a whole contribute to 84.62 percent of the overall variance. These factors were the same as those contained in the original instrument used by Middlewood & Lumby, (1998)

Reliability

After obtaining responses from the pilot test, internal consistency (Cronbach Alpha) approach was employed to establish the reliability of the needs instrument. The alpha values spanned between 0.572 and 0.857 as indicated in Table 4. According to Leech, Barrette and Morgan (2005), an alpha value of 0.70 and above indicates a reasonable internal consistency and that alpha values between 0.60 and 0.69 indicate minimally adequate reliability. The alpha values obtained for each factor span between 0.736 and

0.844. The instrument was therefore accepted as reliable by the researcher based on the purpose and objectives of this study.

Table 4: The Reliability Coefficient of the Science Teachers Needs Assessment Instrument

Dimension	No. of Items	Alpha Coefficient
Personal attributes	6	0.736
System requirements	3	0.832
Pedagogical knowledge	11	0.857
Modeling	8	0.799
Feedback	6	0.844

Data Collection Procedure

Letters of introduction obtained from the head of Science Department at the University of Education, Winneba were presented to the heads of the basic schools who in turn informed the mentees concerned about the intension to involve them in the study. The researcher on his first visit to the schools explained to the teachers sampled what they were expected to do. A date was then agreed upon for the questionnaire administration. On the agreed dates the researcher administered the questionnaires personally taking time to explain the intention of the study and the demands of the items in the questionnaire. All respondents were assured that any data collected from them would be held in confidence. They were informed that identifying information of the participants written on the questionnaires would not be used in the text and data will be stored in a secure, private place. The completed questionnaires were collected on agreed dates. All the 100 questionnaires administered were successfully retrieved giving a retrieval rate of 100%.

Data Analysis

The data collected from questionnaires were descriptively analysed using Statistical Package for Social Sciences (SPSS version 16.0). Descriptive statistics was used to organise the data into frequency counts, percentages, mean scores and standard deviation to answer the research questions.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Overview

The purpose of this study was to assess the importance of mentoring and supervisory practices on final year pre-service teachers of Abetifi College of Education for developing effective primary science teaching. It was also intended to find out the extent to which the pre-service teachers received the range of mentoring practices that would assist them in developing their primary science teaching based on five factors namely; personal attributes, system requirement, pedagogical, modeling and feedback. Questionnaire was used to collect data from 100 primary pre-service teachers (mentees). Descriptive statistics was used to organize the data into frequency counts, percentages, mean scores and standard deviation.

The results were presented in two sections. The first section dealt with the respondents' demographic data while the second part presented the analysis of the data collected to answer the study research questions.

Results

Demographic Characteristics of Respondents

Description of Mentees (Final-year Pre-service Teachers)

Hundred per cent of these mentees (*n = 100*) entered teacher education straight from senior high school, with 100% completing biology units at school. All mentees had completed at least one science methodology unit at the college of education, and all mentees had completed at least two On-Campus-Teaching-Practices (OCTPs). There were no professional experiences under a 2-week observation, and professional

experiences were of 30-week duration. All the mentees were required to teach science during professional experiences as part of their college of education requirements; however, the number of science lessons taught by mentees varied considerably (11% taught one lesson, 24% taught two lessons, 22% taught three or four lessons, 38% taught six lessons or more, and 15% did not teach science at all).

Description of Mentors (Primary Teachers) by Mentees

Most mentors were over 30 years old, although 17% were younger than 30 years of age. Mentees indicated that 27% of mentors did not have an "interest" or a "strong interest" in science. Forty per cent of mentors did not model a science lesson during their mentees' professional experiences, which may equate to the 40% of mentees who considered science not "strength" of the mentors. Eleven per cent of mentors did not talk about science during the total professional experience, and 45% of mentors spoke to their mentees about primary science teaching a maximum of three times during their final professional experience.

Research question 1

What personal attributes are exhibited by mentors for mentoring primary science teaching?

