AN ANALYSIS OF THE CONTEXTUAL FACTORS AFFECTING THE USE OF FIELD ACTIVITES IN THE TEACHING OF BIOLOGY IN SECONDARY SCHOOLS IN KENYA

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DECLARATION

DECLARATION BY THE CANDIDATE

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ABSTRACT

Despite biology being a potent tool for social and economic development in Kenya, students have constantly displayed low achievements in the Kenya Secondary School Examinations. Field activities have been shown to be a key factor for improving students' understanding of biology. Very little has been documented on the use of field activities in biology teaching in Kenya, especially the contextual factors affecting out-of-class activities in secondary schools. This study aimed at analyzing the contextual factors affecting the use of field activities as instructional media in the teaching of biology in secondary schools in Kenya. Specifically, the study focused on the effects of teachers' knowledge, attitudes and skills, curriculum influences, administrative support and time table factors on use of field activities in biology teaching. A causal research design was used in executing the study. Through a questionnaire and interview schedules, data was collected from 135 teachers from public and private secondary schools in Uasin Gishu County, Kenya. Demographic data of participants, their knowledge, attitude and skills on the use of field activities; curriculum influence, administrative support, time and time table factors were reported in terms of frequencies, percentages, means and standard deviations. Bi-variate correlations were employed to establish the relationship among the variables. Finally, multiple regressions were used to analyze the effect of contextual factors on the use of field activities as instructional media in the teaching of biology. The results revealed that teachers' knowledge, skills and attitudes significantly affect the use of field activities in the teaching of biology. Similarly, administrative support and the biology curriculum have influence on the use of out-of-class activities. However, there was no statistically significant relationship between time-table factors and the use of field activities in biology instruction. The findings of this research make it clear that learners can benefit from effective outdoor learning. However, despite such positive research evidence and the long tradition of outdoor learning in this country, there is growing evidence that opportunities for outdoor learning are in decline and under threat. It is therefore recommended that there is an urgent need for policy makers at all levels and in the education programs, especially in secondary school biology to consider their role in: tackling barriers that stand in the way of the provision of effective outdoor instruction for all students, encouraging development of knowledge, attitude and skills in teachers thus promoting the use of field activities in biology. This study contributes to the theoretical and practical knowledge by providing the evidence about factors affecting science teaching. It is also expected to extend the knowledge on out-door learning.

DEDICATION

This thesis is dedicated to my father Francis, mother Ephsibar, husband Ronald, children Mevine, Ivy and Michael, for their love, advice, care, patience and for all that they have sacrificed for me.

God bless you all.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES:

LIST OF ABBREVIATIONS

DES- Department of Education Science

DF- Degree of Freedom

FSC - Field Studies Council

KAS- Knowledge, Attitude and Skills

KICD- Kenya Institute of Curriculum Development

SC- Science Curriculum

SD- Standard Deviation

SE- Standard Error

SPSS- Statistical Package for Social Science

SSR- School Science Review

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CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Introduction

In many academic disciplines, among them biology, field activities are commonly regarded as one of the most valuable forms of teaching and learning (Orion and Hofstein, 2001). Whereas the content of school-based lectures and practicals seems to fade from students' recollection all too rapidly, field activities, by contrast, are memorable (Michie, 1999). According to Wolins, Jensen, and Ulzheimer (2002) field activities offer an exceptionally intensive educational experience which often brings social as well as academic benefits. This is in line with the grounded theory, expressed as four dimensions of learning. According to this theory, three dimensions of learning should be considered when trying to understand learning. According to Illeris (2002), learning simultaneously involves a cognitive, affective, as well as social and societal dimension. All these learning experiences can be achieved through field activities. Yet, despite its widely recognized value, fieldwork is under challenge (Beasley, Butler and Satterthwait, 2001). The substantial increase in student numbers now poses serious logistical and academic problems for the operation of teaching in the field. Moreover, the exam oriented curriculum in secondary school education questions whether field activitiesare sufficiently valuable to justify their continuation (Gallagher, 2001). It is important, therefore, to reconsider the role of field activities, to identify and spread best practice and this will ensure that the goals and objectives of practical work as stipulated in the biology curriculum are not jeopardized (Monroe, 2003). Classrooms are expected to be places where learning occurs not just by hearing, but also by seeing and doing things under the guidance of teachers (Fisher, 2001).

1.2 Background to the study

Field activities according to Michie, (1999) can be considered as one of the three avenues through which science can be taught - through formal classroom teaching, practical work and field activities. Krepel and Duvall (1981) define field trip as "a trip arranged by the school and undertaken for educational purposes, in which the students go to places where the materials of instruction may be observed and studied directly in their functional setting: for example, a trip to a factory, a forest, a city waterworks, a library, a museum etc." (p. 7). The use of the term 'field work' as stated by Price and Hein (1991) emphasizes some of the formal exercises which are done outside of the classroom, especially in biology. These activities may be considered to be a subset of field trips or excursions. According to Beasley, Butler and Satterthwait, (2001) biologists recognize that knowledge based upon experimental results and accurate observations is gained through a variety of experiences. Thus, the role of the field learning becomes a key component in understanding biology. Field activities and inquiry as suggested by Orion, (1993) provides students with opportunities to question, observe, sample, experience, and experiment with scientific phenomena in their quest for knowledge of living things.

Field activities involve inquiry-based learning activities. There is evidence that actively engaging participants during an educational experience increases learning outcomes and is more likely to influence attitudes than passive programs (Heimlich, 1993, DeWhite and Jacobson, 1994, Leeming et al., 1997, Manzanal et al., 1999). The study of Biology aims at equipping the learner with the knowledge, attitudes and skills necessary for controlling and preserving the environment. The subject enables the learner to appreciate humans as part of the broader community of living organisms. Inquiry learning is a process in which students address their own curiosity by seeking answers to their own questions (Pearce 1999, Minstrell and Van Ze 2000).

This approach is perfect for exploration of the natural world. Field activities provide positive experiences in nature predict positive attitudes towards nature (Bogner 1998, Kals et al. 1999, Monroe 2003), although this may only be true in the absence of direct conflicts of interest. Positive experiences in nature, which involve repeated experiences that are personally rewarding, seem to have the most impact when they start during childhood and continue through adulthood (Kals et al. 1999). Nature-based programs can be made more active by engaging the participants in field projects. Manzanal et.al. (2003) measured the effect of field activities on the ecological knowledge and environmental attitudes of students in Spain and found that field activities help to clarify ecological concepts and directly improved attitudes in defense of the ecosystem wherein the students were working.

The study of biology provides students with opportunities to develop an understanding of our living world. Biology is the study of life and its evolution, of organisms and their structures, functions, processes, and interactions with each other and with their environments. Scientific inquiry is the primary process by which scientific knowledge is gained. It involves the basic skills of questioning, prediction, qualitative and quantitative observation, classification, inference, communication. Additionally, inquiry develops integrated skills such as identifying and controlling for variables, generating procedures, planning strategies for testing hypotheses and answering questions, and for collecting and interpreting appropriate data. The knowledge of biology includes scientific data, concepts, hypotheses, theories, methodology, use of instruments, and conceptual themes. Sorrentino and Bell (1990) reviewed texts and research articles by science educators, summarizing their reasons for taking field trips into five 'attributed values': providing first-hand experience, stimulating interest and motivation in science, giving meaning to learning and interrelationships, observation and perception skills, and personal (social) development. Thus, the most effective vehicle by which the process of inquiry can be learned appears to be a field setting where the student experiences, firsthand, the inquiry process. Similarly, studies conducted by Fisher (2001) indicate that field study has also been demonstrated to be effective means for comprehension, understanding and application of biological knowledge. Field experiences provide opportunities for teachers to model best practices in the study of biology, including application of scientific methodologies, respect for life and the environment, inclusion of learners of all abilities, and consistent adherence to safety standards. Thus, study in a field setting is an integral and essential part of a biology course.

Rickinsonet al, 2004 in their research on outdoor biology found out that: "Field activities can have a positive impact on long-term memory due to the memorable nature of the fieldwork setting. Effective field activities can lead to individual growth and improvements in social skills. More importantly, there can be reinforcement between the affective and the cognitive domain, with each influencing the other and providing a bridge to higher order learning."

The Kenya Secondary School Biology Curriculum is meant to meet the need for making the subject matter of high school biology lessons more contemporary, meaningful and interesting for the students, while still reflecting the developments in the field to the curriculum and relating lessons to daily life and health issues. The basic philosophy underlying this curriculum is:

> *"to provide students with the knowledge about their own body structure and environment, getting them to gain the ability to use scientific knowledge in daily life, share this knowledge with others, develop a positive attitude towards biology, gain an understanding of a wholesome life and to have scientific curiosity about biology." (Ministry of Education, 1998)*

It was stated in the curriculum guide (Ministry of Education, 1998) that all of the goals and objectives were prepared for the students who could meaningfully use and evaluate scientific knowledge, and who do not focus on memorizing the content. Classrooms are expected to be the places where students are active learners; learning not just by hearing, but also by seeing and doing things, and living and searching instead of being the "empty can" wherein knowledge is stored. Student-centered activities such as group discussions; group learning or projects are suggested and outlined in the curriculum. Instructional techniques incorporated into the curriculum include lecturing, questioning, discussion, observation, demonstration and experimentation (Ministry of Education, 1998). The intended role for the teacher is stated in the guide to be that of a facilitator or a guide who enables students to comprehend the subject matter optimally using all their senses, and not just listening, learning by interpreting, integrating, and questioning. The teacher is also expected to try and get the students to be active learners by encouraging them to do research and experiments. The teacher will provide the students with interesting concepts and issues and give interesting assignments and projects on the subject matter. The teacher motivates the students to study individually, and sometimes prepares the laboratory for group work so students can do the experiments required for each biology unit.

Quantitative studies of the attitudes of teachers towards field trips were undertaken by Falk and Balling (1999), Fido and Gayford (2002) and Muse, Chiarelott and Davidman (2002). The researchers found that, in the opinion of teachers, the positive benefits derived from field trips were; Hands-on, real world experiences, quality of education, positive attitudes to science and motivation towards the subject, improvement of the socialization between students, which would impinge on the classroom, and development of rapport between teachers and students, enabling teachers to utilize other learning strategies such as cooperative learning. Using observations and field trips, the teacher encourages the students to see, examine and interpret the things in their original settings, things that they learnt in the classroom. In this way, he/she ensures that the learners relate subject matter to everyday life and health issues. One of the teachers' aims is to help students to develop a consciousness of the environment, and to be sensitive to the preservation of nature. Finally, teacher is there to evaluate the learners' success. Unfortunately, field activities are not commonly used in biology instruction. Davis (2002) reports "traditional lecture-textbook methodologies" as the continuous focus of science instruction, and that in traditionally teacher-centered classrooms students have little status and voice regarding how they learn and what happens in the classroom.

Similarly, Zohar, Degani and Vaaknin (2001) describe science classrooms as places where teachers still transmit knowledge and cover curriculum rather than guide students as they think and construct their own ways of learning. Accountability, based on minimum skills proficiency exams, is the center of the educational world. The decline in expertise is at the heart of the decline in biology field activities. Biology teachers with whom field activities have an emotional resonance are declining in numbers as are those with fieldwork experience; new recruits to teaching have less experience of field activities themselves, with increasing numbers coming from laboratory or classroom-based disciplines. It is likely that without external pressure and support, factors such as health and safety, cost, intransigent colleagues, pressure from teaching unions, parental concerns and students' jobs will exacerbate the decline of field activities. If allowed to continue, this trend will result in schools losing the 'tradition' of offering field activities to support biology teaching and it will be much more difficult to re-instate field activities in the future, particularly as supporting resources such as books and equipment, and knowledge about sites, techniques and field activities procedures also fade away.

However, there is a significant absence of studies in Kenya on the importance of field activities in biology instruction and especially on knowledge, attitude and skills (KAS) on field activities. In order to fill this gap, this research sought to find out whether teachers have the knowledge, skills and right attitude about field work for effective field teaching. This will promote debate on the future of field activities and on how it may need to adjust in the light of the changing circumstances facing secondary school education and students. There is a need for considerable thought and effort to be given to what teachers know; how this change over time and what processes bring about change in individual teacher practices, changes that must be accompanied by long lasting changes in science classrooms (Davis, 2002). However, to deal with this need we must look at the problems that educationalists are faced when attempting to use field instruction. The reasons for failure in use of field activities in many schools over the years are summarized by Scott (1994) who found that this failure relates to organizational structure and school administration, lack of meaningful role in staff development decision making for teachers, and isolation of teachers. According to Davis (2002) reform efforts should enable teachers to reflect upon, and make explicit, their personal practical knowledge, including beliefs, attitudes, and concerns. Teachers' knowledge and practices should be considered as the starting point of change, and they should be provided with experience and training in reform-based strategies, and opportunities to see these approaches modeled.

Teachers' knowledge, attitude and skills on use of field activities especially in Kenya have not been documented. There is need to understand the teachers' knowledge, attitude and skills towards field activities. It also focused on finding out other factors affecting the use of out-of-classroom activities in biology especially curriculum factors, administrative procedures, time and timetable factors. This will help shed light on how to improve the use of outdoor activities in biology and provide opportunities for teachers to model best practices in biology teaching.

1.3 Statement of the Problem

Field investigations help students become systems thinkers, learn the skills of scientific inquiry, and understand that science doesn't only happen in a laboratory or classroom. Outdoor experiences in natural settings increase students' problem solving abilities and motivation to learn science. In field learning, activities are student-centered, with students actively engaged in hands-on, minds-on activities using field materials and techniques. This will help students develop consciousness of the environment and relate subject matter to everyday life.

However, field activities are not commonly used in biology instruction in secondary schools despite the very clear educational and personal development strengths that they offer, Slingsby and Tilling, (2001). This is happening at a time when there is increasing demand for students with the skills and confidence to practice outdoor biology and to be aware of their impacts on the world around them. Research on outdoor instruction by Dyment (2005), Jordet (2007), Moffet (2011), Barker, Slingsby and Tilling, (2002), Lock, (2002) and Tilling, (2004) indicate low levels of fieldwork provision in secondary school science teaching. Is it because teachers are not excited and eager to perform field activities? Is it because the curriculum does not require fieldwork experiences? Is it because the Kenya Certificate of Secondary Education biology paper does not require exhibition and field work skills? Do practicing teachers have necessary administrative and parental support to present field activities to schools? However, to deal with this need scholars must look at the factors that affect the use of field work in relation to the Kenya Institute of Curriculum

Development biology curriculum. There is lack of empirical research regarding the factors affecting the use of field activities in biology instruction. Hence, this study was undertaken in order to gain an understanding of contextual factors that influence the use of field activities in the teaching of biology in secondary schools in Kenya.

1.4 Purpose of the study

In addition to describing the contextual factors affecting the use of field activities in relation to the K.I.C.D biology curriculum, the main purpose of this study was to examine the relationship if any, between contextual factors and use of field activities.

1.5 Objectives of the Study

The objectives of the study were:

1. To establish the extent of the teachers' use of field activities as an instructional method.
2. To establish the relationship between teachers' knowledge and their use of field activities.
3. To determine the relationship between teachers' attitude and their use of field activities.
4. To establish the relationship between teachers' skills and their use of field activities.
5. To determine the relationship between the biology curriculum influence and the use of field activities.
6. To establish the effects of administrative support on the use of field activities.
7. To establish the relationship between time and timetable factors and the use of field activities.

1.6 Null Hypotheses

Ho_1: There is no significant relationship between teachers' knowledge and their use of field activities

Ho_2: There is no significant relationship between teachers' attitude and their use of field activities

Ho_3: There is no significant relationship between teachers' skills and their use of field activities

Ho_4: There is no significant relationship between the biology curriculum and the use of field activities

Ho_5: There is no significant relationship between administrative support and the use of field activities

Ho_6: There is no significant relationship between time and timetable factors and the use of field activities.

1.7 Research questions

1. What are the teachers' perceptions on the use field activities as an instructional method?
2. Do the KCSE biology papers require knowledge of out-of-classroom experiences?

1.8 Assumptions of the Study

This thesis was based on the following assumptions:

1. All biology teachers had been trained in both content and pedagogy
2. The respondents were able to read and understand the questions or items
3. The respondents provided honest and truthful answers.

1.9 Justification of the study

Possible advantages from outdoor learning include its potential to encourage meaningful learning by moving between the abstract and concrete as well as transforming experience into knowledge through reflection and communication. Improved teaching and learning will promote understanding and c consequently performance and application of biology which could contribute to attainment of vision 2030. In a review of the literature, it is clear that few studies have been done on outdoor biology. More specifically, there are limited studies on contextual factors affecting the use of field activities especially in Kenya. This study therefore intends to find out whether teachers' knowledge, attitude and skills; biology curriculum and administrative support influence the use field activities as outlined in the KICD syllabus.

1.10 Significance of the Study

This study provides detailed information about factors affecting the use of out-door activities in biology instruction in different settings. It will help educationists to visualize how curriculum developers' decisions are interpreted and practiced by teachers in classrooms. The rich information collected through the survey questionnaire also helps us to identify the forces applying to the process of implementation. This study also helps to identify the practical problems faced by teachers. When taken into consideration, the results of this study can help teachers to improve their performance and instructional practices, and can be used as a reference study in biology teaching methods courses. As one of the few studies on field activities implementation in Kenya, this study will also contribute to the literature. It will provide a close look to the curriculum implementation where new approaches in the field of science education are closely followed. It will help us to comprehend the process of, and the problems experienced during field activities implementation in a country where the education system is centralized. The study will therefore be beneficial to biology teachers, school administrators, curriculum developers and policy makers.

1.11 Scope and Limitations of the Study

1.11.1 Scope of the study

This study was undertaken to provide information about the relationship between conceptual factors and the use of field activities. The study was intended to answer seven sets of objectives which include: the relationship between teachers' knowledge and their use of field activities; the relationship between teachers' attitude and their use of field activities; the relationship between teachers' skills and their use of field activities; the relationship between the biology curriculum and the use of field activities; the effects of administrative support on the use of field activities; the relationship between time and timetable factors and the use of field activities; teachers' perceptions on the use field activities as an instructional method and lastly whether the KCSE biology papers require knowledge of out-of-classroom experiences. Data was collected using survey questionnaires, observation schedules, interviews and document analysis to obtain primary and secondary data. The study was carried out in Uasin Gishu County which had126 public and 33 private secondary schools by the year 2011. The survey was carried out between October and November 2011.

1.11.2 Limitations of the Study

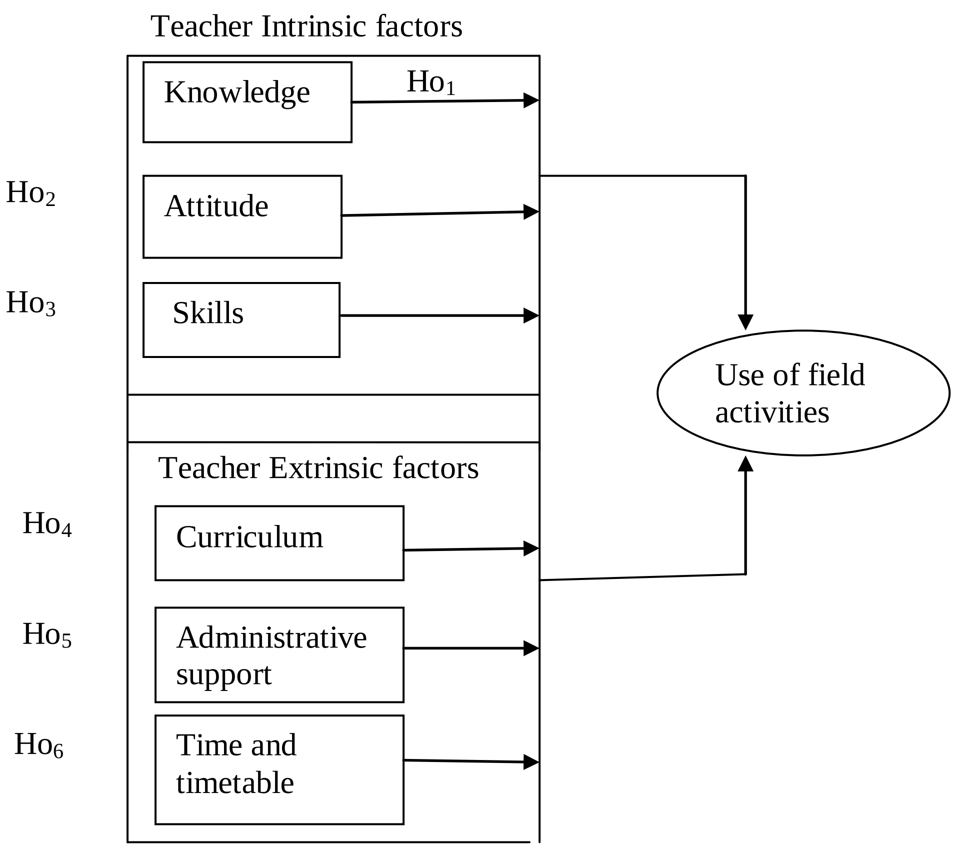
A large sample of randomly selected teachers excludes external validity threats from the study. However, lack of demographic information about the population and lack of information about representation ratio of the sample group to the population create a threat for the representability of the study's sample. Lack of students was one constraint of the study, because students are the ones who actively participate in the learning process together with teachers and their beliefs, thoughts and perceptions are as important as teachers' beliefs and perceptions to describe the process of learning. To reduce this constraint, rich interpretative information drawn from teachers regarding their classroom activities and their students was collected using the questionnaire. Another constraint of the study can be seen as the situations in which the questionnaires are applied because these can influence and differentiate teachers' responses. To counter this limitation, more data was collected through interviews and content analysis.

1.12 Conceptual Framework

The study sought to establish the relationship between contextual factors and the use of field activities in the teaching and learning processes. The dependent variable of the study was the perceived use of field activities in biology. On the other hand, the independent variables comprised of the contextual factors affecting the use field activities in biology teaching. The study investigated three dimensions of contextual factors which include teacher factors:

(Knowledge = 13 items; attitude=22 items and skills=5 items), curriculum influences (8 items), administrative support (12 items), and timetable factors (3 items).

Fig 1.1 Conceptual model



Source; survey, 2011

1.13 The Theoretical Framework: Learning Dimensions

Following the logic of grounded theory (Bryant and Charmaz, 2007; Laser and Strauss, 1967), the theoretical framework for this thesis has evolved as a continuous interplay between empirical work and the literature. The primary focus of this research, contextual factors affecting the use of field activities in secondary schools, has not been well-researched, and many different theories and assumptions underlie the rationale for outdoor encounters, which has resulted in the need for a flexible and evolving framework. The research has gradually evolved through an abductive approach. To a large extent, this study was inspired by Knud Illeris (2002, 2007) and Peter Jarvis (2006). Illeris and Jarvis are two educational theorists who emphasise the multidimensional nature of learning. They stress that individual as well as social dimensions must be considered to understand human learning. There is always someone learning something, or in other words acquiring knowledge, understanding, skills, attitudes or insight. However, there is also an interactive process between the learner and the social and societal environment (Illeris, 2007). This might seem like a common sense understanding of learning, but in educational discourse, often either the individual/cognitive or socio-cultural aspects are emphasised. One important notion is that, in the following discussion, the whole person learns and that body and mind are perceived as inseparable (Damasio, 1994; Jarvis, 2006).

1.13.1 Three Dimensions of Learning

Illeris (2002, 2007) emphasizes that three dimensions of learning should be considered when trying to understand learning. According to Illeris (2002), learning simultaneously involves a cognitive, emotional, as well as social and societal dimension. In his later works, he instead refers to the three dimensions as content, incentive and environment (Illeris, 2007). Environment' has a material dimension, but Illeris regards the nature of interaction with the material environment as overwhelmingly social and societally transmitted. The process of learning involves content and incentive, and the social dimension relates the interaction between individuals and the environment (Illeris, ibid.). The three dimensions are referred to as content, social and emotional in this thesis. Jarvis is another educational theorist who stressed that an interdisciplinary approach is necessary to study learning and included cognitive, affective and social dimensions of learning in his theories (2006). According to Jarvis, it is impossible to divorce our philosophical or psychological thoughts on learning from the sociological aspects; 'all learning theories must be inter-disciplinary' (2006, p. 52). One distinction between Illeris and Jarvis is that Jarvis emphasised individual activity and experience as a third dimension through which we learn in contrast to social/environmental experience, which is the third dimension in Illeris' work. However, according to Jarvis (ibid.), cognition, emotion and action are all affected by social context.

Jarvis (2007) defines human learning as:

> *...the combination of processes whereby the whole person –body (genetic, physical and biological) and mind (knowledge, skills, attitudes, values, emotions, beliefs and senses): experiences a social situation, the perceived content of which is then transformed cognitively, emotively or practically (or through any combination) and integrated into the person's individual biography resulting in a changed (or more experienced) person. (p. 13)*

According to Jarvis (2007), any combination of thinking, doing and experiencing emotion could compose different forms of learning. They are not only reactions to previous experiences but they can also look to the future. Jarvis further argues that the distinction between cognitive and practical learning is over-simplified if not false. Having just concluded that learning comprises three dimensions that are difficult to separate, these dimensions are discussed in the following section.

1.13.1.1 The Content Dimension of Learning

A cognitive/constructivist approach to learning emphasises that content, knowledge, and concepts are entities that can be acquired by the learner and possessed internally. When knowledge is acquired, it can be applied, shared and transferred (Sfard, 1998; Vosniadou, 2007). Building on Piaget's theory, from this perspective, learning is as an inherently constructivist process in which individuals structure and organise new experiences into mental schemas that relate to previously established structures (Illeris, 2002, 2007; von Glasersfeld, 1989). The constructivist approach excludes any form of learning as a transmission or filling process, and there are two central concepts of importance, assimilation and accommodation. This equilibrium is established through interplay between assimilation and accommodation processes (Illeris, 2007; von Glasersfeld, 1989). Several educational researchers have elaborated on Piaget's concepts regarding assimilative and accommodative learning processes, but they can still be perceived as two basic concepts in Piaget's theory of cognition (von Glasersfeld, 1989). Illeris (2007) emphasizes that the content dimension not only concerns knowledge, skill and attitude; it should be understood as far more reaching. For example, reflexivity and personal development are also part of the content dimension according to Illeris.

One rationale in outdoor education literature is that the outdoor context enhances direct multisensory experiences, which constitutes a solid foundation for meaningful holistic learning (Dahlgren and Szczepanski, 1998; Jordet, 2010). The increased multisensory stimulation is believed to facilitate 'patterns of activity' by connecting several areas of the brain, which leads to a more robust learning experience. This assumption is supported by a constructivist approach to learning with a focus on individual assimilation and accommodation.

1.13.1.2 A Social Dimension to Learning

Human infants are born social (Frith and Frith, 2012). We are not a *tabula rasa* but have skills and abilities that facilitate social relationships from early infanthood. New insight into research on mirror neurons shows how we are adapted to adjust to other human's feelings and activities from an early age (Rizzolatti and Fabbri-Destro, 2008). However, we also have a very long childhood to successfully learn how to live and participate in cultural settings from others. Although we are social by nature, we also learn social life activities in a culturally and socially constructed reality. As Illeris' (2002) phrases it, 'because we are talking humans, the societal dimension is given' (p. 119). The Russian theorist Lev Vygotsky (1978) was one of the first to acknowledge the role of social aspects, such as culture and history, as relevant to learning. Followers of the socio-cultural learning theory tradition emphasize the importance of activity, participation, communication, culture and language in human learning (Daniels, 2001; Illeris, 2002, 2007; Jarvis,2006; Wells & Claxton, 2002), but the role of the individual versus culture and society varies in socio-cultural theories of learning (Daniels, 2001). Illeris (2002, 2007) discusses seven different aspects of interaction processes based on the level of a learner's involvement as a reference framework for learning: perception, transmission, experience, imitation, activity and participation. The last two are concepts that most often compose socio-cultural learning theories, and Illeris (2007) suggests that meaningful learning is more likely to take place where one is active and engaged, i.e., learning that is memorable and useful in relevant contexts.

In comparison, action is one of three aspects of learning with thought/reflection and emotion in Jarvis' (2006) model of learning; all are influenced by the social dimension. In short, according to Illeris (2002), activity is a goal-directed action characterised by use of tools, which are not only instruments but also include language and social conventions. Participation includes the learner in a goal-directed activity with a recognised position and, thus, influence. The social aspect of learning is elaborated in an outdoor learning context by, for example, Jordet (2010) and Rickinson et al., (2004). Outdoor teaching and learning can enhance students' social relationships and social learning in several ways, including increased participation and activity. A socio-cultural perspective emphasises learning through participation in a cultural practice (Illeris, 2002, 2007; Jarvis, 2006; Lave & Wenger, 1991). Jarvis describes the way that psychological consciousness (i.e., our basis for interpretation of experiences) is learned and validated when we internalize social culture and it becomes our 'second nature'. Driver, Asako, Leach, Mortimer and Scott (1994) argue that learning science is not only about acquisition of scientific concepts but also about socialising students to participate in science culture.

1.13.1.3 The Emotional Dimension of Learning

The cognitive/content and social aspects of learning both have a long history as theories of learning, but information on the role of emotions in the learning process is limited (Illeris, 2002; Immordino-Yang, 2011; Jarvis, 2006; Levine & Pizarro, 2004; Linnenbrink-Garcia and Pekrun, 2001; OECD, 2002). The important roles of interest and emotion in successful learning have likely been understood by teachers for a long time, and Dewey (1912) discussed the interplay between interest and effort at the beginning of the 20thcentury. Illeris (2007) argues that in the acquisition process of learning, content closely interacts with the incentive aspects. The emotional and motivational dimension of learning affects the learning results even if it does not influence the epistemological content. Illeris (2002) draws on Furth's book *Knowledge as Desire* when he claimed the following:

> *The title suggests that the acquisition of knowledge and skills is essentially libidinal and thus also includes something positively emotional –that ultimately in mankind's genetically evolved nature there lies a capacity for acquiring knowledge and skills, and a fundamentally limitless desire to do so. (p. 65).*

Thus, the desire to learn is innate, but certain researchers suggest that the school system does not make use of this desire to learn but diminishes it, which results in a perception of school learning as boring and fragmented (Sanderoth, 2002; Splitter, 2000). Reasoning and learning have long been separated from emotions (Damasio, 1994; 2003; Goleman, 1996), but currently, growing evidence suggests that emotions play a more significant role in learning than previously expected (Fredrickson, 2001; Immordino-Yang and Damasio, 2011; Jarvis, 2006; Kuhbander, Lichtenfeld and Pekrun, 2011; Larson and Rusk, 2011; Linnenbrink-Garcia and Pekrun, 2011). Jarvis (2006) concluded that learning through emotions is much more significant than originally realised and stated that 'emotions can have a considerable effect on the way we think, on motivation and on beliefs, attitudes and values' (p. 19). Goleman (1995) wrote that a positive mood increases the ability to think flexibly and follow complicated thought patterns, which improves our ability to find solutions to problems, both intellectually and personally. In a school context, students make many decisions on how to think and behave, which are informed by conscious or unconscious emotional states. Thus, engaging in a task or interpreting a problem is a process supported by the intertwined relation between emotions and cognition. Emotions may aid us in focusing our attention and stimulating out working memory, which are two fundamental factors in learning (Damasio, 1994). Previous research on outdoor learning primarily supports it as a motivation tool for students (Jordet, 2007; Waite, 2011).

1.13.1.4 Experience and Experiential Learning

Experience is a term that might require further discussion because it is frequently used in outdoor education discourse, but it is a multi-layered term. In everyday understanding, its definition ranges from a single incident to accumulated knowledge, such as a life history. Following the pragmatic philosopher John Dewey, Illeris (2002, 2007) and Jarvis (2006) regard experience as at the heart of learning. Illeris (2002) stressed that his use of the experience concept extends beyond everyday use of this term and as its use by many scholars that study experiential learning. Fox (2008) criticised the lack of a theoretical understanding of experience in much of the experiential and outdoor education contexts, and Fox emphasised the socio-cultural aspect of experience. Illeris (2002) argued that experience spans the three dimensions of learning, in contrast to, for example, 'activity', which excludes the emotional aspect. Experience is broader than physiological perception from our senses. Illeris defined experiential learning as learning 'of considerable subjective significance with regard to the cognitive as well as the emotional and the socio-societal learning dimension' (p. 153). Further, experience must be rooted in a subjectively relevant social context and part of a continuous coherent process, not a single episode without connection to previous and future experiences. The learner must also be an active participant in the interaction between an individual and social and/or material surroundings, not passively enduring without commitment.

Jarvis (2006) also claimed that proponents of experiential learning often understand experience too narrowly. Drawing on everyday understanding, he distinguished between four different ways to understand the nature of experience; each is relevant to understanding human learning. These various aspects are consciousness, biography, episode and sensation. According to Jarvis, consciousness is 'the ability to be able to be in the world and "know it" (p. 71); it includes phenomenological and psychological dimensions. In experience as biography, Jarvis (ibid.) emphasised that accumulation of previous experiences affects current experiences, and our biography comprises bodily, emotive and cognitive dimensions. Direct encounters with the external world may include both an episodic experience and a premeditated experience, such as at a lecture in a classroom. Building on Dewey's definition of experience, Jarvis (2006) concluded that the significance of an experience is the disjuncture it evokes (i.e., when we become aware of the external world and realise that our interpretation thereof may not be consistent with our experience). Thus, an episodic experience urges us to ask 'why' and 'how'. In addition to Illeris (2002), Jarvis concluded that an experience is never a single episode, but it is embedded in the continuous flow of time.

1.13.1.5 The Implications for this Thesis

The consequences of using the perspective of the three dimensions of learning herein is that any aspects related to the consequences from outdoor teaching can be incorporated into the analysis. This approach is consistent with the exploratory character of this research, which does not focus on a particular aspect. Sfard (1998) discussed two metaphors for learning: the acquisition (knowledge as an internal possession) and participation metaphors (knowledge as an aspect of practice and activity). She concluded that each metaphor offers a theoretical aspect that the other does not provide and that none of the recognized metaphors sufficiently provide a coherent theory of learning. This is the perspective adopted herein. To limit this approach to either the individual or social/participatory aspects limits our understanding of what transpires when teaching and learning are moved out of the classroom. By choosing this approach, the researcher follows several other scholars in their attempts to bridge the individual and socio-cultural aspects (Davis, 2008).Jarvis' (2006) work on experience has bearing on the outdoor learning context. Experience as sensation and an episode is likely most evident on a short-term basis, but long-term rationales include consciousness and biography. Illeris' (2002) emphasis on the social dimension and his notion that experience is rooted in a subjectively relevant social context as part of a continuous process also lie at the heart of outdoor teaching and learning theory (Jordet, 2010).

1.14 Summary

This chapter has provided an introduction to the study. It cites the key variables of interest to the researcher. Section1.1 Presents issues related to the research background, section 1.2 specifies the research problem. Section 1.3 presents the objectives of the study, section 1.4 identifies the research questions, section 1.5 presents the Hypotheses, section 1.6 describes the significance of the study, and 1.7 presents the theoretical framework.

OPERATIONAL DEFINITION OF TERMS

Attitude: A delimited totality of a person's cognitions, affective reactions, and behavioral tendencies (Dunham, Grube, Gardner, Cummings, & Pierce, 1989).

Contextual factors: Teacher intrinsic factors (Knowledge, Attitude and Skills) and extrinsic factors (Curriculum, Administrative support, time and timetable factors)

Curriculum: Although there is no consensus on the definitions, it refers, in this study, to the curriculum intended that is, all planned for learning under the auspices of schools according to the administrator's point of view (Kilpatrick, 2009)

Field activities: are defined as learning experiences in which students interact with materials and/or with models to observe and understand the natural world.

Knowledge: Teachers' familiarity, awareness or understanding of role and significance of field instruction in biology

Inquiry: Refers to diverse ways in which scientists study the natural world, propose ideas, and explain and justify assertions based upon evidence derived from scientific work.

Scientific inquiry: the primary process by which scientific knowledge is gained.

Skills: Teachers' ability to carry out field instruction in order to achieve specific aims and learning outcomes

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This study was undertaken to provide information about the relationship between conceptual factors and the use of field activities. The study was intended to answer seven sets of objectives and two research questions which include: teachers' use of field activities; the relationship between teachers' knowledge and their use of field activities; the relationship between teachers' attitude and their use of field activities; the relationship between teachers' skills and their use of field activities; the relationship between the biology curriculum and the use of field activities; the effects of administrative support on the use of field activities; the relationship between time and timetable factors and the use of field activities; teachers' perceptions on the use field activities as an instructional method and lastly whether the KCSE biology papers require knowledge of out-of-classroom experiences. The chapter presents literature on the concept of fieldwork, why do fieldwork, types of fieldwork, the role of fieldwork in biology, the value of fieldwork and factors affecting the use of fieldwork in secondary schools.

2.2 The Field Activity Concept

According to Price and Hein, (1999) all learning is a mixture of first-hand experience and received information and ideas, only a limited part of which can be acquired in the classroom. First-hand experience outside the classroom involves field activities. Often it is undertaken primarily for teaching purposes but despite the development of modern techniques such as remote sensing, computer simulations and advanced laboratory analytical methods Beasley et al., (2001) says that many sciences still rely on field activities for the collection of their raw data. Field activities, therefore, is not only a learning vehicle; it is part of the scientist's research methodology (Orion, 1993). In the same vein, Muse et al., (2002) argues that anybody who aspires to become a practitioner in a subject which requires an ability to collect data ‘outdoors’ must be able to undertake fieldwork competently, safely and, preferably, enthusiastically.

2.3 Justification for Field Activities

No matter what the level of study (school, undergraduate, postgraduate or professional), any discipline that acquires a significant part of its primary data in the field, regards field activities as central to the understanding of the subject(Fido and Gayford, 2002). An axiom that is still quoted by biologists is that there is no better way to train and educate students in the subject than to expose them to as much field activities as possible. According to Jenkins, (2000), field activities remain an important part of the professional life of many scientists and it is essential that the techniques and methodologies of field activities are inculcated at an early stage in science training. In addition, the exposure to, and attempts to solve, ‘real’ problems in the natural world build self-reliance and self-confidence Lock and Tilling, (2002). As old-style apprenticeships recognized, you cannot teach simply by telling, or even demonstrating; students need to tackle problems for themselves and must continuously practice the techniques they need to become competent field scientists. As noted by Dando and Wiedal (1991), field activities produce total immersion in the subject area. There can be no better way of gaining an in-depth understanding of the discipline and of developing students’ capacity for observation and for data collection and analysis Barker et al, (2002). Field activities can also provide an excellent arena for the development of students’ personal skills, such as team work, and for building good relations between students and staff Jenkins, (2000).

2.4 The Field Experience

The experience of observing real biological structures in their natural environment and learning about the types of evidence that contribute to scientific understanding has been demonstrated to be of value in promoting inquiry and processing teaching behaviors. Results from learning research support the cognitive and affective value of incorporating a field experience into science curricula. A comprehensive review of research studies dealing with the impact of field activities experiences that cannot be duplicated in the classroom; it also positively impacts attitudes, leading to reinforcement between affective and cognitive domains of learning and higher level learning. Other research has shown that field experiences not only permit but actually encourage perception of the integrated whole, not just the individual parts (Kern and Carpenter, l996).

The opportunity for direct hands-on experience provided by field activities can be useful for transition from a concrete to abstract level of cognition as described by Piaget (1990). It can lead to conceptual change and refinement of student pre-conceptions (Tal, 2004). Furthermore, McKenzie, Utgard, and Lisowski (1986) showed that students who participated in biological field activities for education majors exhibited significant gains in evaluation items that involved inquiry and investigative skills and that required active involvement. Field activities have also been shown to be a key factor for improving students' understanding of biology (Dodick and Orion, 2003). The type of experience afforded by the field experience is a critical variable. Mackenzie and White (1992) compared the value of learning programs with *processing* field excursions versus learning programs plus *traditional* field excursions. The processing excursions emphasized students (a) becoming an active part of the experience Impact of a Field-Based, Inquiry Focused rather than mere observers, (b) generating information rather than receiving it, and (c) constructing their own records of the scene rather than accepting the teacher's version. Results documented the superior effectiveness of the processing excursions, particularly in fostering student retention. "Authentic science," a central strategy of science teaching, occurs through fieldwork. It requires that students assume active, investigative roles, thinking like a scientist and "doing" real science. Key to the success is not just providing students with a science immersion experience, but also helping them conceptualize science as a creative process and way of thinking rather than a defined body of content (National Research Council, 2007).

The need to integrate more authentic science experiences is prevalent in all secondary school science, undergraduate science, and teacher education courses. The traditional biology laboratory experience provided to students, although a valuable addition to the traditional lecture, can never be a substitute for evidence gathered directly from the field. It cannot replace the experience of observing real biological structures in their natural environment and learning about the types of evidence that contribute to scientific understanding, as well as extraneous evidence that can obscure (Manduca, Mogk, and Stillings, 2002). The goal of the new course described in this thesis is to teach biological science concepts and inquiry methods by actively engaging students in field activities.

2.5 The Role of FieldActivities in Biology

Before considering how best to deliver effective field teaching, the role of field activities within biology needs to be considered. There are a number of reasons why field activities have an important place in the teaching of science and in the biology content: Croft and Thomas (2004) points out that, field activities provide a balanced perspective by linking together many other biological disciplines and providing an over-arching view for biology as a whole. This conceptual map provides the academic foundation from which informed decisions can be made at whole organism and community level. Field activities provide students contacts with whole organisms. There are few opportunities in the biology curriculum for students to experience living plants and animals. It is this contact which provides a powerful tool for developing an understanding of, and in many cases sympathy for, living organisms. According to Rickinson *et al*. (2004), field activities provide a wider perspective in the teaching process. The fact that field activities lie at the core of biology, with many synoptic links to other parts of the subject, means that it is also critical to the science underpinning wider environmental and conservation issues. It is a vital part of cross-curricular teaching for topics such as Education for Sustainable Development.

Croft and Thomas, (2004) point out that field work enables the practising of real science. The teaching through field activities also provides strong opportunities for students to carry out original research. Because much of ecological research is rooted outside the classroom, the practical teaching of biology can introduce students to ‘real’ science, showing how scientific methodology can work in situations which are more unpredictable and less easily organized than the ‘sanitized’ situations encountered in classrooms and laboratories. Without this experience students can lack an understanding of science and an appreciation of the real capacity of scientists to deliver answers to environmental questions. Field activities provide strong opportunities to generate data and practice original research. This ‘real world’ experience introduces students to science which can be unpredictable and contradictory. In short, it is the ideal vehicle for teaching practical and transferable scientific methodology and skills Rickinson *et al*. (2004). Real world, small scale and local studies can provide knowledge and understanding to transfer to similar or larger scale case studies in other areas. Without this experience, students will have a sanitized and misleading impression of the scientific method. This may contribute to unrealistic expectations of what scientists can do, and the answers and guarantees that they can provide.

Hillcox, (2003) states that, field activities may provide the only opportunity for students to investigate living animals and plants which are interacting with each other and the world around them. It is the first time that students may realize that animals and plants may not fit the tidy 'identikit' images portrayed in books and virtual environments. Many major scientific discoveries have resulted from unpredictable and random observations of natural phenomena; the outdoor experience is the only effective way of introducing students to the potential, and challenges, of such observations. Hillcox, (2003) also notes that, fieldactivities provide some basic natural history and investigatory experience and skills which are lacking from virtual or classroom teaching. Field skills are needed to support work in the environmental sector. Currently, there is a shortfall in skills such as field surveying and identification. Rickinson, *et al*. (2004) in their research on field work also states that, field activities can be novel and inspiring; it can lead to life-defining decisions. It can help to broaden horizons, both literally and educationally, and offers great potential for personal development, building independence, self esteem, self confidence and teamwork. Such potentially life-defining opportunities for biologists need to be celebrated and nurtured. Whilst attention often focuses on pressures and demands, fieldactivities can be highly effective in developing mutual understanding between teachers and students which enhances the effectiveness of learning and can provide motivation which transfers/remains after the field experience Hillcox, S. (2003).

2.6 The Value of Field Activities

The report, from a Field Studies Council report entitled published in 2002, recommended that fieldwork should be a compulsory part of the science curriculum

(Barker, Slingsby and Tilling, 2002). Writing three years earlier, Smith noted that, '*The importance of fieldwork to biologists is beyond question' (1999, p. 181*). So what is it about fieldwork that generates such unconditional support among its devotees? Why should we continue to regard it as an essential part of everyone's education?

2.6.1 The Value of FieldActivitieswork to Students

Stuart Nundy, has summarized research into fieldactivities (Nundy, 2001). He highlighted three major benefits: A positive impact on long-term memory due to the memorable nature of the fieldwork setting, affective benefits of the residential experience, such as individual growth and improvements in social skills, reinforcement between the affective and the cognitive, with each influencing the other and providing a bridge to higher order learning. Nundy (1998, 1999a and b) looked specifically at residential field activities for primary school students. He reported that improvements in the affective domain can lead to improvements in cognitive outcomes. Nundy wrote that:

> *Residential fieldactivitiesare capable not only of generating positive cognitive and affective learning amongst students, but this may be enhanced significantly compared to that achievable within a classroom environment.* (Nundy, 1999a, p. 190)

McNamara and Fowler (1998) studied different ways of teaching some science concepts to students. They found that a field approach was more effective than other strategies. Manzanal*et al.* (2003) found that field activities (involving sample collection and fieldwork at a freshwater system) aided the conceptual understanding of students and '*intervenes directly in the development of more adorable attitudes towards the defense of the ecosystem'* (p. 431). Dierking and Falk (1997) found that 96% of a group of 128 children and adults remembered field trips (particularly those to natural sites, nature centers and farms). However, remembering a trip does not necessarily mean that much or indeed any, significant learning took place. Measuring the impact of fieldwork on students is notoriously difficult. Partly for that reason, most studies have tended to stress outcomes in the affective domain (such as attitudes and values) or those that are social/ interpersonal (such as communication skills or leadership). Some writers have stressed the value of fieldactivities as a teaching approach (for example, Cooper, 1991). Usually, though, the rationale for using fieldactivities is more philosophical, Tim Brighouse who once said that '*One lesson outdoors is worth seven inside'* (Brighouse, quoted in May *et al.*, 1993, p. 2). Other educators point out that field activities are essential in the training of some professions (Lock and Tilling, 2002). Some writers advocate the psychological value of field activities arguing that they are a 'creative form' of learning (Baker-Graham, 1994).

Despite fears about safety and concerns about the resource implications of fieldactivities, the situation looks quite promising (NFER, 2006). The report *Engaging and Learning with the Outdoors* (Dillon *et al.* 2005), which focused on the use of school grounds, farms and city farms, and field centers, provided evidence across a range of subjects that children's outdoor learning can include: knowledge and understanding; attitudes and feelings; values and beliefs; actions and behaviors; personal development, and social development. For many teachers and students engaged in field activities, the opportunities for personal and social development are seen as highly significant. In the study, teachers and students noted that field activities developed knowledge and understanding of geographical, ecological or food production processes, and helped the development of values and beliefs about the environment. One teacher in the study commented:

> *I think the perceived benefits over time are sustained in that [they] give the children ... a wider view of the countryside, an informed view. ... They ... have plants pointed out to them, trees, flowers, birds, what's going on around them, why things are happening at a particular time of year. I think it's adding to their general knowledge, their view of the world. That's the biggest benefit.*

For students, field activities offered the chance for more personal outcomes (increased confidence, improved social skills and a greater belief in personal efficacy). Some students found, sometimes to their surprise, that learning could be fun. As one primary teacher said:

> *It's just being somewhere where the children have headspace without the constraints, I think it is being somewhere where they are unfamiliar, it can be unnerving but exciting as well. Being out in an environment like that is like giving gifts to children for just being there and also it encourages [them] and they will go home full of it to their parent and careers and say "'I want to go, it's not far".' [Primary school teacher]*

2.6.2 The Value of Field Activities to Teachers

Teachers as well as students benefit from well-planned and delivered field activities delivered by experts. In the *Engaging and Learning with the Outdoors*(Dillon *et al.* 2005),study, participating teachers welcomed the chance that field activities gave them to watch experienced outdoor educators who often used different styles of teaching than they themselves employed. Teachers noted that they improved their own subject knowledge and picked up new skills as well as ideas that they could take back to their own classrooms. Field activities provide an opportunity for teachers to develop a different and, potentially, more positive and productive relationship with their students. It often involves students working together with peers; the dynamics and interrelationships developed whilst working in groups can have a huge influence on how students develop socially. This is particularly true for residential experiences (Dillon *et al.* 2005).Field activities can deliver joined-up teaching at its best. A field course, particularly a residential one, often takes the form of an effective teaching model which differs markedly from the usual school timetable. For a few days pupils get used to unfamiliar surroundings and become immersed in a single topic looked at in a multifaceted way. The (NFER, 2006) affirms that theory can be taught through motivating practical experiences and placed in a wider context of enjoying field biology. Students returning from such experiences often indicate that it was one of the most enjoyable but also a deeply satisfying aspect of their A level studies. They are often surprised how much they learnt in a short time. In a quality field course, intellectual activity and fun go hand in hand.

> *"Working in groups can have a huge influence on how students develop socially ... Fieldactivities can deliver joined-up teaching at its best"*

2.6.3 The Value of Field activities to Biology

All science is rooted in observation of the real world, leading to questions, hypotheses, predictions and experiments. Biological field activities provide one of the few places in a science curriculum where students quite literally observe the real world and use it as the basis for scientific enquiry. Science in the environment is one of the places where science can be truly integrated and holistic biology is a broad and diverse subject, which is becoming more fragmented as new disciplines emerge. Over the past few years there has been a steady and accelerating trend for biologists to become increasingly specialized to the point where a molecular biologist may be isolated from an ecologist and vice versa. This fragmentation is now being repeated in school biology teaching where students learn ‘bits’ of biology in units isolated from each other (Barker, Slingsby and Tilling, 2002).

Field activities, where whole organisms are studied, enable integration of different elements of biology showing how the biological jigsaw functions. Biology is an experimental subject, and whole organism ecological studies provide an opportunity to investigate and collect data on a topic – often intensively, over prolonged periods, in great breadth and depth. Field activities offers students a particularly good opportunity to collect numerical data on a large scale, either working individually or in groups, and to subject the data to statistical analysis in an open-ended manner. This can rarely be achieved in the laboratory where the tendency is for most practical investigations to be simplified or ‘sanitized’. Charles Darwin, when analyzing his own strengths highlighted his ability to ‘grind general laws out of a large collection of facts’ (Jones, 2000). Most of his facts were observations made outdoors, but founded on interests kindled in his earlier childhood. It is unlikely that a new Charles Darwin could emerge from our schools at present.

> "*Biological fieldactivitiesprovide one of the few places in a science curriculum where students quite literally observe the real world ... biology is a broad and diverse subject, which is becoming more fragmented as new disciplines emerge*"

2.6.4 The Value of Field Activities to the Wider Community

According to McGlashan et.al (2007), the outdoor classroom can help to develop understanding, attitudes and values, and lead to a more enlightened commitment. Field activities often leaves a lasting impression and promotes a deeper understanding of the experimental, analytical and interpretative approaches that underpin the whole of science and the way in which the world around us really works. The outdoor classroom provides a link between theoretical aspects of biology and issues which affect our homes, communities and the world around us. Field activities can help to develop understanding, attitudes and values, and lead to a more enlightened commitment and action in areas such as citizenship, conservation, animal welfare, genetic engineering, biodiversity and sustainable development (Kelsey & Steel, 2001). The majority of students learning about the need to conserve rainforest biodiversity or to evaluate the Kyoto Protocol will do so abstraction without hands-on experience of real habitats. Yet, first hand science-based experience of local habitats is a key part of acting locally that is as the pre-requisite to thinking globally (World Commission on Environment and Development, 1997). Thus the need for this study to investigate the factors that affect the use of field instruction in secondary schools in Kenya.

2.7 Teachers' Attitudes and Their Use of Field Activities

Attitudes have been receiving a great deal of attention from educational researchers and widely discussed in the literature (Fang, 1996; Kagan, 1992; Mansour, 2009; Nespor, 1987; Pajares, 1992). Although there have been many studies related to attitudes, educational researchers still discuss the definitions and nature of attitudes. Therefore, there is a need to clarify the terms and definition of attitudes in order to better understand the relationship between teacher attitudes and practice. The first part of this paper discusses the definitions and nature of attitudes as found in literature and makes distinctions between attitudes and knowledge. Studies of attitudes are mostly related to classroom practice and the relationship between teacher attitudes and practice has widely been discussed in regard to a broad variety of issues in science education including: (a) constructivism (Beck, Czerniak, and Lumpe, 2000; Haney, Lumpe, and Czerniak, 2003; Haney and McArthur, 2002); (b) curriculum (Cronin-Jones, 1991); (c) goals of science education (Mcintosh and Zeidler, 1988); (d) inquiry (Luft, 2001; Wallace and Kang, 2004); (e) nature of science (Gess-Newsome and Lederman, 1995; Hashweh, 1996; Lederman, 1999; Lederman and Zeidler, 1987); (f) reform strands (Haney, Czerniak, and Lumpe, 1996; Roehrig and Kruse, 2005); (g) science, technology and society, (Lumpe, Haney, and Czerniak, 1998); (h) teaching and learning (Hancock and Gallard, 2004; Haney, Lumpe, Czerniak, and Egan, 2002; Laplante, 1997; Levitt, 2002; Lumpe, Haney, and Czerniak, 2000; Mellado, 1998; Porlan and del Pozo, 2004); and (i) thematic units (Czerniak, Lumpe, and Haney, 1999). These studies indicate that the relationship between teacher attitudes and practice is controversial. Some studies (Cronin-Jones; Haney and McArthur; Haney et al., 1996, 2002;Hashweh; Levitt) found that teacher attitudes are consistent with classroom practice, while others found that teacher attitudes do not necessarily influence classroom practice (Hancock and Gallard; attitudes should be considered within context because of the context-dependent nature.

2.8 Debates on Definitions and Nature of Attitudes and Knowledge

Attitudes, as a term, has been defined in a variety of different ways in the literature and used interchangeably with a variety of other terms including beliefs, values, judgments, opinions, ideology, perceptions, conceptions, conceptual systems, dispositions, implicit theories, explicit theories, internal mental processes, action strategies, rules of practice and perspectives (Pajares, 1992). However, according to Pajares, the confusion focuses on the distinction between attitudes and knowledge. Therefore, it is necessary to clarify the differences between attitudes and knowledge.