This question sought to identify the personal attributes exhibited by mentors for mentoring primary science teaching. In the analysis, only responses on 'agree' and 'strongly agree' were presented since these show the degree to which a particular practice was done. The mentees' responses were organized into frequency counts and then converted into percentages, mean score and standard deviation.

Table 5: Respondents' response to mentors' "personal attributes" for mentoring primary science teaching

Respondents Question numbers	A	SA	Percentage[a]	Mean score	SD
Supportive *(Q1)*	68.0	26.0	94	4.20	0.53
Comfortable in talking *(Q17)*	49.0	9.0	58	3.34	1.08
Attentive *(Q31)*	69.0	11.0	80	3.84	0.71
Instilled confidence *(Q26)*	39.0	10.0	49	3.23	1.10
Instilled positive attitudes *(Q22)*	36.0	3.0	39	2.82	1.15
Assisted in reflecting *(Q23)*	35.0	13.0	48	3.11	1.25

Note: Percentage[a] refers to the % of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.

The findings on the mentees' perceptions of the six mentoring attributes and practices associated with the Personal Attributes factor indicated a significant number of mentors who did not provide these particular Personal Attributes (mean item score range, 2.82 – 4.20; SD range, 0.53 – 1.25; Table 5). For example, only 39% of mentors were perceived to be supportive to instill positive attitudes in mentees' development in primary science teaching whilst 69% of mentors were perceived not to be supportive to instill positive attitudes in mentees' development in primary science teaching.

Research Question 2

What system requirements practices are provided by mentors for mentoring primary science teaching?

Research question two intended to identify the requirement practices provided by mentors for mentoring primary science teaching. In the analysis, only responses on 'agree' and 'strongly agree' were presented as already explained in Research Question 1. The mentees' responses were organized into frequency counts and then converted into percentages, mean score and standard deviation.

Table 6: Respondent' view on "System Requirements" for mentoring primary science teaching

Respondent Question Numbers	A	SA	Percentage[a]	Mean score	SD
Discussed aims *(Q25)*	38.0	5.0	43	3.03	1.10
Outlined curriculum *(Q11)*	21.0	1.0	22	2.40	1.40
Discussed policies *(Q4)*	72.0	10.0	82	3.87	0.64

Note: Percentage[a] refers to the % of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.

The findings from Table 6 indicated that 82% of mentees perceived that their mentors provide mentoring practices associated with discussed policies whereas 8% indicated their mentors provided this practice. These System Requirements items (mean item score range, 2.40 – 3.90; *SD* range, 0.65 – 1.13; Table 6). For example, although aims are emphasized for general teaching practices and mandated as a system requirement, 57% of mentors in this study were perceived not to discuss with their mentees the aims for teaching primary science curriculum to their mentees for the aims for

teaching primary sciences since it was only 43% who perceived their mentors did. Similarly, 78% of mentors were perceived not to outline the primary science curriculum to their mentees since only 22% mentees perceived they did. These mentors were responsible for the mentee's understanding of aims, curriculum, and policies.

Research Question 3

What pedagogical knowledge are exhibited by mentors for mentoring primary science teaching

This question sought to identify the pedagogical knowledge experienced by respondents from mentors for primary science teaching. In the analysis, only responses on 'agree' and 'strongly agree' were presented. The mentees' responses were organized into frequency counts and then converted into percentages, mean score and standard deviation.

Table 7: Respondent' view on mentor' "Pedagogical Knowledge" for mentoring primary science teaching

Respondent Question Numbers	A	SA	Percentage[a]	Mean score	SD
Guided preparation *(Q3)*	67.0	15.0	82	3.93	0.67
Assisted with timetabling *(Q10)*	71.0	2.0	73	3.44	1.05
Assisted with classroom management *(Q6)*	78.0	5.0	83	3.75	0.77
Assisted teaching strategies *(Q14)*	56.0	13.0	69	3.74	0.85
Assisted in planning *(Q24)*	50.0	6.0	56	3.36	0.99
Discussed implementation *(Q8)*	61.0	4.0	65	3.36	1.78
Discussed Knowledge *(Q21)*	23.0	4.0	27	2.56	1.17
Provided viewpoints *(Q30)*	59.0	9.0	68	3.53	1.02
Discussed questioning techniques *(Q18)*	66.0	16.0	82	3.87	0.81
Discussed assessment *(Q32)*	82.0	11.0	93	4.01	0.54
Discussed problem-solving *(Q27)*	39.0	13.0	52	3.20	1.23

Note: Percentage[a] refers to the % of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.