Abelson (1979) defined attitudes in terms of people manipulating knowledge for a particular purpose or under a necessary circumstance. According to Brown and Cooney (1982), attitudes are dispositions to action and major determinants of behavior. Rokeach (1972) defined attitudes as “any simple proposition, conscious or unconscious, inferred from what a person says or does, capable of being preceded by the phrase ‘I believe that’” (p. 113). Rokeach discussed three kinds of attitudes: descriptive or existential attitudes, evaluative attitudes and prescriptive or exhortatory attitudes. Rokeach (1972) suggested that all attitudes have three components: a cognitive component, an affective component and a behavioral component. A cognitive component represents a person’s knowledge about what is true or false, desirable or undesirable. An affective component of the attitudes is capable of arousing affect of varying intensity centering on the object of the attitudes, taking a positive or negative position in an argument. A behavioral component of the attitudes leads to action when it is activated. According to Rokeach, the nature of attitudes is somewhat similar to the structure of an atom in terms of the ways in which attitudes are organized.

Rokeach claims that some of the attitudes (core attitudes) are more central, more connected to others (peripheral), and more resistant to change. Moreover, Ackermann (1972) examined attitudes in four different categories as behavioral attitudes, unconscious attitudes, conscious attitudes, and rational attitudes. Behavioral attitudes are not distinguished simply because of fixed behavioral patterns that anyone holding a certain attitudes will exhibit. Rather unconscious attitudes long-standing attitudes that can influence behavior over a long period of time but resist recognition by the agent. Unlike behavioral attitudes, unconscious attitudes cannot be interpreted from behaviors. Behavioral attitudes, by contrast, will be thought of as non-conscious rather than unconscious. Behavioral attitudes are important in human action where the agent encounters no difficulty, so that his attitudes do not require scrutiny at the consciousness level. Conscious attitudes are any attitudes a person has explicitly formulated and is aware of. Rational attitudes are defined as a philosophical idealization of actual attitudes structures.

Based upon a literature review of attitudes, Pajares (1992) defined attitudes as an individual's judgment of the truth or falsity of a proposition, a judgment that can only be inferred from a collective understanding of what human beings say, intend, and do" (p. 316). Anthropologists, social psychologists, and philosophers have agreed upon a commonly accepted definition of attitudes; "attitudes are thought of as psychologically held understandings, premises, or propositions about the world that are felt to be true" (Richardson, 1996, p.103). In educational settings, Haney et al. (2003) defined attitudes as "one's convictions, philosophy, tenets, or opinions about teaching and learning" (p. 367), hence the need for this study to investigate how attitude influence teachers' use of field activities.

2.9 Teachers' Knowledge and Their Use of Field Activities

The definition of knowledge as a term can be traced back to the time of Socrates. Plato suggested that knowledge has three components: beliefs, truth, and justification (Woolfolk-Hoy and Murphy, 2001). In the traditional philosophical literature, knowledge depends on a "truth condition" that is being agreed upon in a community of people (Richardson, 1996). Based upon this definition, knowledge is a belief that meets two conditions: (a) the truth of what is believed and (b) the justification someone has for believing it (Woolfolk-Hoy and Murphy, 2001). Alexander, Schallert, and Hare stated that beliefs are a category of knowledge and define knowledge as "encompasses all that a person knows or believes to be true, whether or not it is verified as true in some sort of objective or external way" (Woolfolk-Hoy and Murphy, p. 146).A number of scholars have made the distinction between knowledge and beliefs. As Pajares (1992) stated, the problem is associated with the difficulty of finding the border where knowledge ends and beliefs begin. Table 1 summarizes the differences between beliefs and knowledge as discussed in the literature.

Table 2.1: The differences between beliefs and knowledge based on the literature

Beliefs	Knowledge
• Refer to suppositions, commitments, and ideologies • Do not require a truth condition • Based on evaluation judgment • Cannot be evaluated • Episodically-stored material influenced by personal experiences or cultural and institutional sources • Static	• Refers to factual propositions and the understandings that inform skillful action • Must satisfy "truth condition" • Based on objective fact • Can be evaluated or judged • Stored in semantic networks • Often changes

According to Calderhead (1996), beliefs generally refer to "suppositions, commitments, and ideologies while knowledge refers to factual propositions and the understandings that inform skillful action" (p. 715). Richardson (1996) distinguished knowledge from beliefs based on the notion of "truth condition." In her definition, knowledge must satisfy the "truth condition" or have some evidence but beliefs do not require a "truth condition." Ernest (1989) proposed a distinction between knowledge and beliefs by identifying a case in which two teachers may have similar knowledge, but one can teach mathematics with a problem-solving orientation, while the other has a more didactic approach because of different beliefs they hold. Nespor (1987) suggested that four features of beliefs: (1) existential presumption, (2) alternativity, (3) affective and evaluative loading and (4) episodic structure can be used to distinguish knowledge from beliefs. First, Pajares (1992) defined existential presumptions as "the incontrovertible, personal truths everyone holds" (p. 309). They are deeply personal and formed by chance, an experience, or an event. For example, a teacher may have beliefs about student "ability," "maturity," or "laziness" which are labels for entities about the students, rather than descriptive terms. Second, beliefs sometimes refer to "alternative worlds" or "alternative realities" which are different from reality (Nespor; Pajares). Third, belief systems depend on affective and evaluative components more than knowledge systems. Nespor suggested that feelings, moods, and subjective evaluation based on personal preferences may significantly influence one's belief system. Unlike knowledge systems, belief systems do not require general consensus regarding the validity and acceptability of beliefs. Individual beliefs do not even require internal consistency in the belief system. Finally, Nespor differentiated these two terms based on episodic structure. A knowledge system is stored in semantic networks whereas belief systems consist of episodically-stored material influenced by personal experiences or cultural and institutional sources. In summary, Pajares synthesized the findings of research on beliefs in the literature as follows: 1.Beliefs are formed early and tend to be self-perpetuated, tend to be persistent against the contradiction caused by time, experience, reason and schooling. 2. Epistemological beliefs play a key role in knowledge interpretation and cognitive monitoring. 3. Belief substructures, such as educational beliefs, must be understood in terms of their connections not only to each other but also to other, perhaps more central, and beliefs in the system. 4. By their nature and origin, some beliefs are more incontrovertible than others. 5. The earlier a belief is incorporated into the belief structure, the more difficult it is to change. 6. Belief change during adulthood is a relatively rare phenomenon.7. People's beliefs strongly affect their behavior. 8. Beliefs cannot be directly observed or measured but must be inferred from what people say, intend, and do. 9. Beliefs about teaching are well established by the time a student attends college (pp. 324-326)

2.10 Teacher Attitudes and Classroom Practice

Many scholars believe that the implementation of any reform movement heavily depends on teachers (Bybee, 1993; Haney, Czerniak, and Lumpe, 1996; Levitt, 2002; Nespor, 1987; Pajares, 1992; Tobin, Tippins, and Gallard, 1994). As Prawat (1992) indicates, teachers are expected to play a crucial role in changing schools and classrooms. Paradoxically, however, they are also viewed as major obstacles to change due to their traditional beliefs. According to Bandura (1986), an individual's decisions throughout his/her life is strongly influenced by his/her attitudes. Similarly, Pajares asserts that attitudes are, "best indicators of the decisions that individuals make throughout their lives" (p. 307). Teacher attitudes play a major role in teachers' decision making about curriculum and instructional tasks (Nespor; Pajares). In summary, educational researchers have advocated the need for closer examination and direct study of the relationship between teacher attitudes and educational practices (Pajares; Pomeroy, 1993).

Therefore, the relationship between teacher attitudes and practice is well documented in science education literature. A number of studies investigating the relationship between teacher attitudes and practice have found that teacher attitudes are consistent with classroom practice. Hashweh (1996) conducted a study with 35 science teachers in order to identify the relationship between their epistemological beliefs and classroom practices. Data obtained through the use of a three-part questionnaire consisted of critical incidents, direct questions about teacher strategies for conceptual change, and ratings of the use and importance of specific teaching strategies. The author characterized teachers as learning constructivists, learning empiricists, knowledge constructivists and/or knowledge empiricists. He found that differences in epistemological attitudes influenced classroom teaching.

According to the findings of his study, teachers holding learning constructivist and knowledge constructivist attitudes are more likely to detect student alternative conceptions, have a richer repertoire of teaching strategies, use potentially more effective teaching strategies for inducing student conceptual change and report more frequent use of effective teaching strategies compared with teachers having empiricist attitudes. Although Hashweh investigated the relationship between teacher attitudes and practice, he collected self-reported data from teachers about their classroom practice without observation. This should be considered as one of the biggest weakness of this study.

Haney and McArthur (2002) constructed case studies for four prospective science teachers in order to identify teachers' attitudes and classroom practices. Participants were purposively selected as a result of their scores on the Classroom Learning Environment Survey ([CLES] Taylor, et al., 1994). The CLES instrument has five subcategories that were viewed as critical to the formation of a constructivist classroom environment: (1) personal relevance, (2) scientific uncertainty, (3) critical voice, (4) shared control, and (5) student negotiation. Other data sources came from classroom assignments, semi-structured interviews conducted after observations and classroom observations. However, each participant was only observed teaching a self-selected constructivist lesson. As a result, the authors may not find much inconsistency between teachers' beliefs and practice. In their study, Haney and McArthur (2002) analyzed teacher beliefs as either core beliefs or peripheral beliefs. Core beliefs are defined as those beliefs that are both stated and enacted, while peripheral beliefs are defined as constructivist beliefs that are stated but are not enacted. The study showed that teachers' attitudes (constructivist, conflict and emerging) were stable and resistant to change. Teachers' attitudes regarding personal relevance, scientific uncertainty, and student negotiation were constructivist core beliefs that were consistent with their practices. However, shared control was a peripheral belief for three teachers who stated that they would like to implement it, but they found it both difficult and frustrating to incorporate. The authors suggested that the attitudes, necessary to cover the existing local science curriculum, were evident as an obstacle for all participants.

Beck et al. (2000) conducted a study consisting of 203 teachers, having different backgrounds, teaching experiences and race, to identify the factors influencing science teachers' implementation of constructivism in their classrooms. The authors used an open-ended questionnaire and the Classroom Learning Environment Survey (Taylor et al. 1994) as instruments. In general, the teachers possessed positive attitudes about teaching for personal relevance, but teachers with Bachelor's and Master's degrees had a more positive attitude toward teaching for personal relevance than teachers with Doctoral degrees. Middle level teachers expressed their intent to teach for personal relevance more than primary teachers. Significant differences were found between teachers' intent to implement and their gender. Female teachers were more likely to implement the targeted behavior than male teachers for both critical voice and student negotiation. Middle level teachers were the most likely to implement student negotiation, while primary teachers had the most positive attitude about teaching for student negotiation. Generally, the teachers believed that teaching for personal relevance, scientific uncertainty, critical voice, shared control, and student negotiation in the classroom can motivate students, help students understand the limitations and imperfections in science, that science changes over time and involve students in their own learning. On the other hand, they also indicated that they were concerned with the amount of time, student misuse of critical voice, the immaturity and inexperience of students in the use of shared control and classroom management problems.

Haney et al. (1996) identified teacher attitudes and intentions regarding the implementation of science education reform strands. Data was obtained through structured interviews and questionnaires. Four questionnaires related to the reform strands of inquiry, knowledge, conditions and applications were developed by the authors from the structured interviews conducted using a sample of 13 teachers. Findings indicated that women were more likely to intend to implement reforms strands than were men. The primary teachers held more favorable beliefs toward the implementation of science education reform strands than did the middle-level or high school teachers. Teacher familiarity was another component that influenced teacher intentions. Teachers in this study did not believe that they had the ability to bring about educational change. They believed that barriers such as lack of effective staff development opportunities, available resources and administrative support impeded their ability to implement educational reform.

Although studies conducted by Beck et al. (2000) and Haney et al. (1996) could provide information of teacher attitudes about constructivism and science education reform strands, they provide little information about their actual classroom practice since the authors did no classroom observation. Levitt (2002) conducted a study in order to identify the attitudes of elementary teachers regarding the teaching and learning of science and the extent to which the teachers' beliefs were consistent with constructivism, which underlies science education reform. Sixteen teachers from two school districts involved in a local systemic project for science education reform participated in the study. Although data was collected via semi-structured interviews and classroom observations, each teacher was only observed teaching a single lesson from the program. Levitt (2002) categorized teacher attitudes and classroom practice into three groups: traditional, transitional and transformational. The author concluded that although gaps still exist between the teacher attitudes and the principles of reform, the implication of teacher beliefs is that the teachers are moving in a direction consistent with science education reform. The author described teacher beliefs as incomplete when compared to the philosophy of teaching and learning underlying science education reform. On the other hand, the findings of the study could not give in-depth information regarding teacher-classroom practices due to few classroom observation hours.

A more recent study was done by Roehrig and Kruse (2005) in order to understand the impact of a reform-based chemistry curriculum on teachers' classroom practices and to identify the effects of teacher attitudes and knowledge on their implementation of the curriculum. Twelve high school chemistry teachers participated in the study. Data was collected through interviews. Participant responses were categorized as traditional, instructive, transitional, responsive or reform-based and then given a numerical value from 1 (traditional) to 5 (reform-based). In addition, each teacher was observed teaching non-LBC lessons at least twice prior to the field test of LBC and observed weekly, totaling four-to-seven observations per teacher. The findings of the study revealed that teachers' classroom practices became more reform-based as a result of the presence of the new curriculum. This study is also consistent with the idea that teaching attitudes have a significant influence on classroom practices. Experienced, out-of-discipline teachers with transitional or student-centered teaching beliefs exhibited the most growth in reform-based teaching practices.

The studies previously discussed found that teacher attitudes are mostly consistent with their practice. However, most of these studies have collected self-reported data by rating their use of teaching strategies without observation (Beck et al., 2000; Haney et al., 1996; Hashweh, 1996); or limited observation (Haney & McArthur, 2002; Levitt, 2002; Roehrig and Kruse, 2005). Therefore, this can be one of the reasons that they have found consistency between their attitudes and practice. On the other hand, studies investigating the relationship between teacher attitudes and practice should consider the context in which teachers work in order to better understand the relationship. There have been some studies that teacher attitudes do not necessarily influence classroom practice because of several factors (Hancock and Gallard, 2004; Mellado, 1998). Teacher education and teacher background, school community including administrator, parent and student perspectives and other factors such as the need to cover curriculum influence teacher classroom practice as well as teachers' attitudes towards teaching and learning, and should be taken into account by researchers. This study therefore sought to investigate the relationship between teacher attitudes and use of field activities.

2.11 Teachers' Skills on FieldActivities: The Design and Conduct of Field Activities

2.11.1 Placing Field activities in the Wider Curriculum

Given the importance which many academics attach to field activities, it is surprising how little attention is sometimes given to placing field activities within the context of the school program(s) to which it contributes (McGlashan et al, 2007). Field activities are regarded as so valuable in their own right that their role within the wider curriculum can sometimes be neglected. It is such a different form of teaching that it can all too easily become detached from the rest of the students' educational experience. If full value is to be obtained from field activities, it must support and relate to the wider curriculum. It needs to be carefully designed to contribute to the aims and learning outcomes for biology. Field activities, however worthwhile in their own terms, cannot stand in splendid isolation: they must be integrated. These links may, for example, be in terms of subject-based knowledge, data collection techniques, research methods or transferable skills (Brune, 2002).It follows from this, that field activities need to be given careful consideration at the stage of overall curriculum design, and that the pattern of field teaching across the school program should be carefully thought through. Field activities should be conceived both within their wider academic context and as a distinctive part of the curriculum which requires design in its own right. Debates and decisions are needed about the role of fieldactivities, their amount, their character and their timing. The field activities curriculum also requires planning to ensure that it is progressive. Students may well benefit from experiencing not only different types of field activities but also different levels of challenge. Across the four years of the biology program, the work expected of students needs to become increasingly demanding, with a greater emphasis on students taking responsibility for their own learning.

2.11.2 A Curriculum check list

According to Kelsey & Steel, (2001), the following questions should be considered in designing the biology curriculum: Is your fieldactivity curriculum properly designed and integrated with other parts of the school program? Does it have clear aims and learning outcomes and are these assessed? Is the fieldactivity pattern progressive and well-balanced? Does it offer a variety of learning experiences? Does it meet the needs of different groups of students? What alternatives are offered for disabled and other students who may be unable to participate in some or all field-based activities? Is the curriculum regularly reviewed and updated? Are student views and feedback sought and used? Does the department know how much it is spending on fieldactivities? Does the existing curriculum offer best value for money?

2.11.3 Field Activities Aims and Learning Outcomes

In broad terms the aims of school fieldactivities can be summarized as follows: to develop students' skills in observation, measurement, and in data and specimen collection, to link theory with practice by relating knowledge derived from reading, lectures and, laboratory work to information and evidence gained in the field, to provide experiential learning, to promote learning through case studies examined at first hand, to promote students' transferable skills, to develop good working relations amongst students and between staff and students, to ensure that students learn how to work safely in the field (McGlashan et al, 2007).In planning a particular field program or course, staff will need to specify which of the above aims (or others) are relevant and to ensure that students are fully aware of the purpose(s) of the work they are being asked to undertake. Students should also be aware of the expected learning outcomes. These are statements of the detailed skills or knowledge they should develop as a result of the field activities. These outcomes (which will tend to mirror the discipline-based curriculum) are often expressed in terms of what students should be able to do or know on successful completion of the field program (Brune, 2002). In the light of aims and learning outcomes, this study sought to establish the extent to which teachers plan to achieve specific aims and learner's outcomes.

2.11.4 Choosing the Location

For exercises which have to be conducted close to the school, there is often only a limited choice of appropriate destinations or sites. However, there may well be a wide range of potentially suitable venues. In weighing up the merits of alternative locations, the list below provides a range of criteria which could be taken into account: Does the area match your curriculum aims? Is it likely to motivate and interest the, students? To what extent does it provide suitable learning environments and academic opportunities? Are there health and safety concerns? Is the level of challenge appropriate for this student group? Is the area already known to you or your colleagues? Is there supporting literature and information? Can you benefit from local contacts? Are there any impediments to student project work (language, access restrictions, site over-use etc.)?' What are the implications for disabled students? Is there suitable and affordable accommodation? What would be the transport costs? (Fulwiler, 2007). Any given area is unlikely to be ideal in terms of all of these criteria and in practice some degree of compromise is inevitable. Given the limitations imposed by the annual academic calendar and by financial constraints, it is possible that problems of timing and cost may play as large a role in location selection as the more desirable educational criteria. This study sought to find out whether schools take effort to establish the suitability of places they visit, or any other consideration they put in place before they visit any area as part of their field activities.

2.11.5 Teaching, Learning and Assessment

Although field activities are certainly a distinctive form of educational experience, the basic rules of good practice still apply (Windschitl et al, 2007). For example, aims and learning outcomes need to be made explicit, the level of the work has to match the students' background, and at least some of the tasks need to be open-ended so as to allow the students to be imaginative and resourceful. This section of the literature makes no attempt to re-state all the features of good educational practice but instead highlights a number of issues which have particular relevance to field activities.

2.11.5.1 Preparation. Field activities are sometimes expensive and so as much as possible of the time away must be spent 'on task'. It is important, therefore, to ensure that students are well prepared and briefed in advance. If, for example, they are visiting an area with which they are unfamiliar, a good deal of background or contextual information can be presented before the trip. This can be achieved by set reading, web sites, lectures or seminars. A handbook could be prepared containing both academic and logistical information. This kind of provision enables students "to hit the ground running" and to take maximum advantage of their time in the field (Fulwiler, 2007).

2.11.5.2 Staff and Student Expectations. Teachers may have an unrealistic expectation of what students can achieve and perceive at particular sites. Equally, students can easily feel overwhelmed when staff explains what they can see and infer from the field evidence. The group may be dismayed by the apparent wealth of observation that can be obtained and the ease with which staff can pick out relevant features and weave them into a coherent model. Students may then start to regard the whole process of field interpretation as beyond their abilities. This is the route to demoralization and a loss of confidence. It is vital, therefore, for staff to appreciate the difficulties which students face and to give support and encouragement when students develop hypotheses which are erroneous. Everyone involved need to appreciate the value of reasoning in the face of incomplete evidence.

2.11.5.3 Field Note-Books .According to McGlashan et al, (2007),in some disciplines there is a strong tradition of students keeping field notebooks as a record of their personal commentaries on what they have seen and learned. Indeed in geology, the commercial geologist's field notebook belongs to the company and not to him or her. Field notebooks will be fully archived for use by subsequent visitors from the company to the sites recorded. Field notebooks in non-vocational courses can be an excellent device for encouraging students to develop skills of observation - often regarded as one of the main purposes of field activities. If assessed, they can also provide a means of ensuring that students remain "on task" and alert throughout the day. However, given the difficulties of producing neat work in the field (or on the coach), there are obvious limits to what can be achieved in terms of standard of presentation. Particularly if notebooks are to be assessed, staff will need to provide guidance on their content and format and on the evaluation criteria by which they will be judged.

2.11.5.4 Local Experts. Field activities can provide an opportunity for students to meet a variety of local professionals such as planners, foresters, ecologists, academics, industrialists, farmers, conservationists and estate managers. Such people can provide real local insights together with at least a brief impression of their professional responsibilities (a useful glimpse of possible careers). The student experience of field activities can be substantially enriched by these contacts. Under these circumstances, the role of academic staff becomes one of organizer and 'compare': it is also important to place the local expert's comments in context and to link them back to theories and ideas drawn from the mainstream academic curriculum. Making connections between theory and practice is an important part of learning in the field (Windschitl et al, 2007).

2.10.5.6 Group Projects. Field activities provide many opportunities for active learning but foremost amongst these is the opportunity for students to engage in group projects. These are mini-research exercises typically involving a group of four to six students and stretching over two or three days. The degree of staff involvement in the project's formulation, design and execution will depend on the level of the students' capacity for autonomous learning. Such projects can develop students' research skills and provide experience in team work (Lener and Pinou, (2007).

2.11.5.7 Large Classes. Large student numbers present a challenge to the traditional model of field activities which were generally based on small groups receiving intensive tutoring designed to further an inquiring and questioning attitude. There is a danger that with large numbers, field trips become walking lectures (or even bus tours with commentary) and students become passive. The issue of how to undertake field activities with large student numbers has been addressed by Jenkins (1994) and Ternan *et al.,* (1999). First is that large cohorts can, of course, still be divided into small groups for project work. Assuming student/staff ratios on field courses do not substantially deteriorate (and for safety reasons they are unlikely to do so) then it may be perfectly feasible to continue to offer the small group experience. The second point refers to the numbers of students one can address at a field site. In some places large groups will pose real problems in that they cannot all be physically accommodated, because those at the back simply cannot see or because slow walkers are still arriving as the mini-lecture ends. For students, this kind of field experience can be very frustrating. In so far as possible, field trip itineraries need to be designed to avoid this kind of problem by careful choice of route or by working in small or medium-sized groups. It is important that all students have comparable opportunities to learn from their fieldwork.

2.11.5.8 Social Considerations. Teachers claim that field courses provide an excellent opportunity for getting to know students. Indeed, this is often said to be one of the most important benefits of field activities.

2.11.5.9 Assessment. Most field activities are too important for them not to be assessed: indeed, if marks are not attached, there is a danger of the least motivated students perceiving it as simply a day out or week away with their friends. According to Orion and Hofstein, (1994), the nature and form of assessment obviously needs to match the intended learning outcomes. Where group work has been involved, attention will need to be given to the question of whether to assess the group as a whole or whether to require an individual report from each group member. Peer evaluation is another way of dealing with this issue; it is possible, for example, for a proportion of the marks to be devoted to peer review of each student's contribution. The assessment of field activities opens up a range of possible alternatives and an opportunity for getting away from the over-used, standard essay. It may, for example, be appropriate to use field note books, research reports, videos, verbal presentations, posters, travel articles, role plays, travel brochures or other more unusual modes of assessment. Whichever format is adopted, it is important to make the criteria clear to the students and to reward work which shows evidence of first-hand and personal observation in the field (Lener and Pinou, (2007).

2.11.5.10 Safety: According to Pope, (1992), safety has always been an important issue in fieldwork education and, as indicated earlier, it must be built into fieldwork planning at the outset. Departments must produce general guidelines for safety in the field together with a formal Risk Assessment for each field trip. Students should receive written warnings about particular hazards and this documentation must be augmented by verbal reminders both before and during the trip. Legal proceedings following accidents on fieldwork can and do occur. Safety is not a matter that can be taken lightly.

2.12 Biology Teacher's Perceptions on the Potential of and Barriers to Outdoor Teaching

One focus in this thesis is teachers' perceptions on the use of field activities as instructional media. Therefore, it is relevant to summarise earlier research on teachers' perceptions on the potential of and barriers to outdoor teaching. A number of studies have reported teachers' perceptions on advantages of and barriers to outdoor teaching and learning (Bentsen et al., 2010; Bixler and Floyd, 1997; Dyment, 2005; Ernst and Tornabene, 2012; Han and Foskett, 2007; Moffet, 2011; Rickinson et al., 2004; Tal, 2001; Tal and Morag, 2009; Simmons, 1998; Smith, 1999; Szczepanski et al., 2007; Taylor, Power and Rees, 2010; Waite, 2011). In summary, well-documented teachers' perceptions of barriers include lack of confidence to teach outdoors, time and resources, as well as over-crowdedness and inflexible curricula. Disciplinary issues, such as students' behaviour and lack of interest, are also a concern to teachers. Safety concerns are sometimes reported as a barrier, although not in the Kenyan context. One conclusion is that fieldwork and learning on school grounds are not frequently practiced (Dyment, 2005; Han and Foskett, 2007; Taylor, Power and Rees, 2010). The frequency of outdoor teaching typically decreases with student age (Dyment, 2005; Jordet, 2010; Bentsen et al., 2010) perhaps because primary schools are more effective at using their school grounds and local areas, which reflects greater flexibility in the schools' timetables (Taylor, Power and Rees, 2010). However, despite the barriers, teachers' have also discussed the many advantages. There does not seem to be a limitation on the type of subjects that can be taught outdoors (Dyment, 2005; Jordet, 2007; Szczepanski, Malmer, Nelson and Dahlgren, 2007), but science seems to be the most regularly taught subject according to Dyment. Acknowledging national differences in context and approach, the assumptions for the potential advantages of outdoor teaching and learning are general. Several rationales were set forth in an intervention study on outdoor teaching in primary school (Szczepanski et al., 2007). Overarching answers from teachers' were that the outdoor context improved meaningful, multidisciplinary and multisensory learning. Outdoor learning facilitated links between theory and practice, and the value of the out-of-school context as 'authentic and real' were other reported advantages. However, the answers were given on a general level. In the study conducted by Mygind and colleagues (2005), teachers' found that nature improved cooperative, experiential and inquiry-based learning, but the inquiry-based and student-centered approaches often collided with teachers' intentions and plans for curriculum goals (Stelter, 2005). The potential for outdoor learning to promote experience-based learning opportunities in 'real-life' contexts are further supported by Dyment (2005), Jordet (2007), Moffet (2011) and Waite(2011).Research by Barker, Slingsby and Tilling, (2002), Lock Tilling, (2002) and Tilling, (2004) that there has been a 25% decline in biology fieldactivities over the past 20 years. This could be as a result of the following factors;

2.12.1 Financial Influences:

Costs are known to be a major influence on present-day fieldwork provision, but this has also been true in historical surveys (Lock and Tilling, 2002), Tilling (2004) and Fido, (1982). There is a heavy reliance on parental/guardian contributions, even in the most disadvantaged boroughs, (Field Studies Council/DES 2004). There is some evidence that the decline in biology fieldwork has been more pronounced in the public compared to the private schools, Stagg et al. (2004). Costs are not the exclusive, or even the most important, barrier in some teacher surveys Tilling (2004). Even with 100% funding many schools will not take up opportunities, (Field Studies

Council/DfES (2004). There is concern within schools that financial support targeted through measures such as free school meals excludes a significant number of deserving pupils (DfES 2004).

2.12.2 Curriculum Influences

The curriculum is the major critical factor amongst many teachers (Tilling, S. 2004). The statutory requirement to carry out fieldwork has a major positive impact on levels of biology field activities. Curriculum specifications, has had a major impact on the numbers and timing of field courses, (Lock and Tilling, 2002). A strong curriculum requirement also affects content of inspections—this affects profile of outdoor learning within schools; "if it isn't inspected it isn't important" (Croft, and Thomas, 2004). Research done by Stagg, et al. (2004) indicates that nearly two thirds of biology teachers feel that there is insufficient time for fieldwork. This study sought to determine the relationship between the biology curriculum and use of field activities.

2.12.3 Organization and Integration of Field Activities

There is evidence that well planned and appropriately delivered field activities can add significantly to educational achievement (Nundy, 2001) and Rickinson, et al. (2004).The delivery of fieldwork is variable in biology—students' descriptions ranging from "inspiring' to "tedious and dull' (Stagg, et al. 2004). There is a very strong association with techniques, skills and coursework—and associated assessment—in secondary science field activities. This has been described as "unbalanced' in meeting of biology educators, (Field Studies Council 2004). The outdoor experience is sometimes poorly integrated into the school, and often lumped into the end-of-year "activity' period (Amos and Reiss, 2004). The study therefore sought to establish how field activities are organized and integrated in the biology curriculum.

2.12.4 Qualification and Motivation of Teachers

Most biology teachers and students think that fieldwork is important (Stagg, et al. 2004). There is strong evidence that many trainee teachers are entering the profession with little previous fieldwork experience: for example, nearly half of trainee biology teachers (all with good biological sciences degrees) had less than two days fieldwork in total during their previous school and university experience (Harrison, 2004). A survey of students'/teachers' ability to recognize common plants has demonstrated that most participants will be able to name fewer than two out of 10 plants (Amos and Reiss, 2004). Strengthening the provision of teacher training and in-service support is seen as critical in many surveys (Field Studies Council 2004).

2.12.5 Effect on Teacher Workload

Negotiating timetable cover, and paying for supply cover, is a major barrier cited by teachers who are trying to organize field activities. This appears to have become more of a problem as courses have become increasing modularized, thus reducing flexibility, (Tilling, S. 2004). There is concern that the workload agreement may have an impact on field activities, particularly where there is a requirement to undertake such work.

2.12.6 Administrative Support

Excellence and equity in science teaching and learning in urban schools are determined by various social, cultural, and linguistic factors by the major players in the arena (Fraser-Abder, Atwater, Lee, 2006). Urban school teachers continue to seek avenues to engage their students in a meaningful way while addressing other external variables that play a significant role in daily classroom behavior. To promote goals established for student learning, reform efforts in science education have focused attention on classrooms and how teachers can improve their instructional practices (Schneider, Krajcik, and Blumenfeld, 2005). Although educators agree that the 1996 National Science Standards has prompted a focus on inquiry based instructional strategies, however, there is a need for urban school administrators to address the issue of teacher preparedness in addressing inquiry-based science instruction (Basista, Tomlin, Pennington, and Pugh, 2001).

Secondary school science classrooms often lack appropriate science instructional materials and supplies, a state of affairs often exacerbated by more generalized lack of resources and funding in schools serving large numbers of underperforming and underrepresented groups of students (Fraser-Abder, Atwater, Lee, 2006). Administrators have to reflect on this lack of resources and funding as a major cause of the achievement gap and the teacher attrition, as well as student and teacher low moral as they plan and design relevant professional development opportunities for secondary science teachers. Basista, Tomlin, Pennington, and Pugh (2001) in their study, emphasized the need for administrators to participate in professional developments focusing on inquiry based instruction. Professional development for administrators to understand and support an inquiry based pedagogical strategy is important in effectively supporting urban teachers in their quest to reform instruction. According to the National Commission on Mathematics and Science Teaching for the 21st Century (2000), administrators need to understand that effective teacher professional development will, (1) deepen their knowledge of the subject; (2) sharpen their teaching skills in the classroom; (3) keep up with developments in their fields, and in education generally; (4) generate and contribute new knowledge to the profession; and (5) increase their ability to monitor students' work, so they can provide constructive feedback to students and appropriately redirect their own teaching, and invoking their use of complex reasoning and experimental inquiry skills.

2.13 Outdoor Teaching and Learning in Secondary Schools

The majority of research on outdoor teaching and learning in a secondary school context was conducted on classes travelling to particular sites, such as environmental education centers, natural parks or other natural or urban places, participating in an activity, and soon thereafter, they are quantitatively evaluated for academic or affective consequences. Examples include studies in ecology where students that attend an outdoor program (Eaton, 1998; Prokop, Tuncer and Kvasnicak, 2007) or participate in field work (Hamilton-Ekeke, 2007; Manzanal, Barreiro and Jiménez, 1999) made greater cognitive gains than the control groups. A more qualitative approach to explore the influence of the outdoors in learning ecology was discerned in a study by Magntorn and Helldén (2007), where they explored 13- to 14-year-oldstudents' abilities to transfer ecological knowledge between ecosystems. They found that human influence and abstract processes, such as energy flow and matter cycling, were difficult to understand in a new ecosystem. They also researched tertiary students' perspective on learning in nature (Magntorn and Helldén, 2005). Field trips were perceived as a significant part of learning ecology because the students could explore, discuss and link theory to practice. An additional qualitative study was conducted by Rozenszayn and Ben-Zvi Assaraf (2009), who revealed that collaborative outdoor learning in ecology had a positive effect on student's knowledge construction and long term knowledge retention. Openshaw and Whittle (1993) questioned the effectiveness of ecological field trips and argued that students' problems with ecological concepts must be understood first for a field trip to have an impact, and an excessively unstructured learning environment may negatively impact the learning outcome. However, Stewart (2003) found that students' long-term recollections from learning in a botanical garden were linked to their teachers' expectations. Experience-based learning at environmental education centers seem to positively influence student learning, but the most effective learning experiences are likely those that integrate outdoor and reflexive classroom learning (Ballantyne and Packer, 2002, 2009; Ballantyne, Anderson and Packer, 2010).

2.13.1 Social and Affective aspects

Few studies have explored secondary students' attitudes toward outdoor learning. A three-year long action study of six secondary schools involved in improving their school grounds demonstrated the benefits for participating students, such as increased self-confidence, decision-making skills and collaboration (Rickinson and Sanders, 2005). Participating in the project benefited curriculum-related learning, particularly the technology curriculum. Other reported effects from school grounds and community projects include stronger links between the school and broader community as well as a greater sense of belonging and responsibility (Rickinson et al., 2004). Studies that have explored the affective consequences of environmental education centres and botanical gardens suggest that students appreciate outdoor teaching and learning (Ballantyne and Packer, 2002; Ballantyne, Anderson and Packer, 2010; Stewart, 2003). Uitto, Juuti, Lavonen and Meisalo (2006) showed that out-of-school nature experiences was the most important factor that correlated with an interest in biology for Finnish secondary students. In a study on mathematics outdoor camps in Malaysia, a country where students are rarely taught in outdoor settings, students valued learning mathematics outdoors and enjoyed the new learning environment (Noorani et al., 2010).

2.14 Research in Pre-school and Primary school

The trend with quantitative evaluations of knowledge and attitudes, from short-term outdoor programs, is found also in the primary school contexts (Cachelin, Paisly and Blanchard, 2007; Dimopoulos, Paraskevopoulos and Pantis, 2008; Nundy, 1999; Powers, 2004) with mixed results. Greater cognitive gains from outdoor programs were observed than with classroom learning (Cachelin, Paisly and Blanchard, 2007), but student background had a greater effect than the length of the visit (Powers, 2004). Nundy (1999) emphasised the relationship between cognitive and affective influences and argued that they are intertwined and provide a bridge to higher-order learning. There are also a number of qualitative studies that have explored the academic, social and affective consequences (Beames and Ross, 2010; Byrd etal., 2007; Dismore and Bailey, 2005; Carrier, 2009; Miller, 2007; Moffet, 2011; O'Brien and Murray, 2007; Waite, 2011). In response to the critique that outdoor education often is fragmented and decontextualised (e.g., Brookes, 2002), Beames and Ross (2010) studied students' learning in 'outdoor journeys', which transpired in the neighbourhood surrounding the school. They reported that journeys outside the classroom support cross-curricular learning connected with the location. For example, a real-life situation outdoors was reported as valuable in children learning mathematics (Dismore and Baily, 2005; Moffet, 2011). Several authors have emphasized the affective dimension of outdoor teaching (Dismore and Baily, 2005; Moffet, 2011, O'Brien and Murray, 2007; Waite, 2011). Children's enjoyment and interest were reported as significant consequences of outdoor teaching, and student-centered learning and task ownership also seem to be important consequences (Beames and Ross, 2010; Waite, 2011).Two longitudinal school-based case studies were conducted in Scandinavian primary schools (Jordet, 2007; Mygind 2005). Their findings suggest that an outdoor environment can be used for all subjects and support affective and social advantages. Children's engagement in outdoor learning seemed not to decline during a three-year-long forest school project (Mygind, 2009). Although the sample was small and the results were ambiguous at times, Mygind's results indicate that well-being and social relationships were favoured in the school forest setting. Children's statements on aspects of teaching and learning did not differ significantly. However, there are little documented studies on outdoor teaching in biology in Kenya, both in pre-primary, primary and secondary school contexts hence the need for this study.

2.15 Summary

This chapter has presented various aspects of fieldactivities and the factors affecting the use of fieldactivities in the teaching of biology in secondary schools. The evidence points to a range of values for fieldactivities across the age range and across subjects. To quote from a recent review of outdoor learning (Rickinson et al. 2004, p. 28):

> *Substantial evidence exists to indicate that fieldwork, properly conceived, adequately planned, well-taught and effectively followed up, offers learners opportunities to develop their knowledge and skills in ways that add value to their everyday experiences in the classroom.*

This means that field activities are an essential element in biology instruction and can help achieve learning objectives as stated in the biology curriculum. However, as evident from the existing literature, little is documented on knowledge, attitude and skills on the use of field activities especially in Kenya. To fill this gap is the need for this study, the contextual factors affecting the use of field activities in secondary schools in Kenya.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The objectives of this study were: to establish teachers' use of field activities; to establish the relationship between teachers' knowledge and their use of field activities; to determine the relationship between teachers' attitude and their use of field activities; to establish the relationship between teachers' skills and their use of field activities; to determine the relationship between the biology curriculum and the use of field activities; to establish the effects of administrative support on the use of field activities and also to establish the relationship between time and timetable factors and the use of field activities. In order to achieve these objectives, this chapter details the methodology that was used to collect data, discusses the design of this research and justifies why quantitative survey methodologies were used. It also describes the instruments used to collect data, the pilot (pre-test), the sampling frame and sampling procedures. Reliability and validity of the instrument and ethical considerations related to this research are also outlined. Lastly, a summary of the chapter is provided.

3.2 Research Design

There are three types of research designs namely qualitative, quantitative, and mixed methods. This study used mixed methods research design which combines methods, philosophies and research design orientations (Creswell and Plano Clark, 2011). A definition of mixed methods research from Johnson, Onwuegbuzie and Turner (2007) is as follows:

> *Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration. (p. 123)*

3.2.1 Philosophical Foundations in Mixed Methods Research

At least two major different philosophical foundations compose mixed methods research. One is the use of multiple worldviews. Thus, multiple paradigms can be used in mixed method research. During the qualitative phase, the constructionist paradigm is used, and the quantitative phase is informed by the post-positivist paradigm. This approach is sound as long as the researcher is explicit (Creswell and Plano Clark, 2011). No paradigm is perceived as superior, but they are simply regarded as different and valuable for different research phases. However, the most common philosophical foundation for mixed methods research is adopting a pragmatic approach (Creswell and Plano Clark, 2011; Morgan, 2007). This is an alternative way of approaching commensurability with different perspectives. With a pragmatic foundation, ontology and correspondence are not the primary concerns. A pragmatist is concerned with opening up the world to social inquiry and choosing the methods that best support the research aims (Morgan, 2007; Johnson and Onwuegbuzie, 2004). The goal is to utilise the strengths of the different approaches by combining them and searching for workable solutions and improvements (Onwuegbuzie and Johnson, 2006). According to Morgan (2007), the pragmatic approach is described as follows:

> *In a pragmatic approach there is no problem with asserting both that there is a "real world" and that all individuals have their own unique interpretations of that world. Rather than treating incommensurability as an all or nothing barrier between mutual understanding, pragmatists treat issues of inter subjectivity as a key element of social life. (p. 72)*

The foundation for the design of this thesis is the pragmatic approach. The assumption is that a combination of qualitative and quantitative research approaches is the best method for approaching the research aims and better understanding the phenomena. An additional assumption is that 'workability' and mutual understanding are better guiding principles than ontology and correspondence (Morgan, 2007).

3.2.2 An Ontological and Epistemological Perspective

Generally, theses stimulate reflections on ontological and epistemological questions. The researcher’s choices for research questions, methodologies and methods are influenced by understanding what comprises the world and how we come to know it. Research is an activity aimed at understanding a phenomenon.

The ontological foundation for this thesis adopts that of a moderate realist or an interpretative pragmatic realist perspective (Lenk, 2009). This world view implies a belief in a world that is independent from humans and our language but is aware of the interpretative social construction of knowledge. It is definitely easier in the natural sciences than social sciences to distinguish between the knower and the known and rely on an independent reality. The researcher’s role is much more complex and intertwined when other people are the object of study and the researcher’s role can be described as a creator in the research process (Charmaz, 2006). According to Lenk (2009), interpretative pragmatic realism leads to a manifold picture.

We have no last, ultimate foundation which cannot be doubted at all, which would render a conceptual or linguistic formative basis to build a safe intellectual construction on it. We however do not operate like a rope artist without net, but we ourselves on the basis of biological fixed dispositions and formal operational necessities /.../ we ourselves would knit or construct our nets in which we try to catch or capture elements and parts of the world. Thus we elaborate our own net including the rope on which we try to balance ourselves. These nets and ropes may be extended and modified /.../ any “graspability” whatsoever is interpretation-laden. The world is real, but “grasping” the world is always interpretative. (p. 20)

The epistemological perspective underlying this thesis is best characterised as post-positivist, as a median between positivism and constructivism (Tashakkori and Teddlie, 1998; Zammito, 2004). Applying the pragmatic realist ontology outlined above in a post-positivistic context, science is not isolated from humans and society, which is in contrast to the more ideal logic positivism perspective. Our understanding of reality is perceived as socially constructed with no value-free inquiry. Further, post-positivists know that observations are theory-laden and do not mirror an objective independent reality.

Thus, the results herein are perceived as interpretative, but they are also not solely social constructions. An assumption is that these results indicate something beyond the immediate situation and that an additional researcher with the same focus would not have generated fundamentally different results. However, as Miles and Huberman (1998) noted, ‘a useful theory should apply to more than one case. The assessment of local causality should be tested and deepened through application of the casual explanation to other cases’ (p. 147).

3.2.3 Survey-Based Research

Survey methodology was the most appropriate tool to collect the data for the following five reasons. First, it is designed to deal more directly with the nature of respondents’ thoughts, opinions and feelings (Shaughnessy and Zechmeister, 1997) and collect information on belief, attitudes and motives (Burns, 2000). Second, it is an effective tool, especially when the investigator does not require, or has little control over behavioral events (Yin, 1994). Third, it provides accurate means of assessing information about the sample and enables the researcher to draw conclusions about generalizing the findings from a sample of responses to a population (Chisnall, 1992; Creswell, 1994). Fourth, it is more concerned about causal research situations (Hair et al., 2003). Finally, it is considered useful because it is quick, inexpensive, efficient, and can be administered to a large sample (McCelland, 1994; Churchill, 1995; Sekaran, 2000;. Hair et al. (2003) regards large samples (i.e., 200 or more respondents) as one of the main reasons for using a survey research method.

Although the survey method has its advantages, criticisms have arisen in regards to its reliance on self-report data (Spector, 1992). This becomes a problem when both the independent and dependent variables are assessed within the same instrument (Campbell, 1982), raising questions about the conclusions drawn from systematic response distortion, and the reliability and validity of the measures used in the instrument. Further, a lack of control that researchers have over timeliness, difficulty in determining whether the selected respondents are being truthful and lack of detail and depth of information, are seen as other problems associated with survey methods (Hair et al., 2003). For these reasons, the guidelines recommended by Hair et al. (2003) were taken into account to ensure precision, and to avoid those problems associated with the survey methods. In order to address these issues, the following steps were taken. First, previously tested, reliable and valid scales to measure the underlying constructs were used. Systematic response distortion was addressed by ensuring that the questionnaire and interview schedule were designed in a way that was easy for the respondents to understand and was free of response bias. As for the issue of research control, any research method has its own limitations. However, the above mentioned five reasons for choosing the survey methods were strong factors for use in this thesis.

3.3 Study area

The study was carried out in selected secondary schools in Uasin Gishu county of Rift Valley Province. Uasin Gishu County is located 350km North-West of Nairobi, the capital city of Kenya. It borders six other districts namely; Trans-Nzoia to the North, South Nandi to the South West, Keiyo and Marakwet to the North East, Lugari to the North West and Koibatek to the South East. It lies between latitude -$0^0$03'and 0^o551' North and longitude $34^0$50' and 35^o37'East. It covers an area of 3,784 sq.km. with a population estimated at 795,970 (UasinGishu District Development Plan, 2002-2003, Republic of Kenya, 2004).The researcher found the county most appropriate for the study because it has secondary schools of all the three types, District, Provincial and National schools. There is also very little known research on outdoor teaching in Biology. Due to limited time and finances, the researcher found it appropriate to confine the study to this area. The county is cosmopolitan in nature and has fairly well developed social economic infrastructure.

3.4 Population size

The target population of this study included all the 318 trained biology teachers in the public and private secondary schools in Uasin Gishu County (Uasin Gishu County Education, Office Records, 2011) and the Kenya National Examinations Council Report. Out of the 159 secondary schools, 126 were public and 33 were private schools.

3.5 Sample and Sampling Procedure

The target population of this study included all biology teachers in public and private secondary schools. The population was so large that it was difficult to access all classroom teachers in Uasin Gishu County. Thus, sampling procedures were employed. By sampling, it was considerable that the sample selected was representative of the target population. There were 126 public and 33 private secondary schools; with a total of 318 biology teachers in Uasin Gishu County as at October 2011. Among the sampled teachers, questionnaires were randomly distributed, and 135 of them returned the questionnaires administered resulting in a response rate of 77.6%. It was required to obtain a sample of at least 174 biology teachers with regard to Cochran (1962)'s sample size formula, n= $[t^2 (PQ) / d^2][1+ (1/N) t (PQ) /d^2]$ (Cited in Balci, 2001). According to this formula, N refers to the size of the population of interest (N=318) while n means the required minimum sample size. By d, the level of significance (herein d is equal to .05) is meant. Besides, t refers to values corresponding to proportions in one or in two tails combined (herein t = 1.96). Finally, by (PQ), sample percentage for a maximum sample size is meant herein (PQ) is equal to (.05). (.05) = .25 (Cochran, 1962).

3.6 Research Instruments

Self-administered questionnaires were used to collect data aimed at achieving the following research objectives:To establish the relationship between teachers' knowledge and their use of field activities; To determine the relationship between teachers' attitude and their use of field activities; To establish the relationship between teachers' skills and their use of field activities; To determine the relationship between the biology curriculum and the use of field activities; To establish the effects of administrative support on the use of field activities and also to establish the relationship between time and timetable factors and the use of field activities. Structured interviews were carried out to find out teachers' views on the use field activities as an instructional method in biology. Document analysis on KCSE biology past papers was also carried out to find out whether they require knowledge of out-of-classroom experiences.

3.6.1 Self-Administered Questionnaire

Due to their effectiveness in gathering empirical data from large samples (McCelland, 1994), questionnaires are the most frequently used method of data collection (Clarke, 1999; Saunders et al., 2003). The questionnaire is “a reformulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives” (Sekaran, 2000, p.233). Bowen and Shoemaker, 1998; Bloemer and de Ruyter, 1999; Pritchard et al., 1999; Hennig-Thura et al., 2002; Kim and Cha, 2002; Wang et al., 2006). These considerations made using a questionnaire the most effective data collection tool for this thesis.

Self-administered questionnaires, the methodology used in this thesis, is described as “a data collection technique in which the respondent reads the survey questions and records his or her own responses without the presence of a trained interviewer” (Hair et al., 2003, p.265). Self-administered questionnaires present a challenge in which they rely on the clarity of the written word more than on the skill of interviewers. However, this method also has a number of advantages as follows: 1) the population in this thesis included a large number of respondents, and thus self-administered questionnaires can be used to survey quickly and economically compared with other methods such as personal interview or telephone interview; 2) the questionnaire can be completed whenever respondents have time; and 3) it reaches a geographically widespread sample with lower cost because the researcher is not required.

The self-administered questionnaire form used within this thesis is called a drop-off survey. This method involved the researcher traveling to the respondents’ location and hand-delivering survey questionnaires to respondents. Following this, the completed surveys were picked up by the researcher after the respondents had finished (Hair et al., 2003). The two advantages of using this method are outlined by

Hair et al. (2003). They include: the availability of a person to answer questions (i.e., teachers and laboratory technicians); and the ability to generate interest in completion of questionnaires (i.e., researcher can encourage teachers and technicians to complete questionnaires through interaction with them). Furthermore, other means of survey data collection such as mail, web-based survey, and telephone was not possible because of lack of these facilities in most schools.

There are different views in regards to the length of questionnaire. For instance, Frazer and Lawley (2000) outline that an instrument up to twelve pages in length is generally considered as appropriate. Hair et.al (2003, p. 214) recommended that, "a general rule of thumb is that questionnaires should not exceed six pages". All the questions in this thesis including the covering letter were presented on six pages, within the recommended length. Questions are also neatly organized and conveniently spaced to minimize eyestrain. Further, because sequencing of questions can influence the nature of the respondents' answers and can lead to an error in analysis (Kinnear and Taylor, 1996), considerable care was taken. That is, the questionnaire was designed to represent the goal of the research, moving from one topic to another in a logical manner, with questions focusing on the completed topic before moving to the next (Tull and Hawkins, 1990).

The wording and language used in this questionnaire was kept as simple as possible to communicate easily with all respondents. Questions are clear, answerable, unbiased, and suitable to the school context. As recommended by Janes (1999), Fowler (1992), and Frazer and Lawley (2000), the respondents should be able to read and understand the words used in the instrument, as this encouraged them to complete the questionnaires. The draft of instrument was presented to a number of experts in the field to identify any potential problems. As a result, any ambiguity or unclear words were eliminated from the questionnaire. This procedure also served to establish validity and reliability (Churchill, 1995; Frazer and Lawley, 2000). In addition to this, great care was taken by the researcher to design the instrument attractively with easy to follow instructions, which has been found to increase response rate (Janes, 2001; Sanchez, 1992; Babbie, 1990), and minimize measurement errors (Sanchez, 1992).

Respondents were invited to participate in this survey through a cover letter enclosed on the first page of the instrument. The covering letter was important because it encouraged respondents to complete and return the questionnaire (Lukas et al., 2004; Churchill, 1995). This letter introduced the study and its aims and assured confidentiality and anonymity of the respondents as well as providing the researcher's contact details.

3.6.1.1 Scoring of the Questionnaire

The data was collected using a questionnaire consisting of 83 items of which the first 8 items aimed at collecting background information of the respondents and the remaining 75 items measuring teachers' knowledge, attitude, skills and their use of field activities in biology instruction; influence of the curriculum, administrative support and timetable factors on use of outdoor activities in biology. The biology teachers' questionnaire (BTSQ) was a 5-point likert scale. Scale scores were obtained by calculating the average responses such that higher scores indicated a more positive association (Pierce, 1989). The data on use of field activities were obtained by the next 7 items which were rated on a 5-point likert scale ranging from 1 (never) to 5 (always). The second section consisted of 14 items measuring teachers' knowledge on significance of field activities in biology, which were rated on a 5-point likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The next

27 items measured teachers' attitude and skills on use of field activities both on a 5-point likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The last 27 items were aimed at measuring the influences of the biology curriculum, school administration and time table factors on the use of field activities on a 5-point likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire administered to teachers had a provision for any comments. The rationale behind these comments was to provide in-depth information which might not be possible with the items and sustain internal validity of the research (Jaeger, 1988). Besides, these comments were expected to control social desirability threat which is one of the constraints of survey research (Yidirim and Simsek, 2008). Related review of literature has evidence that the respondents have a tendency of replying to the items without in-depth thinking research (Yidirim and Simsek, 2008). Thus, the respondents were assumed to give more sincere respondents by means of open-comments.

3.6.2 Interview Guide

In order to answer the first research question, what are the teachers' perceptions on the use field activities as an instructional method? interviews were carried out. Interviews are a systematic way of talking and listening to people and are another way to collect data from individuals through conversations. The researcher or the interviewer often uses open questions. Data is collected from the interviewee. The researcher needs to remember the interviewer's views about the topic are not of importance. The interviewee or respondent is the primary data for the study. Interviewing is a way to collect data as well as to gain knowledge from individuals. Kvale (1996, p. 14) regarded interviews as " … an interchange of views between two or more people on a topic of mutual interest, sees the centrality of human interaction for knowledge production, and emphasizes the social situations of research data."

Interviews are ways for participants to get involved and talk about their views. In addition, the interviewees are able to discuss their perception and interpretation in regards to a given situation. It is their expression from their point of view. Cohen, Manion and Morrison (2000, p. 267) explain "… the interview is not simply concerned with collecting data about life: it is part of life it, its human embeddedness is inescapable."

The researcher has to know and select the appropriate method for addressing the needs of the research question. Then, the researcher has to make a decision and choose the right method for that study. Data collection has its complexities and demands (O'Leary, 2004, p. 162). It is the role of the researcher to ask questions. The questions ought to elicit valid response from respondents. Hoyle, Harris and Judd (2002, p. 144) comment that questions have " … dual goals of motivating the respondent to give full and precise replies while avoiding biases stemming from social desirability, conformity, or other constructs of disinterest." Interviewers that have been properly trained, and play the proper role of the interviewers along with well-designed questions can conduct a good interview. Hoyle, Harris and Judd (2002, p. 145) agree "… proper training and proper interviewer behavior can help greatly in achieving the goals." There are many reasons to use interviews for collecting data and using it as a research instrument. Gray (2004, p. 214) has given the following reasons: There is a need to attain highly personalized data, there are opportunities required for probing, a good return rate is important, respondents are not fluent in the native language of the country, or where they have difficulties with written language.