The findings from table 7 indicated that mentees' perceptions of their mentoring experiences of Pedagogical Knowledge varied considerably between them (mean item score range, 2.56 – 4.00; SD range, 0.54– 1.23; Table 7). For example, a descending rank order of frequencies of the 11 Pedagogical Knowledge practices, which mentees agreed or strongly agreed that their mentors articulated such mentoring, revealed that the highest ranked practice of mentors was science lesson discussed assessment preparation (Table 7). Even as the highest ranked practice, 73% of mentees perceived they had not discussed knowledge for primary science lesson preparation. Whilst 23% of mentees perceived they did. Thus, as many as 73% of mentees appeared not to have received comprehensive mentoring on the items associated with Pedagogical Knowledge for primary science teaching.

Research Question 4

What modeling skills are exhibited by mentors for mentoring primary science teaching?

This question was aimed at finding out the modeling skills experienced by respondents from mentors for primary science teaching. In the analysis, only responses on 'agree' and 'strongly agree' were presented. The mentees' responses were organized into frequency counts and then converted into percentages, mean score and standard deviation.

Table 8: Respondents view on mentors modeling for primary science teaching

Respondents Question Numbers	S	SA	Percentage[a]	Mean score	SD
Modelled rapport with students *(Q7)*	57.0	14.0	71	3.62	1.02
Displayed enthusiasm *(Q9)*	45.0	11.0	56	3.28	1.19
Modelled a well-designed lesson *(Q29)*	66.0	5.0	70	3.49	0.97
Modelled science teaching *(Q5)*	80.0	5.0	85	3.85	0.58
Modelled classroom management *(Q12)*	58.0	11.0	69	3.58	0.98
Modelled effective science teaching *(Q15)*	46.0	9.0	55	3.25	1.18
Demonstrated hand-on *(Q19)*	38.0	10.0	48	3.20	1.09
Used syllabus language *(Q2)*	70.0	16.0	86	3.96	0.69

Note: Percentage[a] refers to the % of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.

Modelling teaching provides mentees with visual and aural demonstration of how to teach – yet, despite acknowledging the benefits of modeling practices, the majority of mentors were perceived not to model primary science teaching in this study (mean item score range, 3.20 – 3.96; SD range, 0.57 – 1.20; Table 8). For example, even though mentors regard classroom management as vital to professional experience programmes and mentors claimed that they needed to model classroom management (Ganser, 1996), 52% of final-year perceived they had not experienced demonstrated hands on this modeling during their professional experience programme whist 48 indicated they did,(Table 8). Similarly, 86% of mentors were perceived to demonstrate to use syllabus language which was highest ranked (Table 8). Mentors demonstrated high use of syllabus language. Hence, the perception of appropriate use of language and vocabulary.

Research question 5

What feedback techniques are exhibited by mentors for mentoring primary science teaching?

This question was intended find out the feedback skills experienced by respondents from mentors for primary science teaching. In the analysis, only responses on 'agree' and 'strongly agree' were presented. The mentees' responses were organized into frequency counts and then converted into percentages, mean score and standard deviation.

Table 9: Respondents' view on mentor's feedback techniques on primary science teaching

Mentoring practices	A	SA	Percentage[a]	Mean score	SD
Observed teaching for feedback *(Q34)*	85.0	12.0	77	4.10	0.42
Provided oral feedback *(Q16)*	45.0	11.0	56	3.30	1.20
Reviewed lesson plans *(Q28)*	38.0	10.0	48	3.22	1.10
Provided evaluation on teaching *(Q13)*	65.0	11.0	76	3.74	0.84
Provided written feedback *(Q20)*	23.0	2.0	25	2.52	1.11
Articulated expectations *(Q33)*	75.0	5.0	80	3.66	0.90

Note: Percentage[a] refers to the % of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.

The need for providing this feedback is strongly supported by the literature on generic mentoring (e.g; Edwards &Collision, 1999 Power, Clarke & Hine, 2002), and is also supported for specific subject mentoring (e.g., Jarvis, McKeon, Coates & Vause, 2001). Although the findings indicated that observing mentees' primary science

teaching was perceived as the highest ranked Feedback practice employed by mentors (77%), 56% of mentors were perceived not to provide oral feedback after observing the mentee teach primary science (mean item score range, 2.52 – 4.08; SD range, 0.42 – 1.19; Table 9). Forty-eight (48%) reviewed the mentee's lesson plans. Also, 25% provided written feedback of reviewing the mentee's lesson plan. Thus, as many as 75% of mentors may have observed their mentees teach primary science without providing written feedback when reviewing their lesson plans. Although 56% of mentors were perceived to provide oral feedback, the duration or nature of this feedback is unknown.

Discussions

The study sought to assess the importance of mentoring and supervisory practices on mentees of Abetifi College of Education for developing effective primary science teaching. It was also to find out the extent to which the pre-service teachers received mentoring practices that could assist them in developing their primary science teaching. Data was collected from 100 mentees using questionnaire. Descriptive statistics was used to organize the data into frequency counts, percentages. Mean scores and Standard deviation.

This part of the chapter discusses into details the results of the study with regard to the research questions set to guide the study.

Personal attributes exhibited by mentors for mentoring primary science teaching

Findings under research question 1 are consistent with the findings that the teaching of primary science is largely inadequate in many Ghanaian schools as reported by the research result. Mentors' personal attributes may aid in developing the mentee's

reflective skills (Desouza & Czerniak, 2003). However, assisting mentees to reflect on primary science teaching practices had the lowest rating for the Personal Attributes factor with only 39% of mentors perceived to provide this practice. The ability to reflect is fundamental to effective science teaching because it enables teachers to improve upon their practices (Desouza & Czerniak, 2003). Mentors may need to improve on mentoring reflective practices so that mentees can be assisted to reflect on their own primary science teaching.

There were also mentors who were perceived to demonstrate limited or no Personal Attributes, who may mentor subsequent pre-service teachers. Hence, if these mentors are to improve, they will need to be provided with mentoring strategies that focus on specific personal attributes. The mentor's Personal Attributes can affect the perceived mentoring of the other four factors (i.e., System Requirements, Pedagogical Knowledge, Modeling, and Feedback) and contributes significantly to the mentoring process.

System requirement practices provided by mentors for mentoring primary science teaching

As most mentees perceived they were not mentored on System Requirements, many final-year pre-service teachers about to enter the profession may not be aware of aims, curriculum, or policies for teaching primary science. Even though universities have a key role in educating pre-service teachers on System Requirements, this essential aspect of primary science education reform needs to be implemented at the professional experience level. Indeed, before pre-service teachers enter the profession, there must be some assurance they understand the System Requirements in the school

setting associated with an educational system. However, this does not seem to be apparent within the majority of mentoring experiences (Table 6).

Even at this foundational level of learning about System Requirements, mentees received minimal mentoring experiences towards planning for their science teaching experiences. Not taking into account previous professional experiences and tertiary education, more than three-quarters of primary teachers due to enter the profession may have no or little practical understanding of mandatory requirements such as science aims, science curriculum, and science policies. Implementing departmental directives and primary science education reform by beginning practitioners will not occur without clear input at the professional experience level. In addition, mentors' guidance for developing pre-service teachers' understanding of System Requirements can assist toward implementing departmental directives associated with teaching primary science.