3.6.2.1 Structured Interviews

This study used a structured interview. A structured interview is sometimes called a standardized interview. The same questions are asked of all respondents. Corbetta

(2003, p.269) states structured interviews are "… interviews in which all respondents are asked the same questions *with the same wording and in the same sequence."* It would be ideal if questions can be read out in the same tone of voice so that the respondents would not be influenced by the tone of the interviewer (Gray, 2004, p. 215). Bryman (2001 p. 107) explains structured interview entails:

> *… the administration of an interview schedule by an interviewer. The aim is for all interviewees to be given exactly the same context of questioning. This means that each respondent receives exactly the same interview stimulus as any other. The goal of this style of interview is to ensure that interviewees' replies can be aggregated … Questions are usually very specific and very often the interviewee a fixed range of answers (this type of question is often called closed, closed ended, pre-coded, or fixed choice).*

This type of interview introduces some rigidity to the interview (Corbetta, 2003). For example, probing can be a problem area for structured interviews. Respondents may not understand the question and unable to answer it. Moreover, respondents may not have received sufficient information to answer the question. Bryman (2001, p. 118) clarifies, the problem in either situation is obvious: the interviewer's intervention may influence the respondent and the nature of interviewers' ability in respondent's replies that does not reflect 'true' variation. The strengths of structured interviews are that the researcher has control over the topics and the format of the interview. This is because a detailed interview guide is used. Consequently, there is a common format, which makes it easier to analyze code and compare data. In addition, a detailed interview guide can permit inexperienced researchers to do a structured interview.

According to David and Sutton (2004, p. 160) another strength of structured interviews is,

> *"Prompting can be included with the questions and if a question is inappropriate, data on why no response was made can be recorded." Furthermore, non-verbal cues, such as facial expressions, gestures can be recorded.*

On the contrary, drawbacks of structured interviews are they adhere too closely to the interview guide and may be the cause of not probing for relevant information. Also, since there is a set interview guide, the respondents may hear and interpret or understand the questions in a different manner. The researcher's verbal comments and non-verbal cues can cause bias and have an influence upon respondents' answers.

3.6.3 Content analysis

Content analysis was used to answer the second research question; Do the KCSE biology papers require knowledge of out-of-classroom experiences? Content analysis has been defined as a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding (Berelson, 1952; GAO, 1996; Krippendorff, 1980; and Weber, 1990). Holsti (1969) offers a broad definition of document analysis as, "any technique for making inferences by objectively and systematically identifying specified characteristics of messages" (p. 14). Under Holsti's definition, the technique of document analysis is not restricted to the domain of textual analysis, but may be applied to other areas such as coding student drawings (Wheelock, Haney, &Bebell, 2000), or coding of actions observed in videotaped studies (Stigler, Gonzales, Kawanaka, Knoll, & Serrano, 1999). In order to allow for replication, however, the technique can only be applied to data that are durable in nature.

Content analysis enabled the researcher to sift through large volumes of form four biology papers for the past 10 years data with relative ease in a systematic fashion. It can be a useful technique for allowing us to discover and describe the focus of individual, group, institutional, or social attention (Weber, 1990). It also allows inferences to be made which can then be corroborated using other methods of data collection. Krippendorff (1980) notes that "much document analysis research is motivated by the search for techniques to infer from symbolic data what would be too costly, no longer possible, or too obtrusive by the use of other techniques" (p. 51). Document analysis is also useful for examining trends and patterns in documents. For example, Stemler and Bebell (1998). Additionally, document analysis provides an empirical basis for monitoring shifts in public opinion.

3.7 Pre-Test

Reynolds and Diamantopoulos (1998) maintain that there is wide agreement among scholars that pre-testing is an integral part of the questionnaire development process. As Hunt et al. (1982, p.270) pointed out, the researcher needs to ask: “Will the instrument provide data of sufficient quality and quantity to satisfy the objectives of the research?”(p.270). The benefits of a pre-test prior to conducting the main survey have been supported by numerous researchers (Hunt et al., 1982; Blair and Presser, 1992; Reynolds and Diamantopoulos, 1998 ;). Pre-test is defined as “a trial run with a group of respondents used to screen out problems in the instructions or design of a questionnaire” Blair and Presser, (1992).

Blair and Presser (1992) found real differences between pre-test methods. This was confirmed by Reynolds and Diamantopoulos (1998), who noted several disagreements among scholars about the best method for pre-test administration. Overall, the methodological literature has been found to distinguish between three types of pre-test methods (Hunt et al., 1982; Blair and Presser, 1992; Churchill, 1995; Reynolds and Diamantopoulos, 1998), including planned field survey, personal interviews (face-to-face), and expert panel. The first of these, planned field survey, employs a small sample referred to as ‘pre-testing’. The second, personal interview is where the interviewer is required to identify any obstacles, difficulties, or incomprehensible questions blocking respondents’ ability to provide accurate answers. The third is when an expert panel is asked to judge the instrument and determine any problems it presents.

The above three methods are critically analyzed by Reynolds and Diamantopoulos (1998), who found that a planned survey is useful because it covers all aspects of the field survey, and is less likely to be affected by interaction between the respondents and interviewer. However, a problem with this method is that respondents who are not the targeted sample might complete the questionnaire. Therefore, they suggest that personal interview is the most effective means of conducting a pre-test, due to the accuracy and completeness of the information generated. Although this method is subject to errors resulting from interaction between the interviewer and participants (i.e., bias introduced by interviewers), expert panels (the last method) could be used to determine if there are problematic questionnaire items. In order to minimize any error or bias, all of these methods were used (see pre-test procedures).

3.7.1 Pre-Test Sampling Frame

Hunt et al. (1982, p.269) posed two main questions in discussing the sampling frame for a pre-test. These questions were “who should be the subjects in the pre-test?” and “how large a sample is needed for the pre-test?” For the first question, it was necessary to include subjects who are similar to those approached in the actual survey (Tull and Hawkins, 1990). Hence, a small number of respondents with certain characteristics were deemed to be more efficient in exploring errors in the survey instrument than respondents chosen randomly from the population of interest (Reynolds and Diamantopoulos, 1998). The sampling frame for a pre-test consisted of teachers in Nakuru District that correspond with the population to be studied. These subjects formed the population of interest in the purposive sample generated from the selected schools. In the case of pre-test sampling size (the second question), there is little agreement in the literature (Hunt et al., 1982). For example, Zatalman and Burger (1975) did not specify size, simply recommending a ‘small’ sample. Others such as Boyed et al. (1977) indicated that a sample of 20 is adequate. Luckas et al. (2004) point out a size of 50 respondents allows the running of proper statistical testing procedures. Accordingly, 60 questionnaires were distributed to respondents at these schools, aiming for a completion of at least 50 respondents. Subsequently, 53 questionnaires were returned.

3.7.2 Pre-Test Procedures

Because there are limitations to each of the pre-test methods, many researchers have recommended using different combinations of approaches (i.e., Blair and Presser, 1992; Churchill, 1995). As a result, expert panel, interviews, and planned field survey methods were used to pre-test the questionnaire of this thesis in order to overcome the shortcoming of using one method. The first procedure involved distributing the draft to experts, that is senior lecturers in the School of Education, Department of Curriculum, Instruction, and Educational Media (C.I.E.M). The experts evaluated the questionnaire to: 1) assess the relevance of its conceptualization of educational research operation; 2) appraise the suitability of the terminology to the school context; and 3) make further suggestions, criticism and comments on the questionnaire and its facets. The questionnaire was modified and refined before conducting the pre-test survey.

3.8 Reliability and Validity

Reliability and validity are separate but closely related concepts (Bollen, 1989). Here, a measure may be consistent (reliable) but not accurate (valid), and alternatively, a measure may be accurate but not consistent (Holmes-Smith et al., 2006). That is, an instrument is valid if it measures what it supposed to measure and reliable if it is consistent and stable (Sekaran, 2000). Therefore, in order to ensure the quality of the findings and conclusions of this thesis, both validity and reliability were assessed. Cronbach's (1951) coefficient alpha was computed to assess reliability, while content, construct, and external validity were examined for validity. Both reliability and validity assessments are discussed below.

3.8.1 Reliability

Zikmund (2003, p. 330) defines reliability as "the degree to which measures are free from random error and therefore yield consistent results". That means reliability refers to the extent to which a scale produces consistent results if repeated measurements are made on the variables of concern. Reliability and error are related, and thus the larger the reliability, the smaller the error (Punch, 1998). Therefore, the main objective of reliability is to minimize the errors and biases in a research (Yin, 1994). Reliability can be assessed through two main dimensions: 1) repeatability and 2) *internal consistency (Zikmund, 2003). The first dimension, repeatability, can be* explored using two methods, including test-retest, and alternatives. Test-retest method entails the administration of the same instrument on two different occasions to the same sample of respondents, taking into account the equivalent conditions. In this case, a correlation coefficient is computed to confirm the degree of similarity between the two tests. However, two main problems proposed by Kinner and Taylor (1996), and Zikmund (2003) are associated with this method, making it not suitable for use in this thesis. First, the initial test influences respondents' responses in the following tests. That is, respondents may have learned from the first test to change their attitude when the other is conducted. Second, respondents may change their attitude due to the time factor. For example, if the time between the two tests is long, respondents may change their attitude and thus the longer the time interval between the tests, the lower the reliability. The alternative-form method "is used when two alternative instruments are designed to be as equivalent as possible" (Zikmund, 2003, p.331). In this case, these two measurement scales are administered to the same group of respondents. When the correlation between the two forms is high, that means the scale is reliable (Zikmund, 2003). However, it is difficult in all cases to construct two equivalent forms of the same instrument.

Because the above mentioned methods have shortcomings, they are not appropriate for use in this thesis. Therefore, the researcher decided to look at the internal consistency – the second dimension of reliability, which is "used to assess the reliability of summated scale where several items are summed to form of total score" (Leedy and Ormrod, 2001). If they are reliable, the items will show consistency in their indication of concept being measured. The most basic method to measure of internal consistency is split-half reliability. This method involves dividing a multi-items measurement into two halves, and thus checking the results obtained from the first half of the scales items against the results from the other half. While this method has been widely used in the literature, it has limitations in that results rely on how the items are divided. To avoid this problem, Cronbach's (1951) coefficient alpha, one of the most common methods in gauging reliability (Nunnally, 1978; Peter, 1979; Sekaran, 2000), is considered appropriate. This technique estimates the degree to which the items in the scale are representative of the domain of the construct being measured. It is a measure of the internal consistency of a set of items, and is considered 'absolutely the first measure' one should use to assess the reliability of a measurement scale (Nunnally, 1978; Churchill, 1979). Added to this, Cronbach's coefficient is important in measuring multi-point scale items (i.e., 5-point Likert scale used in this thesis) (Sekaran, 2000). Accordingly, this method of internal consistency was adopted to assess the reliability of the measures in this thesis.

3.8.2 Validity

Reliability alone is not sufficient to consider that an instrument is adequate (Anderson and Gerbing, 1988; Dunn et al., 1994; Hair et al., 1995). Therefore, validity was required to validate the constructs of this thesis. According to Zikmund (2003, p.331), validity means "the ability of a scale to measure what is intended to be measured". Neuman (2003) points out that the better the fit between the conceptual and operational definitions, the greater the measurement validity. Added to this, validity represents the relationship between the construct and its indicators (Punch, 1998). Nunnally and Bernstein (1994) suggest there are three important aspects of a valid construct. First, the construct should be seen to be a good representation of the domain of observable related to the construct. Second, the construct should well represent the alternative measures. Finally, the construct should be well related to other constructs of interest. Taking into account these considerations, three types of validity, including, content and construct (convergent and discriminant validity) were examined in this thesis. These were related to the internal validity of the scales and their respective items. As for the purpose of the generalisability of the research findings, external validity was also investigated.

3.8.2.1 Content Validity

Content or face validity is the first type used within this thesis. Content validity is a subjective but systematic assessment of the extent content of a scale measures a construct (Zikmund, 2003).When it appears evident to experts that the measure shows adequate coverage of the concept, the measure has face validity (Zikmund, 2003). In order to obtain content validity, this thesis followed the recommended procedures of Cooper and Schindler (1998) through identifying the existing scales from the literature and conducting interviews with panel of experts, asking them to give their comments on the instrument. The interviews were conducted as part of the pre-test methods discussed earlier in this chapter. Given that content validity has a subjective nature, it is not sufficient to provide a more rigorous empirical test (Zikmund, 2003). Therefore, it was assured a priority to conducting the final survey as a precursor to other measures of validity.

3.8.2.2 Construct Validity

Construct validity is the second type used within this thesis. It is directly concerned with what the instrument is actually measuring. In other words, it refers to how well the results are achieved from employing the measure fitting the theories around which the test is designed (Sekaran, 2000). In summary, this measure of validity refers to developing correct and adequate operational measures for the concept being tested (Yin, 1994). Although measuring reliability and content validity develops ‘internally consistent’ sets of measurement items, it is not sufficient for construct validity (Nunnally, 1967). Construct validity was therefore examined in this thesis by analysing both convergent validity and discriminant validity. Convergent validity examines whether the measures of the same construct are correlated highly, and discriminant validity determines that the measures of a construct have not correlated too highly with other constructs (Sekaran, 2000).

3.8.2.3 External Validity

External validity is concerned with establishing the extent to which the study findings can be generalized to other subjects or groups. In more specific terms, external validity is related to the generalisability of the cause-effect relationships of the research findings (Yin, 1994). Hence, evidence on external validity for this thesis was obtained by employing a representative sample, and using a real-world setting (Leedy and Ormrod, 2001). In summary, the validity of the constructs was established prior to testing the underlying hypotheses. This was important because having valid constructs provides conclusions that help generalize the results.

3.9 Data collection

Once the researcher finalized the instrument and confirmed its appropriateness after conducting the pre-test, a number of procedures were adopted to conduct the final survey and collect research data. As followed in the pre-test, letters of formal invitation enclosed with the instrument were availed to all of the respondents asking them to participate in this research. The information given to the respondents briefly included the aims of the study, its significance to them, intended use of data, time, and issues related to confidentiality and their voluntary participation.

3.10 Data Analysis

Descriptive statistics has been used to present the profile of the respondents. Since some single constructs in the questionnaire are measured by multiple items, the average score of the multi-items for a construct were computed and used in further analysis such as correlation analysis and regression analysis. Pearson correlation analysis was conducted to examine the relationship between the variables (Wei et al., 2008). Multiple regressions were used to test the effect of teachers' factors (knowledge, attitude, and skills), curriculum, administrative and time table factors on the use of field activities. Hypotheses Ho_1, Ho_2, Ho_3, Ho_4, Ho_5 and Ho_6 were tested using the model specification for the exogenous and endogenous variable given as:

$$Y=\alpha+\beta_1X_1 + \beta_2X_2+ \beta_3X_3+ \beta_4X_4+\beta_5X_5+\beta_6X_6+\varepsilon$$

In the model the endogenous variable Y= (Use of field activities) is a function of the least squares estimate of the intercept (α), the simple additive (or main effects) of the population regression coefficient for exogenous variables $X_1 \ldots X_5$, and the residual term (ε)

Where;

Y= Use of field activities

X_1=Knowledge

X_2=attitude

X_3=skills

X_4=Curriculum

X_5=Administrative support

X_6=Time table

ε= error term

Assumption of the regression model

The regression model used in this thesis was based on the assumptions that, the independent variables (predictors) are fixed; the regression of Y on Xs is linear; Errors (residuals)are uncorrelated; are normally distributed; have equal variances; independent variables are measured without error.

3.11 Ethical Considerations

According to Polonsky and Waller (2005), the researcher should understand the basics of ethical research and how this might affect the research project. In accordance with this, as part of Moi University requirements, a number of considerations were adopted to ensure that no one was negatively affected by conducting this research. First, in the ethics application, the aims, procedures involved and the nature of the research ensured that there were no potential risks associated with this research. Second, letters of formal invitation enclosed with the instrument were mailed to all participating schools in order to obtain permission to conduct the pre-test and final survey. Information given to the teachers included the aims of the study, and its significance to them. It also included the time frame of data collection, the intended use of data, and issues related to their voluntary participation, ensuring confidentiality. In conformity with the ethics requirements of Moi University, formal consents for conducting this research were obtained. Third, those who wanted more information before participating in the research were given the option to contact Moi University School of Education to be provided with more information about the research. Finally, to ensure the confidentiality of the data, the researcher undertook a number of procedures including: The names of schools were kept confidential and they were not described in a way that allowed them to be identified, Individuals' personal information was not identified in any finding, raw data collected was not used for any purpose other than the research as specified.

3.12 Summary

This chapter justifies the need for quantitative analysis to answer the research objectives, and testing the hypotheses. the instrument and the methods used to collect the data in the pre-test and final survey have been described; the population, sampling and procedures used have been identified; the statistical techniques used to empirically test the research hypotheses of have been discussed; the issues related to the reliability and validity have been addressed. Further to this, other issues related to the ethical considerations to this research have been presented.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

In the exploring research objectives, that is;to establish teachers' use of field activities; to establish the relationship between teachers' knowledge and their use of field activities; to determine the relationship between teachers' attitude and their use of field activities; to establish the relationship between teachers' skills and their use of field activities; to determine the relationship between the biology curriculum and the use of field activities; to establish the effects of administrative support on the use of field activities and also to establish the relationship between time and timetable factors and the use of field activities; to establish teachers' perceptions on the use field activities as an instructional method and lastly to find out whether the KCSE biology papers require knowledge of out-of-classroom experiences. The results of the study are presented in different subsections. The first subsection includes the results of descriptive analyses of participant teachers' demographic characteristics. The second subsection includes descriptive analyses of use of field activities in biology, teachers' knowledge, attitude and skills on field activities; and influences of curriculum, administrative support and time table factors on the use of field activities. The third subsection includes the correlation and regression analyses of the independent variables and dependent variables. The last subsection comprises the qualitative analyses of results of the contributions of science knowledge level, attitude and skills towards the use of field activities in biology teaching.

4.2 Background Characteristics of Participant Classroom Teachers

According to the results, among participant teachers (N=135), 27 %(n=37) of them were females whereas 73% (n=98) of them were male. The age of teachers ranged from below 30 years to above 46 years. Approximately 52% (n=70) of them were aged below 30 whereas the age of approximately 16% (n=22) of them ranged from 31 to 35. Also, 27% of them (n=36) were aged between 36-40years, while 5% (n=7) were over 46 years. Considering their teaching experience, the table displays that the majority had less than ten years of experience 36%, (n=49) followed by teachers with experience of 10 to 20 years 27%, (n=36). The obtained data also revealed that 14% of participant classroom teachers had over 20 years of teaching experience.

When the number of students in classrooms were considered, 0.7 %(n=1) of them stated that it ranged from 10 to 19 whereas there were between 20 and 29 students in classrooms as stated by 3% (n=4) of them. More than one fifth of the classroom teachers 19%, (n=25) expressed that there were between 30 and 39 students in classrooms. A majority of classroom teachers 57%, (n=77) indicated that the number of students in their classrooms range between 40 and 49, whereas close to 21%, (n=28) of the participants indicated a classroom composition of over 50 students. Majority of classroom teachers had participated in in-service training. 19% of the participants, (n=26), had participated in in-service training programs once, 7% more at least twice and a majority of 73%, (n=99) had participated in in-service programs more than twice. These programs according to the participants take 1-5 days 33%, (n=45), and others 6 to 10 days 19%, (n=26). Other in-service programs can take between 11 to 15 days 47%, (n=64). A high percentage, 73% of classroom teachers (n=99) found in-service training very helpful, followed by moderately helpful 27%, (n=36).A summary of the descriptive results corresponding to the above mentioned characteristics are presented in frequencies and percentages in Table 4.1.

Table 4.1 Demographic Background of Participant Classroom Teachers (N=135)

		Frequency	**Percentage**
Gender			
	Male	98	72.6
	Female	37	27.4
Age			
	30years and below	70	51.9
	31-35 years	22	16.32
	36- 40 years	7	5.2
	Over 40 years	36	26.7
Highest Professional qualification			
	BEd(Sc)	82	60.7
	BSC with Dip Ed	47	34.8
	Med	6	4.4
	MSC with Ed	0	0
	Other	0	0
Other Subject Taught			
	Agriculture	25	18.5
	Chemistry	74	54.8
	Mathematics	36	26.7
Teaching Experience			
	Less than 5 years	49	36.3
	6- 10 year	14	10.4
	11- 15 years	36	26.7
Number of students in the classes taught			
	10-19	1	0.7
	20-29	4	3.0
	30-39	25	18.5
	40-49	77	57.0
	Over 50	28	20.7
Attendance at in-service training			
	Never	0	0
	Once	26	19.3
	Twice	10	7.4
	More than two times	99	73.3
Duration of in-service training			
	Not-recalled	0	0
	1-5 days	45	33.3
	6-10 days	26	19.3
	11-15 days	64	47.4
Evaluation of in-service training programs			
	Very helpful	99	73.3
	Moderately helpful	36	26.7
	Helpful	0	0
	Not helpful	0	0

Source: Survey Data, 2011

4.3 Descriptive statistics

Descriptive statistics were conducted to describe the study variables.

4.3.1 Use of Field Activities in Biology

The first research objective was to establish whether teachers' use of field activities in biology instruction. Table 4.2 displays information about teachers' use of field activities. In this section, percentages for each item of responses were categorized into five groups for use of field activities scale (N=Never; R=Rarely; ST= Sometimes; O=

Often; A=Always). According to table 4.2, the teachers' scores on the use of field activities indicated moderate use of field activities in biology teaching (M=3.64, SD=.9445). About 54% of the participants asserted that they include field activities in the lesson plans to make students participate in learning (M=3.58, SD=0.748). 62.2% indicated that they plan the field activities considering the students' individual differences (M=3.70, SD=1.141). a little more than 60% stated that they would generally try to meet the students learning needs through field activities as instructional strategy, method and technique(M=3.81, SD=.748).. In addition, close to 87% utilize field resources/experiences in classroom teaching (M=4.19, SD=.652), whereas 66% of the participants claimed that they would continually give students some homework requiring them to use knowledge learnt from field activities (M=3.93, SD=.903). 71.1 % agreed that they ask questions the students to assess what they have learnt from field activities (M=4.20, SD=.862). Finally 64.4 % of the participants take measures to assess what their students have learnt in field activities (M=3.79, SD=.838).

Table 4.2 Classroom Teachers Reported Use of Field Activities in Biology

Statements on use of biology field activities	N (%)	R (%)	ST (%)	O (%)	A (%)	M	SD
a)Planning							
I include field activities in my lesson plans to make my students participate in learning	0	5.9	40.0	44.4	9.6	3.58	0.748
I plan the field activities considering my students' individual differences	5.2	10.4	22.2	34.1	28.1	3.70	1.141
b)Method							
I try to meet my students learning needs through field activities as instructional strategy, method and technique	0	0	39.3	40.7	20.0	3.81	0.748
c)Materials							
I utilize field resources/experiences in classroom teaching	0	0	13.3	54.1	32.6	4.19	0.652
d) Evaluation							
I give my students some homework requiring them to use knowledge learnt from field activities	0	5.2	28.9	34.1	31.9	3.93	0.903
I ask questions to my students to assess what they have learnt from field activities	0	0	28.9	22.2	48.9	4.20	0.862
I take measures to assess what my students have learnt in field activities	0	5.9	29.6	43.7	20.7	3.79	0.838
Mean						**4.860**	**.4022**

Key: Measurement Scale range between 1 and 5: Never= 1, Rarely= 2, Sometimes= 3, Often = 4, Always= 5
Source: Survey Data, 2011

4.3.2 Teachers' Knowledge of Field Activities

The second research objective sought to establish the relationship between teachers' knowledge and their use of field activities. Table 4.3 displays information about teachers' knowledge of field activities. In this section, percentages for each item of responses were categorized into five groups ((SA= Strongly Disagree; D=Disagree; U= Undecided; A=Agree; SA=Strongly Agree). The teachers' scores on knowledge of field activities in biology was moderate (M=4.23, SD=.455). About 100% the participants indicated that field activities develops students' skills in observation, measurement, and in data and specimen collection (M=4.72, SD=.451), stating that they provide experiential learning (M=4.43, SD=.451), and promotes learning through case studies examined at first hand (M=4.30, SD=.458). A little more than 93%, stated that field activities promotes students' transferable skills (M=4.47, SD=.621), while almost90% thought that field activities develops good working relations amongst students and between staff and students (M=4.13, SD=.918). Nearly all participant teachers agreed that field activities ensures that students learn how to work safely in the field (M=4.35, SD=.478) and help link theory with practice by relating knowledge derived from reading, lectures and laboratory work to information and evidence gained in the field(M=4.70, SD=.458). Also, close to 98% of the teachers agreed that field activities helps to deliver curriculum content (M=4.47, SD=.544) and enables students develop fieldwork skills (M=4.44, SD=.606). A little more than 93% agreed that field activities work helps to complete coursework (M=3.73, SD=1.154), with almost all teachers accepting that field activities provides evidence for key learning skills(M=4.46, SD=.620), promoting personal development(M=4.32, SD=.568).Majority of classroom, almost 84%stated that field activities builds progression to the next learning level (M=4.07, SD=.951), and finally that field activities promotes subject recruitment (M=4.01, SD=1.065).

Table 4.3 Teachers' knowledge of field activities in biology

(SA= Strongly Disagree; D=Disagree; U= Undecided; A=Agree; SA=Strongly Agree)

Knowledge	SD (%)	D (%)	U (%)	A (%)	SA (%)	M	SD
Field activities develop students' skills in observation, measurement, and in data and specimen collection	0	0	0	28.1	71.9	4.72	0.451
Field activities provide experiential learning	0	0	0	57.0	43.0	4.43	0.451
Field activities promote learning through case studies examined at first hand	0	0	0	70.4	29.6	4.30	0.458
Field activities promote students' transferable skills	0	0	6.7	39.3	54.1	4.47	0.621
Field activities develop good working relations amongst students and between staff and students	5.2	0	5.2	56.3	33.3	4.13	0.918
Field activities ensure that students learn how to work safely in the field.	0	0	0	65.2	34.8	4.35	0.478
Field activities link theory with practice by relating knowledge derived from reading, lectures and laboratory work to information and evidence gained in the field	0	0	0	29.6	70.4	4.70	0.458
Field activities help to deliver curriculum content	0	0	2.2	48.1	49.6	4.47	0.544
Field activities develop fieldwork skills	0	0	5.9	44.4	49.6	4.44	0.606
Field activities help to complete coursework	5.2	14.8	7.4	46.7	25.9	3.73	1.154
Field activities provide evidence for key skills	0	0	6.7	40.7	52.6	4.46	0.620
Field activities promote personal development	0	0	5.2	57.8	37.0	4.32	0.568
Field activities build progression to the next level	5.2	0	10.4	51.1	33.3	4.07	0.951
Field activities promote subject recruitment	5.2	4.4	11.1	42.2	37.0	4.01	1.065
Means						**3.761**	**.321**

Source: Survey Data, 2011

4.3.3 Teacher's Attitude towards Field Activities

As addressed by the third research objective, table 4.4 displays percentages of responses to each item that fell into five categories for teachers' attitude towards field activities In this section, percentages for each item of responses were categorized into five groups ((SA= Strongly Disagree; D=Disagree; U= Undecided; A=Agree; SA=Strongly Agree). About 100% of the participants indicated that they were knowledgeable about the significance of fieldwork in biology (M=4.36, SD=.480) and that, they 72%, have adequate content knowledge to effectively teach the lessons and activities (M=4.30, SD=.820). A good number of classroom teachers more than 88%

agreed that they have the confidence of conducting field activities (M=4.37, SD=.688). Close to 95% of the respondents indicated that the use of field activities does not complicate a teacher's job (M=4.47, SD=.596), and that 97% like to use field activities in biology teaching (M=4.37, SD=.530). Approximately 88% said it is interesting to integrate field activities in teaching (M=4.34, SD=.682) and nearly 100% of classroom teachers agreed that using field activities in teaching will increase students' motivation to learn biology (M=4.71, SD=.455). More than 90% of them agreed that using field activities in teaching improves effectiveness of teaching (M=4.61, SD=.488), while nearly all respondents, 100%agreed that using field activities in teaching will make learning more effective (M=4.65, SD=.478). A little more than 90% of the respondents agreed that using field activities in teaching will increase students' knowledge(M=4.37,SD=.780), and close to 93% said using field activities in teaching increases students' interest in subject matter (M=4.31,SD=.973). Over 91% agreed to the statement that using field activities in teaching enables students to get information faster (M=4.27, SD=.910), with 82% confirming that use of field activities in teaching encourages students' creativity (M=4.20, SD=1.158). More than half of the respondents, 59% agreed that using field activities in teaching helps increase students' self-confidence (M=3.60, SD=1.477), whereas at least64% accepting that the delivery of fieldwork is "inspiring' to the students (M=3.53, SD=1.292). More than 63% of the teachers felt that field activity sessions need to be accompanied by medical personnel (M=3.50, SD=1.233). Majority of teachers, 78%, were of the view that teachers involved in field activities should be rewarded/ encouraged (M=4.01, SD=1.072).However, negatively worded statements received the least percentages, means and standard deviations, this include statements like; "Field work is a risky teaching approach"(M=2.30,SD=1.204,16%),"The quality of teaching is likely to be compromised if field activities are involved"(M=2.47,SD=1.477,25%),"Field activities disrupts normal learning"(M=2.73,SD=1.448,37%), "Field activities are "tedious and dull"" (M=2.29,SD=1.227,26%), and "Fear of accidents is an important influence on field work provision"(M=2.47,SD=1.251,16%).

Table 4.4 Teacher's Attitude towards Field Activities

Statements on attitudes	SD (%)	D (%)	U (%)	A (%)	SA (%)	M	SD
I am knowledgeable about the significance of fieldwork in biology	0	0	0	64.4	35.6	4.36	0.480
I have adequate content knowledge to effectively teach the lessons and activities	0	0	21.5	23.0	49.6	4.30	0.820
I have the confidence of conducting field activities	0	0	11.9	39.3	48.9	4.37	0.688
Using field activities does not complicate a teacher's job	0	0	5.2	43.0	51.9	4.47	0.596
I like to use field activities in biology teaching	0	0	2.2	57.8	39.3	4.37	0.530
It is interesting to integrate field activities in teaching	0	0	11.9	42.2	45.9	4.34	0.682
Using field activities in teaching will increase students' motivation	0	0	0	28.9	71.1	4.71	0.455
Using field activities in teaching improves teaching effectiveness	0	0	0	38.5	61.5	4.61	0.488
Using field activities in teaching will make learning more effective	0	0	0	34.8	65.2	4.65	0.478
Using field activities in teaching will increase students' knowledge	0	4.4	5.2	39.3	51.1	4.37	0.780
Using field activities in teaching increases students' interest in subject matter	4.4	0	9.6	31.9	54.1	4.31	0.973
Using field activities in teaching enables students to get information faster	4.4	0	4.4	45.9	45.2	4.27	0.910
Using field activities in teaching encourages students' creativity	5.2	7.4	5.2	26.7	55.6	4.20	1.158
Using field activities in teaching helps increase students' self-confidence	11.1	20.0	9.6	16.3	43.0	3.60	1.477
Field work is a risky teaching approach	24.4	48.1	11.1	5.9	10.4	2.30	1.204
The quality of teaching is likely to be compromised if field activities are involved	23.0	51.9	0	5.2	20.0	2.47	1.477
Field activities disrupts normal learning	27.4	24.4	11.1	22.2	14.8	2.73	1.448
Delivery of fieldwork is "inspiring' to the students	7.4	22.2	6.7	37.8	25.9	3.53	1.292
Field activities are "tedious and dull'	28.1	45.9	0	20.7	5.2	2.29	1.227
Fear of accidents is an important influence on field work provision	18.5	46.7	19.3	0	15.6	2.47	1.251
Field activity sessions need to be accompanied by medical personnel	17.4	20.0	8.9	43.0	20.7	3.50	1.233
Teachers involved in field activities should be rewarded/ encouraged	4.4	5.9	11.9	39.3	38.5	4.01	1.072
Means						**3.70**	**.388**

Source: Survey Data, 2011

4.3.4 Teacher's Skills on Field Activities

According to table 4.5 below, more than 95% of the participant classroom teachers agreed that they can plan and appropriately deliver fieldwork to achieve instructional objectives(M=4.19, SD=0.496), with close to 65% confirming that they have received professional development training specifically for field activities(M=3.50, SD=1.158). A majority of the respondents 96% agreed that they frequently modify field activities for science lessons to meet the needs of diverse learners (M=4.27, SD=0.539). It is also important to note that almost 90% of the respondents agreed that there is a very strong association with techniques, skills and coursework-and associated assessment-in secondary science(M=4.17, SD=0.728). However, at least 77% of respondent teachers agreed that many trainee teachers are entering the profession with little previous fieldwork experience (M=3.81, SD=0.918).

Table 4.5 Teacher's Skills on Field Activities

Statements on skills	SD (%)	D (%)	U (%)	A (%)	SA (%)	M	SD
I can plan and appropriately deliver field activities to achieve instructional objectives	0	0	4.4	71.9	23.7	4.19	0.496
I have received professional development training specifically for field activities	4.4	23.7	6.7	48.1	17.0	3.50	1.158
I frequently modify field activities for science lessons to meet the needs of diverse learners	0	0	4.4	63.7	31.9	4.27	0.539
There is a very strong association with techniques, skills and coursework—and associated assessment—in secondary science	0	4.4	5.9	57.8	31.9	4.17	0.728
Many trainee teachers are entering the profession with little previous field activities' experience	2.2	9.6	11.1	59.3	17.8	3.81	0.918
Means						**3.840**	**.369**

Source: Survey Data, 2011

4.3.5 Curriculum Influences on Use of Field Activities

The fifth research objective was to determine the relationship between the biology curriculum and the use field activities. Table 4.6 displays information on the role of the curriculum on use of field activities. Majority of the teachers, 78% agreed that the curriculum is the major critical factor in conducting field activities (M=4.06, SD=0.862) and that the curriculum, through field activities connects lessons to daily life (M=4.21, SD=0.407).A little more than 90% agreed that the goals of the curriculum are appropriate for field activities (M=4.23, SD=0.762), with 68% suggesting that field activities in the curriculum are efficient (M=3.87, SD=0.937). Close to 72% of the teachers asserted that the curriculum will make field activities more effective and efficient (M=3.92, SD=1.079), with more than 78% agreeing that the statutory requirement to carry out field activities has a major positive impact on levels of biology fieldwork (M=3.94, SD=0.741). 63.7%. On issues of curriculum specifications, about 64% of the teachers agreed they have had a major impact on the numbers and timing of field work(M=3.59, SD=0.747), with 52% pointing out that a strong curriculum requirement affects content of inspections which in turn affects the profile of outdoor learning within schools(M=3.47, SD=1.006).At least half of the respondents, 50% acknowledged that the curriculum does not stress on the importance of fieldwork (M=3.04, SD=1.473), with more than87% agreeing that increased workload may have an impact on fieldwork (M=4.18, SD=1.064).It was also indicated by about 55% of the respondents that teachers are not likely to finish the syllabus if they involve field activities (M=3.09, SD=1.385) and that, the outdoor experience is sometimes poorly integrated into the school, and often lumped into the end-of-year ''activity' period (M=3.27, SD=1.094, 53%).

Table 4.6 Curriculum Influences

Statements on the Curriculum	SD (%)	D (%)	U (%)	A (%)	SA (%)	M	SD
The curriculum is the major critical factor in conducting field activities	0	5.9	16.3	43.7	34.1	4.06	0.862
The curriculum connects lessons to daily life	0	0	0	79.3	20.7	4.21	0.407
Goals of the curriculum are appropriate for field activities	0	5.2	4.4	52.6	37.8	4.23	0.762
Suggested field activities in the curriculum are efficient	0	9.6	22.2	40.0	28.1	3.87	0.937
Curriculum makes field activities more effective and efficient	0	17.0	11.1	34.8	37.0	3.92	1.079
The statutory requirement to carry out field activities has a major positive impact on levels of biology fieldwork	0	4.4	17.0	58.5	20.0	3.94	0.741
Curriculum specifications, has had a major impact on the numbers and timing of field activities	0	10.4	25.9	58.5	5.2	3.59	0.747
A strong curriculum requirement affects content of inspections. This affects profile of outdoor learning within schools	0	21.5	26.7	35.6	16.3	3.47	1.006
The curriculum does not stress on the importance of field activities	17.8	31.9	0	29.6	20.7	3.04	1.473
Increased workload may have an impact on field activities	5.2	5.2	2.2	41.5	45.9	4.18	1.064
Teachers are not likely to finish the syllabus if they involve field activities	17.0	25.9	2.2	40.7	14.1	3.09	1.385
The outdoor experience is sometimes poorly integrated into the school, and often lumped into the end-of-year "activity' period	0	37.8	9.6	40.7	11.9	3.27	1.094
Means						**3.768**	**.433**

Source: Survey Data, 2011

4.3.6 Influences of Administrative support on field activities

As addressed by the sixth research objective, table 4.7 displays results of descriptive analysis of the data. According to the results, almost half of the respondents 51% agreed to the fact that their school administration demonstrates a high priority for outdoor/field activities in science (M=3.21, SD=.995), with close to 69% acknowledging that their school administrations has a clear understanding of how field activities should be carried out (M=3.59, SD=.917).An overwhelming 90% agreed that strengthening the provision of teacher training and in-service support is critical (M=4.23, SD=.622). On the issue of protocols for delivering out-of-school visits, about 73% said they are dissuading rather than supporting field activities (M=3.75, SD=.960).On matters of student-teacher ratio, 77% agreed that this is a major barrier when going for out-door activities (M=3.82, SD=.1.239), with almost 64% asserting that increasing dependence on part-time studying does affect field work provision (M=4.36, SD=1.251). Costs are a major influence on present-day fieldwork provision according to close to 95% of the participant classroom teachers (M=4.36, SD=.926).About 79% of the respondents agreed that teachers need to be given financial support on fieldwork activities (M=3.96, SD=1.233). A majority of the teachers close to 95% pointed out that costs are not the exclusive, or even the most important, barrier in field activities(M=3.59, SD=.917), with more than 79% indicating that funds from schools are not sufficient to finance field trips(M=3.59, SD=.917). However, half of the teachers agreed that even with 100% funding many schools will not take up field work opportunities(M=3.59, SD=.917).

Table 4.7 Administrative support

Statements on administrative support	**SD (%)**	**D (%)**	**U (%)**	**A (%)**	**SA (%)**	**M**	**SD**
My school administration demonstrates a high priority for outdoor/field activities in science	0.7	33.3	14.8	45.9	5.2	3.21	0.995
My school administration has a clear understanding of how field activities should be carried out	0	20.0	11.5	59.3	9.6	3.59	0.917
Strengthening the provision of teacher training and in-service support is critical	0	0	10.4	56.3	33.3	4.23	0.622
Protocols for delivering out-of-school visits are dissuading rather than supporting field activities	0	17.0	10.4	53.3	19.3	3.75	0.960
Student-teacher ratio is a major barrier when going for out-door activities	10.4	5.9	6.7	45.2	31.9	3.82	1.239
The increasing dependence on part-time studying does affect fieldwork provision	10.4	11.9	14.1	41.5	22.2	3.53	1.251
Costs are a major influence on present-day fieldwork provision	5.2	0	0	43.7	51.1	4.36	0.926
Teachers need to be given financial support on fieldwork activities	5.2	15.6	0	37.0	42.2	3.96	1.233
Costs are not the exclusive, or even the most important, barrier in field work	16.3	27.4	5.2	32.6	18.5	3.10	1.414
Funds from schools are not sufficient to finance field trips.	4.4	6.7	9.6	43.0	36.3	4.00	1.065
Even with 100% funding many schools will not take up field work opportunities	23.7	21.5	4.4	35.6	14.8	2.96	1.458
Means						**3.667**	**0.494**

Source: Survey Data, 2011

4.3.7 Time and Timetable factors

As addressed by the seventh research objective, table 4.8 displays information about influences of timetable factors on use of field activities. About 60% of the respondents acknowledged that they have adequate time to plan and prepare for instructional activities related to fieldwork. However, 74.1% felt that negotiating timetable cover is a major barrier to teachers who are trying to organize fieldwork. On the other hand, almost 68.2% agreed that there is insufficient time for fieldwork (M=3.49, SD=1.328)

Table 4.8 Time and Timetable factors

Statements on Time and Timetable factors	**SD (%)**	**D (%)**	**U (%)**	**A (%)**	**SA (%)**	**M**	**SD**
I have adequate time to plan and prepare for instructional activities related to fieldwork	7.4	32.6	0	38.5	21.5	3.34	1.328
Negotiating timetable cover, is a major barrier to teachers who are trying to organize fieldwork	0	15.6	10.4	63.7	10.4	3.69	0.859
There is insufficient time for fieldwork	5.2	26.7	0	50.4	17.8	3.49	1.209
Means						**3.385**	**0.561**

Source: Survey Data, 2011

4.4 Reliability analysis of the questionnaire

The results of the reliability analysis conducted are displayed in table 4.9. The reliability coefficient (α) of each of the independent variables were as follows, Field Activities (.785) Knowledge(.701);Attitude(.802); Skills(.699); Curriculum(.707); Administrative support(.793); Timetable(.791). The reliability coefficients of all the independent variables were above .70, and it could be assumed to indicate a high level of internal consistency since reliability should be at least .70 and preferably higher (Fraenkel & Wallen, 2006).

Table 4.9 Reliability results

	Cronbach's Alpha	Number of items
Field Activities	.785	7
Knowledge	.701	14
Attitude	.802	22
Skills	.699	5
Curriculum	.707	12
Administrative support	.793	12
Timetable	.791	3

Source: Survey Data, 2011

4.5 Factors Analysis Results

Factor analysis was used to assess construct validity. The results of the sampling test indicated that the dataset was suitable for factor analysis. Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) value is .687, which is above the threshold of 0.6. The Bartlett's test of sphericity is statistically significant ($p<.001$). As indicated in Table 4.10, all factor loadings, ranging from 0.544 to 0.945, were statistically significant at ($p<0.001$). Therefore, the measures displayed adequate construct validity.

Table 4.10 Factor Analyses

Variable	**Scale items**	Factor Loading	Eigen Values	% of Variance
Field Activities	I include field activities in my lesson plans to make my students participate in learning	.875	3.544	17.88
	I plan the field activities considering my students' individual differences	.786		
	b)Method			
	I try to meet my students learning needs through field activities as instructional strategy, method and technique	.840		
	c)Materials			
	I utilize field resources/experiences in classroom teaching	.796		
	d) Evaluation			
	I give my students some homework requiring them to use knowledge learnt from field activities	.843		
	I ask questions to my students to assess what they have learnt from field activities	.704		
	I take measures to assess what my students have learnt in field activities	.646		
Knowledge	**Knowledge**			
	Field work develops students' skills in observation, measurement, and in data and specimen collection	.570	2.87	14.830
	Field work provides experiential learning	.715		
	Field work promotes learning through case studies examined at first hand	.579		
	Field work promotes students' transferable skills	.775		
	Field work develops good working relations amongst students and between staff and students	.825		
	Field work ensures that students learn how to work safely in the field.	.872		
	Field work links theory with practice by relating knowledge derived from reading, lectures and laboratory work to information and evidence gained in the field	.735		
	Field work helps to deliver curriculum content	.926		

	Field work develops fieldwork skills	.755		
	Field work helps to complete coursework	.907		
	Field work provides evidence for key skills	.683		
	Field work promotes personal development	.725		
	Field work builds progression to the next level	.935		
	Field work promotes subject recruitment	.842		
Attitude	**b) Attitude**			
	I am knowledgeable about the significance of fieldwork in biology	.645	2.720	14.23
	I have adequate content knowledge to effectively teach the lessons and activities	.544		
	I have the confidence of conducting field activities	.685		
	Using field activities does not complicate a teacher's job	.770		
	I like to use field activities in biology teaching	.695		
	Integrating is interesting field activities in teaching	.903		
	Using field activities in teaching will increase students' motivation	.717		
	Using field activities in teaching improves teaching effectiveness	. 792		
	Using field activities in teaching will make learning more effective	.778		
	Using field activities in teaching will increase students' knowledge	.764		
	.Using field activities in teaching increases students' interest in subject matter	.875		
	Using field activities in teaching enables students to get information faster	.855		
	Using field activities in teaching encourages students' creativity	.932		
	Using field activities in teaching helps increase students' self-confidence	.795		
	Field work is a risky teaching approach	.543		
	The quality of teaching is likely to be compromised if field activities are involved	.624		
	Field activities disrupts normal learning	.753		
	Delivery of fieldwork is "inspiring' to the students	.537		
	Field activities are "tedious and dull'	.785		
	Fear of accidents is an important influence on field work provision	.696		
	Field activity sessions need to be accompanied by medical personnel	.773		
	Teachers involved in field activities should be rewarded/ encouraged	.630		
	c) Skills			
	I can plan and appropriately deliver fieldwork to achieve instructional objectives	.881	3.57	15.77
	.I have received professional development training specifically for field activities	.947		
	I frequently modify field activities for science lessons to meet the needs of diverse learners	.591		
	There is a very strong association with techniques, skills and coursework—and associated assessment—in secondary science	.831		
	Many trainee teachers are entering the profession	.597		

	with little previous fieldwork experience			
d) Curriculum influences				
	.The curriculum is the major critical factor in conducting field activities	.774	2.575	18.60
	The curriculum connects lessons to daily life	.545		
	Goals of the curriculum are appropriate for field activities	.609		
	Suggested field activities in the curriculum are efficient	.794		
	.Curriculum makes field activities more effective and efficient	.620		
	The statutory requirement to carry out fieldwork has a major positive impact on levels of biology fieldwork	.832		
	Curriculum specifications, has had a major impact on the numbers and timing of field work	.886		
	A strong curriculum requirement affects content of inspections. This affects profile of outdoor learning within schools	.719		
	.The curriculum does not stress on the importance of fieldwork	.892		
	.Increased workload may have an impact on fieldwork	.802		
	.Teachers are not likely to finish the syllabus if they involve field activities	.547		
	.The outdoor experience is sometimes poorly integrated into the school, and often lumped into the end-of-year "activity' period	.945		
e) Administrative support				
	My school administration demonstrates a high priority for outdoor/field activities in science	.842	2.87	17.67
	.My school administration has a clear understanding of how field activities should be carried out	.891		
	.Strengthening the provision of teacher training and in-service support is critical	.590		
	Protocols for delivering out-of-school visits are dissuading rather than supporting field activities	.878		
	.Student-teacher ratio is a major barrier when going for out-door activities	.758		
	The increasing dependence on part-time studying does affect fieldwork provision	.765		
	Costs are a major influence on present-day fieldwork provision	.828		
	.Teachers need to be given financial support on fieldwork activities	.926		
	. Costs are not the exclusive, or even the most important, barrier in field work	.754		
	Funds from schools are not sufficient to finance field trips.	.934		
	Funds from schools are not sufficient to finance field trips.	.846		
	. Even with 100% funding many schools will not take up field work opportunities	.512		
f) Time and Timetable factors				
	I have adequate time to plan and prepare for instructional activities related to fieldwork	.775	3.22	18.67
	Negotiating timetable cover, is a major barrier to teachers who are trying to organize fieldwork	.795		
	There is insufficient time for fieldwork	.791		

Source: Survey Data, 2011

4.6 T-Tests

A series of t-tests were conducted to evaluate whether there was a statistically significant difference at 0.05 significant levels, between the mean scores of male and female teachers on usage of field activities in teaching biology, their knowledge, skills and attitudes towards the use of field activities. Further t-tests were conducted on teachers' belief on the influence of the curriculum, administrative support and time table factors on the use of field activities. As displayed in table 4.11, the results indicated that there was no statistically significant difference between the mean scores of male and female teachers on usage of field activities in teaching biology, their knowledge, skills and attitudes towards the use of field activities, influence of the curriculum, and time table factors on the use of field activities, ($p > .05$) whereas the results indicated that there was statistically significant difference between the mean scores of male and female teachers on the administrative support ($p < .05$.)

Table 4.11 Independent T-Test Analysis for Differences in responses with Regard to Gender

	Gender	N	Mean	Std. Deviation	Df	Sig.(2-tailed)	t- value
Use of field activities	Female	37	3.7816	.19437	133	.198	1.293
	Male	98	3.8370	.23169			
Knowledge	Female	37	3.7534	.23473	133	.272	1.103
	Male	98	3.7982	.20068			
Attitude	Female	37	3.7706	.17549	133	.153	1.1.438
	Male	98	3.8233	.19477			
Skills	Female	37	3.7838	.24890	133	.542	.611
	Male	98	3.8238	.36698			
Curriculum	Female	37	3.7978	.19045	133	.447	.762
	Male	98	3.8347	.26989			
Administrative support	Female	37	3.5922	.24946	133	.039	2.089
	Male	98	3.7288	.36667			
Timetable	Female	37	3.5881	.37373	133	.275	1.096
	Male	98	3.5014	.42247			

Source: Survey Data, 2011

4.7 Correlation Analysis

Pearson Product-Moment Correlations were computed to explore whether a relationship exists between variables (Wong and Hiew, 2005; Jahangir and Begum, 2008). As cited in Wong and Hiew (2005) the correlation coefficient value (*r*) ranging from 0.10 to 0.29 is considered weak, from 0.30 to 0.49 is considered medium and from 0.50 to 1.0 is considered strong. However, according to Field (2005), correlation coefficient should not go beyond 0.8, to avoid multicollinearity. Since the highest correlation coefficient was 0.735 which is less than 0.8, there was no multicollinearity problem in this research (Table 4.12).The association between the independent variables and dependent variable were found to be statistically significant at level $p<0.01$, except for timetable factors. In other words, knowledge ($r= 0.639$, $p<0.01$), attitude ($r= 0.735$, $p< 0.01$), skills ($r=0.586$, $p< 0.01$) curriculum ($r= 0.678$, $p< 0.01$) and administrative support correlated to use of field activities whereas timetable factors ($r= 0.051$, $p=0.554$, i.e. $p>0.01$) did not correlate to use of field activities.

Table 4.12 Correlations

Measures	M	SD	Field activities	Knowledge	Attitude	Skills	Curr.	Admin. support	Time table
Field Activities	3.8218	.22277	1	.639**	.735**	.586**	.678**	.441**	.051
Knowledge	3.7860	.21061	.639**	1	.591**	.434**	.488**	.166	.002
Attitude	3.8089	.19050	.735**	.591**	1	.509**	.584**	.373**	.053
Skills	3.8128	.33831	.586**	.434**	.509**	1	.548**	.291**	.032
Curriculum	3.8246	.25049	.678**	.488**	.584**	.548**	1	.390**	.087
Administrative support	3.6913	.34319	.441**	.166	.373**	.291**	.390**	1	.217*
Timetable	3.5252	.41016	.051	.002	.053	.032	.087	.217*	1

**. Correlation is significant at the 0.01 level (2-tailed).N=135
Source: Survey Data, 2011

4.8 Null Hypotheses Testing

Analysis of Variance was computed to establish the relationship between the dependent variable and the independent variables. As displayed in table 4.13 the F-statistics produced ($F = 50.769$) was significant at 1 per cent level (Sig. $F< 0.001$), thus confirming the fitness of the model. The coefficient of determination R^2 value was 70.4 per cent. This indicated that 70.4 per cent of the variation in dependent variable (use of field activities) was explained and predicted by independent variables (contextual factors).

4.8.1 Result of Hypothesis HO_1

The first hypothesis to be addressed was “Is there a significant relationship between teachers’ knowledge and their use of field activities in teaching biology. The null hypothesis stated that: There is no statistically significant relationship between teachers’ knowledge and their use of field activities in teaching biology. As can be ascertained from table 4.13 the beta coefficient for teachers knowledge is .246, $t=3.959$, $p< 0.000$. Due to the low p-value associated with t-ratio, the null hypothesis is rejected. Therefore there is a statistically significant relationship between teachers’ knowledge and their use of field activities in teaching biology.

4.8.1.1 Discussion of Findings

The findings of this study indicated that the majority of classroom teachers agreed with statements measuring their knowledge on the significance of field activities and their role in instruction. Inadequate teacher knowledge in science (Franz and Nochs, 1982; Hurd, 1982) has been admitted by teachers as obstacles to effectively teaching science. There is a general agreement that lack of background in science knowledge significantly contributes to hesitancy and possible inability to deliver effective science instruction in classroom settings. Therefore, how much teachers know about science content is important for teacher education program. In this sense, results of this study showed that teachers are aware of the role of out-of class activities in learning. This enables teachers facilitate the development of competent learning skills through the provision of supervised quality fieldwork experiences. It also enhances the development of learning activities and assignments that encompass the breadth and depth of knowledge in the profession and reinforce knowledge and skills leading to quality learning. Similarly, Tekkaya, Çakıroğlu and Özkan (2004) on their research in field activities reported that majority of the teachers' demonstrated knowledge of effective learning processes that identify individual learning styles and use appropriate and individualized techniques for students at their fieldwork education site. They also demonstrated accurate and current knowledge of out-door activities and competencies to develop and maintain proficiency in out-door learning.

4.8.1.2 Summary and Conclusions

Because of strong relationship between science teaching knowledge and science teaching behaviors, one goal of a teacher education program should be to increase teachers' knowledge, especially on out-of-class activities since teaching characteristics developed during training programs will cause a permanent change in teachers' attitudes and beliefs.

4.8.2 Result of the Hypothesis HO_2

The second hypothesis was not supported. It aimed at finding out if there is a significant relationship between teachers' attitude and their use of field activities in teaching biology. The null hypothesis was that: There is no statistically significant relationship between teachers' attitude and their use of field activities in teaching biology. As can be ascertained from table 4.13 the beta coefficient for teachers attitude is .326, $t=4.749$, $p< 0.000$. Since the p-value associated with t-ratio is low, the null hypothesis is rejected. Therefore there is a statistically significant relationship between teachers' attitude and their use of field activities in teaching biology.