Pedagogical knowledge exhibited by mentors for mentoring primary science teaching

It seems evident that mentees' opportunities for developing their primary science teaching will be significantly limited if mentors fail to adequately articulate their pedagogical knowledge. Hence, pedagogical knowledge linked to science education reform may not be promoted (e.g. Bybee, 1997). Indeed, mentees need to understand practices associated with Pedagogical Knowledge for their development as beginning practitioners (e.g., Hulshof & Verloop, 1994; Mulholland, 1999). Generally, mentors will require either further education on mentoring the practices associated with Pedagogical Knowledge or framework to facilitate the articulation of these

Pedagogical Knowledge practices for development of mentees' primary science teaching.

Modeling skills exhibited by mentors for mentoring primary science teaching

Mentees need mentors to model effective teaching practices, and those who have not observed the mentor's modeling of primary science teaching tend to rely on their own experiences as a student in primary and secondary science classes (e.g., which can impact on implementing current primary science education reform. Incorporating the eight attributes and practices associated with the Modelling factor can assist mentors to more readily facilitate the mentees' learning of primary science teaching and aid the reform process. In addition, mentors who experience Modelling of primary science teaching may also develop their own teaching practices. Hence, targeting mentors and mentees through a specific mentoring intervention that includes modeling specific primary science teaching practices can lead to improved mentoring practices (Hudson & McRobbie, 2003). Fine tuning mentoring practices may also lead to implementing primary science education reform.

Feedback techniques exhibited by mentors for mentoring primary science teaching

Most mentees perceived their mentors did not provide written feedback, or assist the mentee to evaluate primary science teaching practices (Table 9). The fact that these evaluative components of effective mentoring practices were not in evidence in so many cases (e.g., 75% mentors were perceived not to provide written feedback for primary science teaching; Table 9). This indicated a lack of adequate direction of mentees in written feedback and providing critical analysis. Indeed, these mentees may also not give written feedback to their pupils after marking their exercises.

Mentors need to provide written feedback to ensure mentees have a record of their science teaching performance and a way to reflect on teaching practices. Arguably, it may be that oral feedback is easier to provide than written feedback, which is reflected in the percentage of mentors who provided each in this study (Table 9).

As feedback of mentees' teaching practices can address a mentoring programme's objectives, and aids in enhancing primary science teaching practices (Jarvis et al., 2001), the effectiveness of primary science teaching and learning may be diminished if mentors do not provide feedback to their mentees. Indeed, mentees who perceived that they had not received feedback from their mentors, even if it were provided, indicated that either these mentors require further education on providing feedback or the clarity of such mentoring was questionable. Thus, the identification of the six attributes and practices associated with the Feedback factor can assist mentors in providing more comprehensive feedback. Primary science education reform relies on developing pedagogical knowledge and system requirements in teaching practices (Bybee, 1997), and mentors who do not provide feedback on primary science teaching practices will not be articulating necessary reform measures (i.e., Pedagogical Knowledge or System Requirements for enhancing their mentees' practices.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

This study explores and describes final-year pre-service teachers' perceptions of their mentoring in primary science education within five factors (i.e., Personal Attributes, System Requirements, Pedagogical Knowledge, Modeling, and Feedback). These findings do not consider mentees' previous experiences or that mentors may not have provided these mentoring practices because they felt the mentees had already acquired those skills. Mentees may be skilled in particular science teaching areas and consequently did not receive specific mentoring as these skills may have been noted by the mentor. For example, although only one-quarter of mentors assisted mentees in problem-solving strategies for teaching science, this may not have been necessary for all mentees. Some mentees may have displayed knowledge of problem-solving, were prepared for teaching, and therefore did not require mentoring in this area. However, this appears unlikely as on average less than one-half of the mentors modeled science teaching practices in this study, which may indicate a lack of confidence from mentors to adequately display their science teaching skills and knowledge. Despite this possible limitation, mentees cannot be considered expert enough that they do not require further mentoring in any of the areas linked to the MEPST survey instrument. It is the mentor's role to ensure that mentees receive full experiences regardless of assumed or previous articulation of experiences. It should be the mentor's role to extend the mentees' experiences in areas of perceived successful practices. An effective mentor can scaffold the mentee's learning and raise the standard of teaching

science in all aspects of the mentees' teaching by addressing specific mentoring issues.