4.8.2.1 Discussion of Results

Analysis revealed that there was no significant difference (F=3.7706, M=3.8233).This finding showed that there is no need for differentiated professional training in biology instruction to improve science attitude toward biology teaching for the different sexes which is consistent with Tukmen and Bonnstetter's (1999). Pearson Product-Moment Correlations were computed in exploring the possible relationship between attitude and the use of field activities in biology teaching. The data from this study recorded significant correlations between attitude and the use of field activities in biology teaching. In the literature, there are number of studies that consider the relationship between teachers' attitude and science teaching. For example, Manning et al. (1982) and Lucas and Pooley (1982) found a significant relationship between the prospective teachers' attitudes and teaching science. Conversely, Stepans and McCormack (1985) found a negative relationship. Furthermore, Wenner (1993), Feistritzer and Boyer (1983) found no significant correlations between attitude and use of resources in teaching science. The result of present study indicated that in-service training does have an impact on teacher's attitude .Also, to explore the possible relationship between attitude and use of field activities in biology teaching; Pearson Product-Moment Correlations were computed. Analyses revealed a significant correlation between attitudes and out-door activities in teaching biology.

4.8.2.2 Summary and Conclusions

Attitudes play a significant role in determining the use of field activities in biology instruction. Teachers with positive attitudes are more likely to use field activities often than those with negative attitudes. Teacher training institutions should therefore ensure that fieldwork training in biology is covered comprehensively so as to enable trainee teachers appreciate the role of out-of-class activities. The Kenya Institute of Curriculum Development should develop 'framework' for biology syllabus with process and content that can be offered through the use of field activities in locations and habitats close to the schools.

4.8.3 Result of the Hypothesis HO_3

The third hypothesis addressed the question, “Is there a significant relationship between teachers’ skills and their use of field activities in teaching biology. The null hypothesis is that: There is no significant relationship between teachers’ skills and their use of field activities in teaching biology. As illustrated in table 4.13 the beta coefficient for teachers skills is .143, t=2.370, $p < 0.05$. Due to the low p-value associated with t-ratio, the null hypothesis is rejected. Therefore there is a statistically significant relationship between teachers’ skills and their use of field activities in teaching biology.

4.8.3.1 Discussion of Results

The results showed that skills on out-of-class activities in biology teaching significantly accounted for the use field activities in biology teaching. And also, knowledge level and attitude toward biology teaching each made a statistically significant contribution to the variation in the use of field activities. This means, teachers with higher science knowledge level and positive attitude toward biology teaching use out-of-class activities more often. Similarly, Haury (1994) concluded that lower skill levels lead to decreased use of practical activities in biology. Victor (1991) arrived at a conclusion similar to Haury’s. On the other hand, Wenner (1995) found negative relationship between skills and teaching science in the 1992 study and the follow-up study in 1994 found a non-significant correlation. And also Ginns, Watters, and James (1990) observed no significant correlations between teachers’ skills and science teaching efficiency.

4.8.3.2 Summary and Conclusions

Since teachers' skills play a significant role in the use of field activities, teacher training institutions need to train biology teachers how to plan and organize out-of-class activities. This is a demanding task which can involve writing field assessments, ordering equipment, planning details and tasks for field activities. It will involve negotiating with colleagues, the head of departments, fieldwork providers and landowners, amongst others. All of this will need to be matched to suitable and desired learning outcomes. The teacher training institutions should ensure that science teachers (including teachers who teach biology) are sufficiently confident and proficient to deliver field activities with competence. This should include training in the use of formative assessment techniques/approaches. Online support for teachers and technicians should be developed. Good practice on out- door activities should be recognised and highlighted

4.8.4 Result of the Hypothesis HO4

The fourth hypothesis was not supported. The null hypothesis stated that: There is no statistically significant relationship between the biology curriculum and the use of field activities in teaching. As can be ascertained from table 4.13 the beta coefficient for curriculum influences is .232, t=3.514, $p < 0.001$. Since the p-value associated with t-ratio is low, the null hypothesis is rejected. Therefore there is a statistically significant relationship between curriculum influences and the use of field activities in teaching biology.

4.8.4.1 Discussion of Findings

There being a statistically significant relationship between the biology curriculum and use of field activities, it therefore follows that fieldactivities need to be given careful consideration at the stage of overall curriculum design, and that the pattern of field teaching across the school program should be carefully thought through. Fieldactivities should be conceived both within their wider academic context and as a distinctive part of the curriculum which requires design in its own right. Debates and decisions are needed about the role of fieldactivities, their amount, their character and their timing. The fieldactivities curriculum also requires planning to ensure that it is progressive. Students may well benefit from experiencing not only different types of fieldactivities but also different levels of challenge. Across the four years of the biology program, the work expected of students needs to become increasingly demanding, with a greater emphasis on students taking responsibility for their own learning.

4.8.4.2 Summary and Conclusions

Field instruction in biology needs an overhaul. That it is not seen as being at the forefront of scientific research even at a time when society is grappling with major environmental issues such as GM crops, global warming, habitat and biodiversity loss; issues in which field science is at the core, indicates a major failing in the way in which the subject is taught. This is doubly embarrassing as the ‘mismatch’ between reality and perception appears to have led to a shortage of top-quality field ecologists and other specialists who are able to deliver work in those fields. An imbalance of content and skills is detrimental to science as a whole, but is even more severely undermining biology instruction. The overwhelming focus on skills and techniques, which are often viewed as tools to deliver assessable instruction, means that the broader scope for field activities is lost, and with it goes the opportunity to show how biology is at the forefront of science in many contemporary issues which affect the students and their communities. Teacher training institutions should focus on building best practice in achieving full coverage of syllabus in biology through field activities, and illustrating the wider contexts that field activities can support Education for

Sustainable Development. Curriculum designers including KICD obviously have a major role to play but for example, refocusing of teaching towards ‘themes’ or ‘issues’ will need to be supported by accessible, effective and up-to-date information, data and resources. Field activities need to be integrated into the teaching profession which enables the out-of-classroom work to build on, and link with, previous biological experience. The introductory and preparatory support will vary greatly depending on the background of the students and the educational objectives which are to be achieved.

4.8.5 Result of the Hypothesis HO_5

The fifth hypothesis to be addressed was “Is there a significant relationship between administrative support and the use of field activities in teaching biology. The null hypothesis is that: There is no statistically significant relationship between administrative support and the use of field activities in teaching biology. As can be confirmed from table 4.13 the beta coefficient for teachers knowledge is .152, $t=2.769$, $p< 0.01$. Due to the low p-value associated with t-ratio, the null hypothesis is rejected. Therefore there is a statistically significant relationship between administrative support and the use of field activities in teaching biology.

4.8.5.1 Discussion of Findings

Administrative procedures were probably seen as significant factors, tending towards the obstructive side. Teachers understood that they had a necessary legal obligation to ensure the safety of their students ('duty of care') and the administrative procedures should reflect that. The school administration demonstrated a high priority for outdoor/field activities in biology and a clear understanding of how field activities should be carried out. Protocols for delivering out-of-school visits by the school administration were said to be dissuading rather than supporting field activities. Most teachers said they need to be given financial support on fieldwork activities and argued that funds from schools are not sufficient to finance field trips. Student-teacher ratio was seen as a major barrier for out-door activities.

4.8.5.2 Summary and Conclusions

The school administration should accord preparatory planning priorities for teachers who are preparing for field activities. Production of a students' 'rough guides' and 'virtual' resources to field activities would help to prepare for fieldwork. Teachers should ensure that external providers are able to deliver field activities that meet the needs of their students. The school administration needs to support teachers especially when they need experts or resource persons. There need to be preplanning consultations which ensures that the field experience meets the needs of teachers and students. The preparation of field activities should ensure that suitable differentiation is included. This could include, for example, adequate time for review and reflection. There should be detailed follow-up work, with recurring back references to the field experience and ensuring that suitable synoptic links are developed.

4.8.6 Result of the Hypothesis HO_6

The sixth hypothesis was "Is there a significant relationship between timetable factors and the use of field activities in teaching biology. The null hypothesis was that: There was no statistically significant relationship between time table factors and the use of field activities in biology. As can be ascertained from table 4.13 the beta coefficient for time table factors is .024, t=.485, $p > 0.05$. Since the p-value associated with t-ratio is high, the null hypothesis is accepted. Therefore there is no statistically significant relationship between timetable factors and the use of field activities in teaching biology.

4.8.6.1 Discussion of Findings

Timetable inflexibility was also seen as negative; teachers were willing to use double lessons but felt less inspired to extend trips over longer periods of time, thus incurring the wrath of their peers for taking students out of their classes and/or generating make-up lessons. One school timetabled double lessons first thing in the morning but many field trip venues didn't open until later in the morning. Time and effort on the part of the teacher were often seen as negative factors. Time is required for all planning in teaching but field trips can be even more demanding. Often venues have to be visited or resource people contacted. Resource materials and relief lessons may need to be prepared. Extended field trips use up teachers' out-of-school time. Overcoming the 'general inertia' to do all this was seen as a hurdle by Falk and Balling (1999), Tamir and Zoor (1977) and Price and Hein (1991). Yet some teachers continue to take field trips so that there must be satisfaction in the effort made.

Table 4.13.Rregression results

Predictor variables	B	*t- value*	Sig.	Tolerance	VIF
Knowledge	.246	3.959	.000	.598	1.673
Attitude	.326	4.749	.000	.490	2.040
Skills	.143	2.370	.019	.633	1.581
Curriculum	.232	3.514	.001	.532	1.881
Administrative support	.152	2.769	.006	.767	1.304
Timetable	-.024	-.485	.629	.950	1.052
R^2	.704**				
Adjusted R^2	.69				
F statistics	50.769**				

**P< 001

4.9 Analyses of Results and Discussion from interviews

The first research question was to find out teachers' perceptions on the use of field activities as instructional media in biology.

4.9.1 The nature and purpose of field trips

In an attempt to start from common ground each interview began with the teacher evaluating the definition of field trips from Krepel and Duvall (1981). All of the teachers agreed with the definition, although some of them expanded on the meanings of terms such as 'journey', 'auspices' and 'educational purposes'. The term, ‘arranged by the school', was contested by some teachers who felt more responsibility for arranging the field trips. For example, one said "I might say, arranged by the school and organized by the teacher". All the respondents took or had taken field trips. They believed that the main purpose of field activities was to give students hands-on, real life experiences which they would not be able to have in the classroom or the laboratory. Teachers perceived that these kinds of activities enhance students' understanding of the processes involved and also improve students’ attitudes towards science and in the classroom as well. Similar outcomes have been described in Sorrentino and Bell (1998), Falk and Balling (1999), Fido and Gayford (2002) and Muse et al. (2002). Some teachers also saw that taking field trips was an effective pedagogy which they wanted to use both more frequently and effectively. Many of the teachers felt that as they had become experienced as teachers, they felt more capable of using a wider range of both formal and informal teaching strategies. The places teachers visited for field trips in and around Kenya were many. There were examples of the major informal venues which are considered in the literature - museums, national parks and reserves, aquariums and zoos, as well as many habitats and industrial sites.

4.9.2 Student outcomes from field trips

There was some variation in the understanding of the teachers about the usefulness of field activities. Most realized the cognitive outcomes of taking them and many also saw their affective values. Other teachers took students for trips to experience firsthand what they are being taught in the class so that it’s real for them. Many of them emphasized field excursions involve getting students out in the real world and real world situations. Some teachers said field activities helps to add a bit of variety in pedagogy can be motivating for student sometimes and that sometimes it's the best way to do things in terms of the content. There is an extensive literature which supports using field activities for achievement of learning outcomes in a variety of venues. The literature also supports the affective changes caused by field activities, mainly to attitudes. However, Beasley et al. (1998) found that there was a difference between teacher perception of the value of taking field trips and actually taking them. On the other hand the teachers saw themselves mainly as active participants in the field trips, interacting with the students and not reflecting some of the practices observed by Griffin and Symington (1997). It has been suggested in the literature (e.g. Griffin, 1994, 1996; Griffin and Symington, 1997; Price and Hein, 1999; Rennie and McClafferty, 1995) that field trips should be integrated into the teaching program. In planning their field trips, most of the teachers included them in their teaching programs. Apart from administrative requirements, this meant that planning started well ahead and the outcomes of the field trip could be integrated with those of the teaching programs.

Most teachers pointed out that for excursions to be successful, they should be planned well and early enough, weeks at least. They insisted that field trips should be included at the inception of the term or year. It has also been suggested in the literature that teachers need to use strategies which reflect informal teaching methods (Griffin, 1994; Griffin & Symington, 1997; Price & Hein, 1991) rather than use formal classroom methods which are the focus of their training. Worksheets are often perceived as being 'busy work', displacing the focus of the field trip to the worksheet itself (Griffin, 1994; McManus, 1985; Michie 1995; Price & Hein, 1991). Some teachers considered that their ability to conduct effective field trips had improved as they matured in their teaching experience. Perhaps as a consequence of using practical work as part of their pedagogy, science teachers are able to use informal methods more easily. Although little comment was made about the actual teaching process while on a field trip, most teachers seemed to be able to adapt their teaching to involve students in small groups but much of it was done usually by preparing some kind of set of focus questions for the students to complete either during or after the trip."

Although strategies such as those advocated by Rennie and McClafferty (1995) recommend follow-up work from field trips, it provoked little comment. Griffin (1994) found that it was often restricted to collecting and marking worksheets. A number of teachers said they often used excursions as the basis of oral communication and found that's a really effective way to make sure that a student on a field trip is getting the information that they need.

Assessment and evaluation of the outcomes were provided for where the teachers suggested that they would use worksheets, focus questions and similar techniques to focus on the learning from the field trip. It was then necessary to integrate that learning with the whole unit by using various follow-up strategies. Although some teachers would use the worksheets as an assessment tool, it is preferable to establish links between the field trip and the unit of work prior to assessment. It has been suggested that the value of worksheets is enhanced when they are used as a focus on subsequent work (e.g., writing reports, Michie, 1994).

4.9.3 Support in the school community

The teachers considered that students benefited from going on field trips and that most of the students wanted to go on field trips. In a few cases teachers felt that this was because students saw them as free, out-of-class time. Perhaps the students' casual comment, "getting out of school", should be interpreted as "getting a day off from the normal school routine" (Falk and Dierking, 1992, p. 30). Again it is the responsibility of the teacher to inform the students of the purpose of the field trip. Students surveyed by Tamir and Zoor (1977) rated field activities as highly important. Falk and Dierking (1992) considered that students attending a field trip had two agendas, one of which was child-centered and the other similar to that of the school and venue. Both of these agendas can be manipulated prior to the field trip by orientation of the students, reducing the novelty factor and at the same time improving learning (Kubota and Olstad, 1999; Orion and Hofstein, 2001; Burnett, Lucas and Dooley, 1996; Anderson and Lucas, 1999). Most of the teachers felt that students' behavior improved when they were on field trips and that improvements could continue afterwards into classroom relationships. Preparation appears to be a major factor in keeping students on task. Orion and Hofstein (2001) concluded from their research that those students who had least preparation for the field trip, "demonstrated poor learning performance in each of the learning stations" (p. 1109) and "the teacher-student relationships were hostile" (p. 1110), whereas those students who were adequately prepared demonstrated negligible off-task behavior. Prior misbehavior by students in class or in the school in general was also considered as a likely reason for not taking students on field trips. Teachers felt that they may not be able to maintain control of their students outside of the classroom, particularly without assistance, and that this would be exacerbated in classes with larger numbers of students. Most teachers said it not possible to physically to control a group of about 40 students or more, all of whom have behavioral problems, by themselves or even with the help of other teachers.

Other teachers felt that their students demonstrated poor attitudes to field work and they (the teachers) could see no reason to go out of their way to organize for field activities. In some of the early research by Falk and Balling (1999) behavior was not seen as a major issue. Fido and Gayford (2002) also discounted behavior as a negative factor. However, Muse et al. (2002) reported that 'students' were identified as a factor for not taking field trips by 22% of the secondary teachers. The relationship between teachers taking field trips and other teachers in the school seems to involve some antagonism. The two causes identified for this were that teachers took students away from the other teachers' classes, and the absent teachers relied on their peers to cover relief lessons for them. Many teachers felt that although generally the other teachers in the school did not complain, some individuals did. It was felt that these would normally be outside the science departments and that the main complaint would be about students losing class time for the other subject area. Most considered that other teachers from the science departments were supportive and often acted as resource people. The legal responsibility of the school administration in permitting field trips appeared to be poorly understood by some teachers, demanding an early notice for all field trips for about four weeks. Other factors which school administrations are responsible for include the provision of transport. Teachers' perceptions about the role of other members of the school community were quite varied. Some groups, particularly parents and the ancillary staff (including laboratory technicians), were marginalized by many of the teachers. Parents were often seen simply as suppliers of money and permission. Ancillary staffs in schools are often involved in ordering buses for field trips, ensuring that school buses are appropriately equipped and in preparing equipment for any activities.

4.9.4 Factors affecting whether teachers take field trips

The safety, administrative procedures and legal issues for teachers were perceived as neutral and it was up to individual teachers how they respond to them. Some teachers spoke about their lack of first aid knowledge, trusting that they wouldn’t have any major accidents. Weather also appeared to be neutral as most schools made allowances in their programming to run weather-susceptible units at more appropriate times. Transportation, money and large class sizes all tend to be related, negative factors. A teacher's dream appeared to be provision of a school bus, large enough to seat all students at no cost. Class sizes were generally greater than the size of the group that could be transported with a small bus. Bigger buses are not only more expensive to buy and maintain, they also require different licensing arrangements. Schools often have to hire outside buses but this often creates financial problems; it can also produce a numbers problem as schools double up classes to reduce costs. Collecting money from students was seen as a hassle, a view often put with industrial or professional implications. There was concern that the students don't want to pay for field trips thinking that the school owes them an excursion or three. Teachers were also concerned that the larger numbers on a field trip made safety an issue.

Timetable inflexibility was also seen as negative; teachers were willing to use double lessons but felt less inspired to extend trips over longer periods of time, thus incurring the wrath of their peers for taking students out of their classes and/or generating make-up lessons. One school timetabled double lessons first thing in the morning but many field trip venues didn’t open until later in the morning. Time and effort on the part of the teacher were often seen as negative factors. Time is required for all planning in teaching but field trips can be even more demanding. Often venues have to be visited or resource people contacted. Resource materials and relief lessons may need to be prepared. Extended field trips use up teachers' out-of-school time. Overcoming the 'general inertia' to do all this was seen as a hurdle by Falk and Balling (1999), Tamir and Zoor (2000) and Price and Hein (1999). Yet some teachers continue to take field trips so that there must be satisfaction in the effort made.

Most of the teachers felt that the availability of resources and resource people was a factor which would make it easy for them to undertake field trips. Many teachers become self-sufficient in preparing for their own field trips, although some do not. Some teachers thought that resources prepared by other people looks at aspects they might not have thought of themselves. Other teachers felt that they have been on a few in-services aimed specifically at showing teachers what's available as far as excursions go. The area of teacher professional development and the preparation of resources, particularly where teachers and resource people worked cooperatively, have been mentioned in the literature by Price and Hein (1999) and Chase (2000). Similarly the advice to teachers about visiting venues beforehand is still relevant and occurs throughout the literature (e.g., Rennie and McClafferty, 1995).

4.9.5 Significance of past experiences

Teachers' recollections of their own school field trips tended to be more extensive with younger teachers, with few of the older teachers indicating any field trips while attending school. This is not a memory problem but reflects the increasing popularity of field trips. For many teachers, their first field trips were at university or teachers college and this depended on the discipline being studied, especially the biological sciences tending to have more field trips than any of the other sciences. For many teachers the main factor which affected their willingness to take field trips appeared to be their successful experiences, primarily as teachers but also as students, and learning the value of using other venues for their teaching. The literature from museums (e.g., Wolins, Jensen and Ulzheimer, 2002) showed that good experiences encouraged people to continue using those facilities. There seems to be a parallel argument here that teachers who have experienced good field trips as part of their teaching will continue to organize and take them; this situation was also apparent to Price and Hein (1999). On the other hand, some museum visitor research indicates that poor field trips to these venues had the effect of creating museum non-users (Hood, 2001; most teachers would be unaware of these long-term consequences.

4.9.6 Summary and Conclusions

The teachers who were interviewed in this study all undertook field trips and there was general agreement that field trips were valuable for students' cognitive and affective development. It is important that schools recognize this and support teachers' use of these opportunities to facilitate achievement of learning outcomes. However the enthusiasm of the teachers for field trips varied from highly enthusiastic to disillusioned. A major factor expressed for this disillusion was the perception of school administrations as discouraging field trips. These teachers felt discouraged because they felt the administrative procedures within the school were burdensome and designed to discourage teachers taking field trips. They also felt that there were hassles with having to get appropriate-sized buses (usually commercially), the cost of field trips and having to get money from their students. These issues need to be addressed by schools. Administrative procedures should reflect departmental requirements, yet provide both legal and professional support for the teacher. The wider issue of 'duty of care' needs to be better articulated between teachers and schools. The provision of transport for field trips and their funding have to be seen as part of the school's overall finances and procedures. Student misbehavior was also seen as a discouraging factor for some teachers but others saw that taking field trips affected student learning and their attitudes, both towards the subject and personally, and enhanced their behavior. Some students go on many field trips, so it is important that teachers understand the need to establish the purpose of the trip beforehand. Teachers also need to realize that there are longer-term implications of taking field trips. Teachers felt that there were many venues they could visit but they did not have the time to prepare teaching materials for them. Professional development, particularly the type that brings teachers face-to-face with local experts, is an important way of developing their confidence, especially if it leads to the development of resources for other teachers. Schools can facilitate this process by promoting the attendance of teachers at these sessions.

4.10 Content Analysis of KCSE Past papers

The second research question was to find out the relationship between the KCSE biology papers and out-of classroom. An analysis of the KCSE biology past papers for the past five years indicate that students could still do well in the examinations without out-of-classroom experiences. Teachers need to become more aware that making links between the domain of objects and observables and the domain of ideas is demanding, and then help them to design practical tasks which take this demand more explicitly and fully into account–tasks which ‘scaffold’ students’ efforts to make these links. This in turn requires that teachers analyse more carefully the objectives of the practical tasks they undertake, and become more aware of the cognitive challenge for their students. The starting point for linking practical work and examinations is therefore to help teachers become much clearer than many are at present about the learning objectives of the practical tasks they use.

Science teaching is essentially a practical activity, with a long tradition of pupil experimental work in schools. And yet, there are still questions about its most appropriate role and the reality of what is actually achieved. What is the purpose of doing practical work? - to increase theoretical understanding or to develop practical competencies? What does it mean to be good at doing sciences? What is the relationship between theoretical understanding and practical performance? How important are such factors as motivation and commitment? How can we assess a student's practical ability in a way which is valid and reliable and at the same time encourages, rather than destroys, good scientific practice in schools? The KSCE biology examinations should address such questions. By bringing together the latest insights and research findings, new perspectives and guidelines are developed. This thesis provides a re-affirmation of the importance of field activities in science, centered on problem-solving investigations. It advocates the need for students to engage in out-of-classroom practical tasks, in which all aspects of knowledge, (tacit as well as explicit), of practical ability, and of personal attributes of commitment and creativity, are iteratively interacting in holistic activity. While considering the particularly pertinent issues arising from the Biology Curriculum in Kenya, its discussion is equally germane to all concerned with developing good practical work in schools. If practical work is to merit the time, money and effort demanded by it in school science teaching, it must find a valid and convincing case for its existence.

4.11 Chapter summary

The results indicated a statistically significant relationship independent and dependant variables at $p<0.01$.On the other hand, there were no statistically significant differences between male and female teachers on the use of field activities in biology instruction. On the hypothesized relationships, the null hypotheses **Ho_1:** There is no significant relationship between teachers' knowledge and their use of field activities in teaching biology; **Ho_2:**There is no significant relationship between teachers' attitude and their use of field activities in teaching biology; **Ho_3**: There is no significant relationship between teachers' skills and their use of field activities in teaching biology; **Ho_4:** There is no significant relationship between the biology curriculum and the use of field activities in teaching biology; **Ho_5:** There is no significant relationship between administrative support and the use of field activities in teaching biology were all rejected whereas the null hypothesis **Ho_6:**There is no significant relationship between time and timetable factors and the use of field activities in teaching biology was accepted.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The aim of the present study was to investigate the contextual factors affecting the use of field activities as instructional media in biology teaching. Specifically, the study sought to establish teachers' use of field activities; the relationship between teachers' knowledge, attitude and skills; curriculum, administrative support and time table factors, and the use of field activities in biology. The results of the study were presented in the previous chapter. Thus, this chapter presents the summary of the findings, discusses the conclusions of the study and provides implications for practice and further research.

5.2 Summary of the findings

5.2.1 Teachers' Use and Knowledge on Significance of Field activities

The first and second research objective of this study was to establish the relationship between teachers' knowledge and their use of field activities. Research findings indicated that teachers agreed with statements measuring their knowledge on the significant of field activities and their role in biology teaching. This means that classroom teachers believe in their ability to perform biology teaching and their power to overcome the negative effects of non-school factors, resulting in positive student learning outcomes. They seemed to be optimistic and they believe that they can indeed be effective in carrying out field activities in biology. However, most of them expressed concern regarding their background knowledge in biology, because low percentage of teachers felt that they understood biology concepts well enough to teach effectively. The teachers generally believed that students' learning can be influenced by effective teaching, especially practical teaching in the natural setting. They are in agreement that effective biology teaching involves out-of-class activities in natural settings. If classroom teachers view that effective teaching (active involvement and hands-on biology) will enable students to learn biology well, they idealistically respond in this manner which is in agreement with Crowther and Cannon (1998).In this study, additionally, teachers' knowledge and their use of field activities regarding biology teaching were compared with respect to gender. T-tests were run on the scores of each subscale to determine differences between male and female teachers' knowledge regarding use of field activities in biology teaching. The results revealed no significant differences between teachers' knowledge and use of out-door activities in terms of gender. This finding is consistent with Celep's (2001) and Savran and Çakıroğlu's (2001) studies that they did not find a difference between male and female science teachers with regard to their science teaching knowledge.

5.2.2 Relationship between Teachers' knowledge and Use of Field Activities

Pearson Product-Moment Correlations were computed to explore whether a relationship existed between in-service teachers' training and their use of field activities in biology teaching. In-service teacher education programs include courses related to pedagogical knowledge and content knowledge. These programs provide opportunities for classroom teachers to apply their content and pedagogical knowledge in instruction and to further develop personal teaching instructional competency, skills and abilities. Some of these programs have provided insights into how children learn science and strategies for teaching science. Shulman (1998) asserted that competent teaching practice requires an integration of such knowledge that of subject matter content knowledge and pedagogical knowledge; therefore, it could be predicted that the sum of the classroom teachers' such experiences during their in-service training programs would impact more on teachers' practices and beliefs. The relationship between the numbers of in-service training pedagogical courses completed and has been shown to be positive in some studies (Cantrell, Young & Moore, 2003) while other studies (Savran and Çakıroğlu, 2001) have shown no relationship. True to these expectations, data of this study shows that number of in-service pedagogical programs completed at the university are positively correlated with biology teaching outcome in relation to out-door activities. That is, increase in the number of in-service pedagogical programs by teachers result in increase in their use of field activities in biology teaching.

5.2.3 Teachers' Attitude toward Field Activities in Biology Teaching

The second research objective was to determine the relationship between teachers' attitude and their use of field activities.A lack of interest in science is one of the barriers to effective science teaching. Stollberg (1999) asserted that teachers with a neutral or negative attitude could either avoid the teaching of science or pass this negative attitude along to young students. Therefore relationship between attitude and behavior must be considered as schools of education that prepare teachers (Tosun, 2000).According to the result of this study, the classroom teachers indicated positive attitude toward use of field activities in biology teaching on most of the items. Majority of the participants claimed that use of field activities in teaching of biology was important to student learning (M=3.8089; SD=.1905). They were in agreement on items which showed the necessity of field activities in teaching biology. On the other hand, participants indicated low attitude toward biology teaching on some items which were related to their efficacy in fieldwork concepts. A low attitude to negatively worded items towards field activities was evident.

5.2.4 Relationships between Teachers' Skills and Use of Field activities in Biology Teaching

The third objective was to determine the relationship between teachers' skills and their use of field activities in biology. Research findings indicated a significant relationship between teachers' skills and their use of field activities. The literature on teaching performance indicates that practical skills is part and parcel with (and essentially is a prerequisite for) teaching ability. Ramey-Gassert et al. (2006) examined factors which influence effective teaching in science with a qualitative study. In their study, group members stated that, although they were growing in the area of science teaching, they harbored feelings of inadequacy for many reasons: A primary reason was their perceived lack of practical teaching skills. Whether these teachers had a real or perceived deficiency in practical skills or science teaching methods would cause them to hesitate when teaching science. One logical solution to enhance teaching skills is that teacher education programs need to provide more science content and methodology for teachers especially on outdoor activities. Bandura (1999) identified four sources of efficacy expectations: performance accomplishment, vicarious experience, verbal persuasion, and emotional arousal. The first source of efficacy expectations, performance accomplishment, may be the most significant. It is based upon personal mastery experiences, where by repeated successes increase mastery expectation and failures lower them. Participant modeling is one method of inducing performance accomplishment. These strategies could be integrated in biology content courses in the teacher training programs to help increase practical teaching skills in biology teaching. Koballa and Crawley (1995) stated that there was an interrelationship among beliefs, attitude and behavior. They offered the scenario whereby schoolteachers judged their ability to teach science to be low (skills), resulting in a dislike for science teaching (attitude) that ultimately translated into teachers who avoided teaching science (behavior). As expected, teachers' attitude toward biology teaching made a significant contribution to the variations in this study. Enhancing teaching skills also cause enhancing attitude toward biology teaching.

5.2.5 The relationship between curriculum and use of field activities

The fourth objective was to determine the relationship between the biology curriculum and the use of field activities. Research findings indicated a significant relationship between the biology curriculum and use of field activities.However, field activities often suffer from being disjointed from the rest of the biology curriculum. The fact that it is often used to deliver the skills and techniques components, and/or is the vehicle for completing learning objectives probably adds to its disembodiment from the rest of the subject, thus undermining its potential synoptic value and negating a powerful opportunity to demonstrate its value to the subject as a whole. This problem is exacerbated if field activities are delivered through pre-determined ‘packages’, where the curriculum is determined and constrained by external providers who impose restrictions on what they deliver. Such inflexible packages are unlikely to be able to deliver the breadth and depth of subject matter which are needed by teachers and students who are coming from a large variety of backgrounds. Practising skills and techniques should not be the sole purpose of field activities. A narrow teaching approach such as this, often allied to lack of time, stifles the creativity and scope for original research which outdoor activity offers. Field activities need to be structured so that time for reflection is available. Biology fieldwork is a powerful learning tool because it helps learners relate to everyday life happenings and that students and teachers are able to reflect on their own learning. The development of these ‘thinking skills’ are also important analytical tools because they encourage students to apply their knowledge to unfamiliar situations such as those which are often encountered outside the classroom.

Findings from this research indicate that field activities, properly conceived, adequately planned, well taught and effectively followed up, offers learners’ opportunities to develop their knowledge and skills in ways that add value to their everyday experiences in the classroom. Specifically, field activities can have a positive impact on long-term memory due to the memorable nature of the fieldwork setting. Effective field activities can lead to individual growth and improvements in learning skills. More importantly, there can be reinforcement between the affective and the cognitive, with each influencing the other and providing a bridge to higher order learning.

Despite the substantial evidence of the potential of field activities to raise standards of attainment and improve attitudes towards learning, there is evidence that the amount of fieldwork that takes place in the Kenya and in some other parts of the world is severely restricted, particularly in biology. The number of studies that address the experience of particular groups (e.g. girls) or students with specific needs is negligible, although those that have been done draw conclusions that are important in terms of both policy and practice. Some children are more likely to take part in field activities than others for a range of reasons, many of which could and should be addressed. A minority of studies provide a health warning to proponents of outdoor education. Poor fieldwork is likely to lead to poor learning. Students quickly forget irrelevant information that has been inadequately presented.

5.2.6 The relationship between administrative support and timetable factors and the use of field activities

The fifth and sixth objectives were to establish the relationships between the administrative support and timetable factors and the use.Research findings indicated a significant relationship between administrative support and use of field activities in biology. However, there was no significant relationship between timetable factors and use of field activities. The school administration need to appreciate the benefits of outdoor adventure education provided by analyses of previous research and provide the necessary support for out-of-class activities. Looking across a wide range of outcome measures, these studies identify not only positive effects in the short term, but also continued gains in the long term. However, within these broad trends, there can be considerable variation between different kinds of outdoor programs, and different types of outcomes. There is substantial research evidence to suggest that outdoor adventure programs can impact positively on young people: attitudes, beliefs and self-perceptions – examples of outcomes include independence, confidence, self-esteem, locus of control, self-efficacy, and personal effectiveness and coping strategies; interpersonal and social skills; such as social effectiveness, communication skills, group cohesion and teamwork. The evidence base for cognitive and physical/behavioral benefits is less strong than for affective and interpersonal/social outcomes. In cases where there is a focus on such measures, however, there are examples of outdoor adventure programs yielding benefits in terms of: the development of general and specific academic skills, as well as improved engagement and achievement; the promotion of positive behavior and reduced rates of re-offending, and improved physical self-image and fitness. In relation to fostering environmental concern and awareness, the evidence of a positive link between outdoor adventure activities and environmental understanding and values is not strong. There seems to be a strong case for questioning the notion that nature experience *automatically* contributes to environmental awareness, commitment and action.

5.2.7 Teachers' perceptions on the use field activities as an instructional method

The seventh objective was to establish teachers' perceptions on the use field activities as an instructional method. This research reports demonstrable benefits for several types of outdoor learning from sampled biology teachers. These findings should provide a source of support and justification for teachers seeking an evidence base for the use of field activities in biology instruction and the capacity to link these activities with the biology curriculum. Two specific examples of benefits stemming from this are positive gains in science process skills and improved understanding of our surroundings. In the affective domain, the most important impacts of learning include greater confidence, renewed pride in community, stronger motivation toward learning, and greater sense of belonging and responsibility. There is significant evidence that social development and greater community involvement can result from engagement in school outdoor activities. Students develop more positive relationships with each other, with their teachers and with the wider community through participating in outdoor activities. Few studies have focused on physical and behavioral impacts of out-of-class activities. Compared with research on fieldwork/visits and outdoor adventure education, there is a need for a greater number of rigorous in-depth studies on outdoor learning in school grounds and community settings.

5.2.8 The relationship between the KCSE biology papers and knowledge of out-of-classroom experiences

The eighth objective was to find out whether the KCSE biology papers require knowledge of out-of-classroom experiences. Content analysis of the KCSE biology papers indicated that students could still do well without knowledge of out-of-class experiences.More specifically, the research gives a clear endorsement for certain kinds of outdoor learning provision and assessment. Research indicates the value of experiences which; (i) provide longer, more sustained outdoor experiences than is often provided; (ii) incorporate well-designed preparatory and follow-up work; (iii) use a range of carefully-structured learning activities and assessments linked to the biology curriculum; (iv) recognize and emphasize the role of facilitation in the learning process and (v) develop close links between learning aims and expected outcomes. The research also throws up several important challenges for biology teachers. These include: the fact that the aims of outdoor learning are not always realized in practice; the different types of barriers faced by individual students in learning out-of-doors; the unresolved issue of the relative benefits of novelty and/or familiarity with the outdoor learning settings; and the fact that the benefits of outdoor learning are not always sustained over time. These challenges raise important questions for those involved in organizing and undertaking outdoor learning activities. Deliberation and reflection about such issues could help to inform the strategic planning and development of curricula involved in providing outdoor learning opportunities for young people. They could also help to direct the ways in which school staff think about the structure, focus and timing of outdoor learning within and beyond the curriculum, and these should be reflected in the KCSE biology papers.

5.3 Conclusions

Findings from these research suggests that it is helpful to distinguish between: factors that can influence *the provision* of outdoor learning by schools, teachers and others factors that can influence *the nature and quality* of young people’s learning in outdoor settings. It is clear that the provision of outdoor learning in schools is affected by a wide range of barriers and opportunities. Notable barriers include: (i) teachers’ knowledge on use of field activities; (ii) teachers’ lack of skills and positive attitude toward teaching outdoors; (iii) secondary school curriculum requirements limiting opportunities for outdoor learning; (iv) shortages of time, resources and support; and (v) wider changes within and beyond the education sector. These various factors make clear the complexity of the challenge facing policy makers, practitioners and others who are seeking to increase and improve young people’s access to learning beyond the classroom and the school. The research that has been undertaken into students’ experiences of outdoor learning activities suggests that there are several factors that can facilitate and/or impede learning in outdoor settings. These can be conceptualized in terms of: program factors – including the structure, duration and pedagogy of outdoor education programs participant factors – including the characteristics, interests and preferences of learners; place factors – relating to the nature and novelty of the outdoor learning setting. Taken together, these factors provide a framework for thinking about how efforts to improve the quality and depth of young people's outdoor learning might be directed. Against the backdrop of calls for educational practice and policy to become more evidence-based, there is much in this research that is of relevance and use to teachers, policy makers and researchers. With this in mind, it is important that the findings of this research are considered not just in terms of how they might help to prove the value of outdoor learning, but also in terms of how can they might help to improve its quality.

5.4 Recommendations

These recommendations have been developed to assist educational programs in determining and/or evaluating the typical responsibilities of teachers as they carry out out-door/ fieldwork instruction. These are statements describing the knowledge, skills, and attitudes that are needed to be successful in the role of field instruction. These recommendations are general statements that may be modified and should be considered a guideline for school settings.

5.4.1 Knowledge

Teachers should demonstrate understanding and comprehension of the information required for the multiple roles they assume. In addition to the recognized competencies for instruction, teachers must be able to facilitate the development of competent students through the provision of supervised quality fieldwork experiences; develop learning activities and assignments that encompass the breadth and depth of knowledge in out-of-class activities and reinforce knowledge and skills leading to quality learning. It is also recommended that teachers demonstrate knowledge of effective learning processes that identify individual learning styles and use appropriate and individualized techniques for students at their fieldwork education site; demonstrate accurate and current knowledge of the contractual agreement between the schools and the fieldwork site when necessary; demonstrate the competence to develop and maintain proficiency in the learning processes and supervision skills through investigation or self-study, and maintain current knowledge of standards, rules, and regulations regarding supervision of students set by the Ministry of Education, and the fieldwork provisions.

5.4.2 Attitude

Teachers should employ positive attitudes in the learning processes to make sound judgments and decisions within the context of their roles. It is recommended that teachers should effectively evaluate and share knowledge in the form of new materials, literature, and educational materials relating to fieldwork that enhance the lifelong learning in students; critically integrate and apply theory, literature, and research into practice at the fieldwork site; critically evaluate the curriculum, particularly in terms of its components and their relationship to out-door learning, and participate in curriculum development in relation to the best practice in the fieldwork setting. It is further recommended that teachers need to demonstrate the ability to encourage development of critical reasoning in students; project a positive image of the fieldwork program to the school, student, and community; demonstrate a competent and positive attitude towards practice and supervision that will result in effective development and mentoring of fieldwork activities and effectively supervise and advise students the role of field activities and expected learning outcomes. They should also identify and clearly communicate both strengths and areas for improvement to students in a manner that encourages student learning.

5.4.3 Skills

Biology teachers should demonstrate the expertise, skills, proficiencies, and ability to competently fulfill their roles in guiding students during field activities. The teachers must also be able to plan fieldwork experiences within their settings that will prepare competent students; develop fieldwork course objectives, course materials, and educational activities and experiences that promote optimal learning for students; evaluate students' performance and learning outcomes in relation to fieldwork objectives and the biology curriculum and also design and implement a plan that develops and maintains accurate documentation of student performance in collaboration with school curriculum, and/or other documentation required for fieldwork experiences.

5.4.4 Curriculum influences

Fieldactivities need to be given careful consideration at the stage of overall curriculum design, and that the pattern of field teaching across the school program should be carefully thought through. Fieldactivities should be conceived both within their wider academic context and as a distinctive part of the curriculum which requires design in its own right. Debates and decisions are needed about the role of fieldactivities, their amount, their character and their timing. The fieldactivities curriculum also requires planning to ensure that it is progressive. Students may well benefit from experiencing not only different types of fieldactivities but also different levels of challenge. Across the four years of the biology program, the work expected of students needs to become increasingly demanding, with a greater emphasis on students taking responsibility for their own learning. Field activities need to be integrated into a teaching progression which enables the out-of-classroom work to build on, and link with, previous biological experience. The introductory and preparatory support will vary greatly depending on the background of the students and the educational objectives which are to be achieved. If teachers are using external providers there need to be preplanning consultations which ensures that the experience meets the needs of teachers and students.

5.4.5 Out-door learning and Policy

Those with a statutory and non-statutory responsibility for policy relating to outdoor education should be in no doubt that there is a considerable body of empirical research evidence to support and inform their work. Policy makers at all levels need to be aware of the benefits that are associated with different types of outdoor learning. The findings of this research make it clear that learners can benefit from effective outdoor education. However, despite such positive research evidence and the long tradition of outdoor learning in this country, there is growing evidence that opportunities for outdoor learning are in decline and under threat. There is an urgent need for policy makers at all levels and in the education programs to consider their role in: tackling barriers that stand in the way of the provision of effective outdoor education for all students, encouraging good programs and practices and capitalizing on policy developments, for example, by linking initiatives in different sectors supporting research, development and training so that good practice can be understood, disseminated and fostered. This has implications for action across a range of policy sectors nationally, regionally and locally, including education, health, environment and science.

5.5 Recommendations for Further Research

This research makes clear the substantial amount and range of research that has been carried out in outdoor learning. It also highlights a number of encouraging signs in this field, such as a diversification of research approaches and foci, and a growth in theoretical/critical exploration and meta-analyses/research syntheses. The current evidence base, however, is not without weaknesses or potential areas for improvement. Examples include: the extent of outdoor learning provision available to school learners in this country; the effectiveness of outdoor learning programs that seek to build progression from local environments to more distant learning contexts; the sorts of fears and concerns that young people can bring to different kinds of learning situations beyond the classroom; teachers' and outdoor educators' conceptions of 'the outdoor classroom'; and the cost-effectiveness of different kinds of outdoor learning.

In order for these gaps to be addressed, attention will need to be given to two important issues. The first is how to improve the methodological rigor of outdoor learning research and evaluation. There was a range of methodological weaknesses evident within certain parts of the literature in this research, including poor conceptualization and research design, and little or no follow-up in the medium to long term. The second issue is how to improve and deepen the research-based understandings of the outdoor learning process. To put it simply, there is still much to be learnt about how and why these programs work or not. Finally, there is a case to be made for greater theoretical and empirical attention being given to three significant 'blind spots' in the current literature. These concerns include: (i) the nature of the 'learning' in outdoor education; (ii) the relationship between indoor learning and outdoor learning; and (iii) the historical and political aspects of outdoor education policy and curricula.

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APPENDIX I: INTRODUCTION LETTER

September, 2011

Dear Respondent,

I am a post graduate student at Moi University in the School of Education, Department of Curriculum, Instruction and Educational Media. In order to complete my study, I am conducting research entitled "*A study of the contextual factors affecting the use of field activities as instructional media in biology instruction*". This survey questionnaire is designed to evaluate the contextual factors affecting the use of field activities as instructional media in biology teaching. This study will enable the researcher to make suggestions to the Educational institutions for the purpose of improving teaching and learning activities. Finally, the results of this study will provide valuable insight to research institutions that wish to improve the education of our future students.

Your participation and opinion will be of great value to the researcher and the Educational institutions. The information you will provide will be kept confidential. To ensure your anonymity, no name or other means of identification are requested in this survey. Your completed survey questionnaire will only be accessed by the researchers of this study.

Thank you for participating in this study. If you have any questions or comments on this study, please contact the researcher using mobile phone 254-0720554340 or e-mail stellakabesa@mu.ke.Moi University, P.O. Box 3900, Eldoret.

Your input is greatly appreciated.

Sincerely,

Stella Kabesa
stellakabesa@mu.ke.
Researcher

APPENDIX II: BIOLOGY TEACHERS' QUESTIONNAIRE (BTSQ)

SECTION I: Background information.

Please respond by putting a tick (√) in the appropriate box.

1. Gender 1) Male 2). Female

2. Age a) 30yrs and below b) 31-35yrs c)36-40yrsd) 41-45yrs e)over46yrs

3. Highest professional qualification.

a) BEd(Sc) ( ) b). BSc with Dip Ed. ( )

c) MEd. ( ) d). MSc with Ed. ( )

e). Any other specify

………………………………………………………………………………………

………………………………………………………………………………………

4. Which other subjects do you teach?

………………………………………………………………………………………

………………………………………………………………………………………

5 Teaching experience.

a)Less than 5 years ( ) (b) 6-10 years ( ) (c) 11- 15 years ( )
(d) Over 15 years ( )

6. Which classes do you teach or have you taught biology since you graduated from college?

a) Form 1 ( ) b) Form 2 ( ) c) Form 3 ( ) Form 4 ( )

7. Number of students in the classes you teach

a) 10-19 ( ) b) 20-29 ( ) c) 30-39 ( ) d) 40-49 ( ) e) Over 50 ( )

f) Any other?...

8. Attendance at in-service training programs

a) Never ( ) b) once ( ) c) twice ( ) d) more than 2 times ( )

9. Duration of in-service training

a) Not recalled ( ) b) 1-5 days ( ) c) 6-10 days ( ) d) 11-15 days ( )

10. Evaluation of in-service training programs

a) Very helpfulb) moderately helpful ( ) b) Not helpful ( )

SECTION II-Use of field activities in biology

Carefully read and select the answer, which best suits your views regarding each statement given by putting a tick {✓} against the response which applies in the appropriate box.

(N=Never; R=Rarely; ST= Sometimes;O= Often;A=Always)

	Statements on use of biology field activities	**N**	**R**	**ST**	**O**	**A**
	a)Planning					
1	I include field activities in my lesson plans to make my students participate in learning	1	2	3	4	5
2	I plan the field activities considering my students' individual differences	1	2	3	4	5
	b)Method	1	2	3	4	5
3	I try to meet my students learning needs through field activities as instructional strategy, method and technique	1	2	3	4	5
	c)Materials	1	2	3	4	5
4	I utilize field resources/experiences in classroom teaching	1	2	3	4	5
	d) Evaluation	1	2	3	4	5
5	I give my students some homework requiring them to use knowledge learnt from field activities	1	2	3	4	5
6	I ask questions to my students to assess what they have learnt from field activities	1	2	3	4	5
7	I take measures to assess what my students have learnt in field activities	1	2	3	4	5

Any comments…………………………………………………………………………….

…………………………………………………………………………………………

…………………………………………………………………………………………

SECTION II- Views of biology teachers on the significance of field work in biology

Carefully read and select the answer, which best suits your views regarding each statement given by putting a tick {✓} against the response which applies in the appropriate box.

(SA= Strongly Disagree; D=Disagree; U= Undecided; A=Agree; SA=Strongly Agree)

	Attitude	**U**	**A**	**SA**	**SD**	**D**
	a) Knowledge	**1**	**2**	**3**	**4**	**5**
1	Field work develops students' skills in observation, measurement, and in data and specimen collection	1	2	3	4	5
2	Field work provides experiential learning	1	2	3	4	5
3	Field work promotes learning through case studies examined at first hand	1	2	3	4	5
3	Field work promotes students' transferable skills	1	2	3	4	5
4	Field work develops good working relations amongst students and between staff and students	1	2	3	4	5
5	Field work ensures that students learn how to worksafely in the field.	1	2	3	4	5
6	Field work links theory with practice by relating knowledge derived from reading, lectures and laboratory work to information and evidence gained in the field	1	2	3	4	5
7	Field work helps to deliver curriculum content	1	2	3	4	5
8	Field work develops fieldwork skills	1	2	3	4	5
9	Field work helps to complete coursework	1	2	3	4	5
10	Field work provides evidence for key skills	1	2	3	4	5
11	Field work promotes personal development	1	2	3	4	5
12	Field work builds progression to the next level	1	2	3	4	5
13	Field work promotes subject recruitment	1	2	3	4	5

Any comments?..
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Please circle the most appropriate number of each statement which corresponds most closely to your desired response

b) Attitude	**SD**	**D**	**U**	**A**	**SA**
1.Iam knowledgeable about the significance of fieldwork in biology	1	2	3	4	5
2. I have adequate content knowledge to effectively teach the lessons and activities					
3.I have the confidence of conducting field activities	1	2	3	4	5
4.Using field activities does not complicate a teacher's job	1	2	3	4	5
5. I like to use field activities in biology teaching	1	2	3	4	5
6.Integratin is interesting field activities in teaching	1	2	3	4	5
7.Using field activities in teaching will increase students' motivation	1	2	3	4	5
8. Using field activities in teaching improves teaching effectiveness	1	2	3	4	5
9.Using field activities in teaching will make learning more effective	1	2	3	4	5
10.Using field activities in teaching will increase students' knowledge	1	2	3	4	5
11.Using field activities in teaching increases students' interest in subject matter	1	2	3	4	5
12.Using field activities in teaching enables students to get information faster	1	2	3	4	5
13.Using field activities in teaching encourages students' creativity	1	2	3	4	5
14.Using field activities in teaching helps increase students' self-confidence	1	2	3	4	5
15.Field work is a risky teaching approach	1	2	3	4	5
16.The quality of teaching is likely to be compromised if field activities are involved	1	2	3	4	5
17.Field activities disrupts normal learning	1	2	3	4	5
18.Delivery of fieldwork is "inspiring' to the students	1	2	3	4	5
19. Field activities are "tedious and dull'	1	2	3	4	5
20.Fear of accidents is an important influence on field work provision	1	2	3	4	5
21.Field activity sessions need to be accompanied by medical personnel	1	2	3	4	5
22.Teachers involved in field activities should be rewarded/ encouraged	1	2	3	4	5

Any comments?..
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c) Skills

	SD	D	U	A	SA
1.I can plan and appropriately deliver fieldwork to achieve instructional objectives	1	2	3	4	5
2.I have received professional development training specifically for field activities	1	2	3	4	5
3.I frequently modify field activities for science lessons to meet the needs of diverse learners	1	2	3	4	5
4.There is a very strong association with techniques, skills and coursework—and associated assessment—in secondary science	1	2	3	4	5
5.Many trainee teachers are entering the profession with little previous fieldwork experience	1	2	3	4	5

Any comments?...
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d) Curriculum influences

	SD	D	U	A	SA
1.The curriculum is the major critical factor in conducting field activities	1	2	3	4	5
2. The curriculum connects lessons to daily life	1	2	3	4	5
3. Goals of the curriculum are appropriate for field activities	1	2	3	4	5
4. Suggested field activities in the curriculum are efficient	1	2	3	4	5
5.Curriculum makes field activities more effective and efficient	1	2	3	4	5
6.The statutory requirement to carry out fieldwork has a major positive impact on levels of biology fieldwork	1	2	3	4	5
7.Curriculum specifications, has had a major impact on the numbers and timing of field work	1	2	3	4	5
8. A strong curriculum requirement affects content of inspections. This affects profile of outdoor learning within schools	1	2	3	4	5
9.The curriculum does not stress on the importance of fieldwork	1	2	3	4	5
10.Increased workload may have an impact on fieldwork	1	2	3	4	5
11.Teachers are not likely to finish the syllabus if they involve field activities	1	2	3	4	5
12.The outdoor experience is sometimes poorly integrated into the school, and often lumped into the end-of-year "activity' period	1	2	3	4	5

Any comments?...
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e) Administrative support

	SD	D	U	A	SA
1 My school administration demonstrates a high priority for outdoor/field activities in science	1	2	3	4	5
2.My school administration has a clear understanding of how field activities should be carried out	1	2	3	4	5
3.Strengthening the provision of teacher training and in-service support is critical	1	2	3	4	5
4.Protocols for delivering out-of-school visits are dissuading rather than supporting field activities	1	2	3	4	5
5.Student-teacher ratio is a major barrier when going for out-door activities	1	2	3	4	5
6.The increasing dependence on part-time studying does affect fieldwork provision	1	2	3	4	5
7.Costs are a major influence on present-day fieldwork provision	1	2	3	4	5
8.Teachers need to be given financial support on fieldwork activities	1	2	3	4	5
9. Costs are not the exclusive, or even the most important, barrier in field work	1	2	3	4	5
10. Funds from schools are not sufficient to finance field trips.	1	2	3	4	5
11. Funds from schools are not sufficient to finance field trips.	1	2	3	4	5
12. Even with 100% funding many schools will not take up field work opportunities	1	2	3	4	5

Any comments…………………………………………………………………………
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f) Time and Timetable factors

	SD	D	U	A	SA
1.I have adequate time to plan and prepare for instructional activities related to fieldwork	1	2	3	4	5
2.Negotiating timetable cover, is a major barrier to teachers who are trying to organize fieldwork	1	2	3	4	5
3. There is insufficient time for fieldwork	1	2	3	4	5

Any comments……………………………………..……………………………………
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THANK YOU

APPENDIX III: INTERVIEW SCHEDULE

a) What is your definition of field activities as it relates to Biology? ----------------
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b) Do you conduct field activities? ---

Why?--

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c) What types of activities do you carry out?---

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d) How important do you consider field activities in achieving the outcomes of the courses you teach? --
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e) How do you ensure that biology field activities are included in your teaching program? ---
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f) How do you ensure that the intended learning outcomes from field activities are achieved? --
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g) What impact do biology field activities have on other aspects such as students' attitudes, motivation and rapport? --
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h) How do you find your students reactions to going on out-of-classroom field activities?---
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i) a) Are there any particular groups of students you will or will not involve in field activities? --
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b) What are the characteristics of these groups? ------------------------------------
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j) How do other members of the school community react to your taking of field activities?--
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k) I want to move onto the factors which you think make it easier or would make it easier, and the ones which make it difficult for you to conduct field activities. Would you like to comment on how you find any factors make it either easier or obstruct you in conducting field activities? -----------------------
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l) What kinds of changes would you like to see that would make use of field activities easier? ---
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How you think that professional development (in- servicing) would influence the way you conduct field activities? --