Conclusion

Expert primary science teachers who are skilled in mentoring would be best suited as mentors for pre-service teachers of science, and this is the crux of the mentoring problem; that is, educating primary teachers to be sufficiently skilled in mentoring for effective primary science teaching. Indisputably, "generalist" primary teachers will not be experts in all subjects in primary school; however, they teach in subject areas where they are not experts. To illustrate, primary teachers teach art without being artists, teach music without being musicians, and teach various sports without being experts in those particular sports, and aim to address the syllabi outcomes for each area. Likewise, teachers can be called upon to mentor in subject areas where they are not experts, which may allow them to further develop their teaching skills in these fields. Nevertheless, if pre-service teachers are to receive quality mentoring in primary science teaching, then teachers in their roles as mentors may require further education. The form this education takes will require further investigation, as primary teachers may be reluctant to be educated on their mentoring practices (e.g., Hulshof & Verloop, 1994). Also the conclusion from this work shows some similarities in the acknowledged works of other research publications on the subject. Pre-service teacher education. It reinforces the fact that more is needed from mentors to achieve the importance of mentoring and supervisory practices on pre-service teachers for developing effective primary science teaching. This will enable the nation to produce first class science human resource base.

Recommendations

This study argues that for mentees to receive adequate mentoring in primary science teaching requires a set of specific mentoring skills to be included in mentors' practices. Final-year pre-service teachers' perceptions of their limited mentoring in primary science may be initially addressed through a specific mentoring intervention that focuses on each of the items associated with the MEPST instrument. Additionally, tertiary institutions may employ the MEPST instruments to gauge the degree and quality of mentoring in primary science and, as a result of diagnostic analysis, plan and implement mentoring programmes that aim to address the specific needs of mentors in order to enhance the mentoring process. The MEPST instrument can be used to assist mentors in their education on specific primary science mentoring and as a way to measure and enhance their own mentoring practices.

Utilizing the mentor's time efficiently is crucial for developing the mentee's practices in primary science, and this is further justification for education of mentors. The mentor's involvement in facilitating the mentee's learning for more effective primary science teaching cannot be indiscriminate; instead, it must be predetermined and sequentially organized so that the mentor's objectives are focused, specific, clear, and obtainable, which means educating mentors. A possible way forward is educating mentors through expert mentors who are recognized for their expertise in both mentoring and teaching in order to have credibility within the teaching profession. Therefore, expert mentors may also need to display personal attributes, understand system requirements, model effective mentoring (which also requires modelling effective teaching practices), and provide pedagogical knowledge and feedback towards enhancing mentoring practices. Indeed, the five factors for mentoring in primary science teaching may be the same factors required of mentor educators.

Educating mentors aims at ultimately targeting the development of more effective science teaching practices, and hence a way to enhance students' learning experiences.

Suggestion for Further Study

The study was limited by the research methods and inclusion of key participants. For example, qualitative research methods can provide further insight into this study's findings. In addition, further investigations on both mentees and mentors' perceptions would provide a clearer picture of mentoring practices in primary science.

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APPENDIX

MENTORIING FOR EFFECTIVE PRIMARY SCIENCE TEACHING

SECTION 1:

This section aims to find out some information about you. Thank you for your participation in this important study on your mentoring. Please ***circle*** that which applies to you.

a) What is your sex? Male Female

b) What is your age? <22yrs 22-29 yrs 30-39 yrs > 40 yrs

c) What science units did you complete in years one and two at high school?

(Please list, for example, 2 units biology, 2 units physics, 2 unit chemistry, etc

d) How many primary science curriculum/methodology units did you complete at the college of education?

0 1 2 3 4 or more

e) How many block practicum have you now completed during your tertiary teacher education?

0 1 2 3 4 5 or more

SECTION 2:

This section aims to find out about this last practicum/internship.

Please ***circle*** the answer you feel is most accurate.

a) What is your mentor's sex? Male Female

b) What was your mentor's approximate age during this last practicum?

<22 yrs 22-29yrs 30-39yrs > 40yrs

c) How many science lessons did **you** teach during your last practicum/internship?

1 2 3 4 5 6 or more

d) How many science lessons did your **mentor** teach during this last practicum/internship?

0 1 2 3 or more

e) Would primary science be one of your mentor's strongest subjects?

Strongly agree Agree Unsure Disagree strongly disagree

SECTION 3:

The following statements are concerned with your last mentoring experiences in primary science teaching during your last practicum/internship. Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate number to the right of each statement.

KEY

SD = Strongly Disagree **U**=Uncertain

D=Disagree **A**=Agree **SA**=Strongly Agree

During my final field school experience (i.e., internship/practicum) in primary science teaching my mentor:

1.	Was supportive of me for teaching science	**SD D U A SA**
2.	Used science language from the current primary science syllabus	**SD D U A SA**
3.	Guided me with science lesson preparation	**SD D U A SA**
4.	Discussed with me the school policies used for science teaching	**SD D U A SA**
5.	Modeled science teaching	**SD D U A SA**
6.	Assisted me with classroom management strategies	**SD D U A SA**
7.	Had a good rapport with the primary students doing science	**SD D U A SA**

8.	Assisted me towards implementing science teaching strategies	**SD D U A SA**
9.	Displayed enthusiasm when teaching science	**SD D U A SA**
10.	Assisted me with timetabling my science lessons	**SD D U A SA**
11.	Outlined state science curriculum documents to me	**SD D U A SA**
12.	Modeled effective classroom management when teaching science	**SD D U A SA**
13.	Discussed evaluation of my science teaching	**SD D U A SA**
14.	Developed my strategies for teaching science	**SD D U A SA**
15.	Was effective in teaching science	**SD D U A SA**
16.	Provided oral feedback on my science teaching	**SD D U A SA**
17.	Seemed comfortable in talking with me about science teaching	**SD D U A SA**
18.	Discussed with me questioning skills in effective science teaching	**SD D U A SA**
19.	Used hands-on materials for teaching science	**SD D U A SA**
20.	Provided me with written feedback on my science teaching	**SD D U A SA**
21.	Discussed with me the knowledge I needed for teaching sciences	**SD D U A SA**

22.	Instilled positive attitudes in me towards teaching science	**SD**	**D**	**U**	**A**	**SA**
23.	Assisted me to reflect on improving my science teaching practices	**SD**	**D**	**U**	**A**	**SA**
24.	Gave me clear guidance for planning to teach science	**SD**	**D**	**U**	**A**	**SA**
25.	Discussed with me the aims of science teaching	**SD**	**D**	**U**	**A**	**SA**
26.	Made me feel more confident as a science teacher	**SD**	**D**	**U**	**A**	**SA**
27.	Provided strategies for me to solve my science teaching problems	**SD**	**D**	**U**	**A**	**SA**
28.	Reviewed my science lesson plans before teaching science	**SD**	**D**	**U**	**A**	**SA**
29.	Had well-designed science activities for the students	**SD**	**D**	**U**	**A**	**SA**
30.	Gave me new viewpoints on teaching primary science	**SD**	**D**	**U**	**A**	**SA**
31.	Listened to me attentively on science teaching matters	**SD**	**D**	**U**	**A**	**SA**
32	Showed me how to access the students learning of science	**SD**	**D**	**U**	**A**	**SA**
33.	Clearly articulated what I needed to do to improve my science teaching	**SD**	**D**	**U**	**A**	**SA**
34.	Observed me teach science before providing feedback	**SD**	**D**	**U**	**A**	**SA**