Investigating the Role of Institutional Management on the Provision of Field Activities in Science in Secondary Schools in Kenya

Stella Kabesa
Department of Curriculum and Instruction,
University of Eldoret
P.O Box 1125-30100 Eldoret
stellakas@yahoo.com

Abstract
Background: *Excellence and equity in science teaching and learning in schools are determined by various social, cultural, and linguistic factors. The opportunity for direct hands-on experience provided by field activities can be useful for transition from a concrete to abstract level of cognition.*
Aims: *This study aimed to empirically examine the role of institutional management on the provision of out-of-classroom activities in secondary schools in Kenya. The five factors examined in this study were: institutional managements' priority for outdoor/field learning activities in science; understanding of how field activities should be carried out; provision of in-service teacher training programs; student-teacher ratio and funding.*
Methods*: The study sample consisted of 135 respondents with a response rate of 84.09 per cent. Data was analyzed using descriptive statistics, correlations and multiple regression analysis.*
Results*: Institutional management's priority and knowledge of how field activities should be carried out; and provision of in-service teacher training programs were found to be positively associated with the provision of field activities in secondary schools in Kenya. Protocols for delivering out-of-school visits; student-teacher ratio and availability of costs/funding were found to have a significant effect on the provision of out-door activities.*
Conclusions*: School managements should focus on improving the provision of out-door learning in terms of reducing protocols for delivering out-of-school visits; providing financial support on field activities and improving on the student-teacher ratio. The findings made a contribution in terms of allowing us to understand the factors that can contribute to the enhancement of provision for outdoor learning which evidently has enormous, both short and long-term effects on science learning- learning by doing.*

Keywords*: Field learning activities; school management; in-service training*

1.0 Introduction

Excellence and equity in science teaching and learning in secondary schools are determined by various social, cultural, and economic factors by the major players in the arena (Fraser-Abder, Atwater, Lee, 2006). Secondary 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 school administrators to address the issue of teacher preparedness in addressing inquiry-based science instruction (Basista, Tomlin, Pennington, & 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 science 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.

2.0 Literature Review

2.1 The Field Learning 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.

2.2 Justification for Use of Field Learning 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), fieldactivities 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).

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 fieldactivities.

2.3 Role of School Administration on Provision of Field Activities

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, & 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.

3.0 Methods

The study employed a survey research design**.** Questionnaires were distributed to a sample of 135 science teachers randomly selected from a population of 318 teachers in Uasin-Gishu County. This was with regard to Cochran (1962)'s sample size formula, n= $[t^2 (PQ) / d^2][1+ (1/N) t (PQ) /d^2]$ quoted in Barci, (2001) . In order to achieve the objectives of the study, two types of data collection were used. The first part of the questionnaire aimed at collecting demographic information including gender, years of teaching experiences, other teaching subjects, educational level; while the second section contained a Likert type scale with five statements and 12 items which were used to measure the effect of the school management on the provision of field activities in secondary school science. The reliability of scale of the questionnaire was found to be Cronbach 0 .793. SPSS version 21 was used in data analysis; and arithmetic mean, standard deviation, descriptive statistics, Pearson correlation and multiple regressions were processed.

4.0 Results

4.1 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.

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
Teaching Experience			
	Less than 5 years	49	36.3
	6- 10 year	14	10.4
	11- 15 years	36	26.7

Source: Survey Data

4.2 Descriptive Analysis of Results

4.2.1 Influences of Institutional Support on Field Activities

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 4.2 Institutional Support

Statements on Institutional 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

4.3 Correlation Analyses

Pearson Product-Moment Correlation was computed to explore whether a relationship exists between variables field activities and institutional support. The association between the independent variable and dependent variable were found to be statistically significant at level $p<0.01$. Institutional support correlated to use of field activities($r= 0.641$, $p< 0.01$)

Table 4.3 Correlations

Measures	M	SD	Institutional support
Field Activities	3.8218	.32277	.641**
Institutional support	3.6913	.34319	1

Source: Survey Data

4.4 Hypothesis Testing

The null hypothesis stated that: There is no statistically significant relationship between school management and the use of field activities in science instruction. The beta coefficient for school management support was .152, t=2.769, p< 0.01. Due to the low p-value associated with t-ratio, the null hypothesis was rejected. Therefore there is a statistically significant relationship between school management support and the use of field activities in science instruction. A major meta-analysis of 97 empirical studies indicated a positive overall effect of adventure education programs on outcomes such as self-concept, leadership, and communication skills, Hattie et.al (1997). This study also indicated that there appeared to be ongoing positive effects. The largest empirical study of the effects of outdoor education programs (mostly Outward Bound programs) found small-moderate short-term positive impacts on a diverse range of generic life skills, with the strongest outcomes for longer, expedition-based programs with motivated young adults, and partial long-term retention of these gains (Neil, 2008).

Table 4.4: Regression results

Predictor variables	**B**	***t- value***	**Sig.**	**Tolerance**	**VIF**
Institutional support	.152	2.769	.006	.767	1.304
R^2	.704**				
Adjusted R^2	.69				
F statistics	50.769**				

**P< 001

5.0: Discussion

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 should therefore demonstrate a high priority for outdoor/field activities in science and a clear understanding of how field activities should be carried out. There is much anecdotal evidence about benefits of outdoor education experiences; teachers, for example, often speak of the improvement they have in relationships with students following a trip. However, hard evidence showing that outdoor education has a demonstrable long-term effect on behavior or educational achievement is harder to identify; this may be in part because of the difficulty involved in conducting studies which separate out the effects of outdoor education on meaningful outcomes.

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 field activities and argued that funds from schools are not sufficient to finance field activities. Student-teacher ratio was seen as a major barrier for out-door activities.

Outdoor education has been found more beneficial to those students who find classroom learning more challenging, (retrieved from http). Maynard, Waters & Clement (2013) in their research found that, resonating with their previous findings, the teachers in their study reported "that when engaged in student-initiated activity in the outdoor environment, over half of the students who in the classroom were perceived to be 'underachieving' appeared to behave differently" (p. 221). Their work aims to support the notion that the more natural outdoor spaces in which student-initiated activities take place both directly and indirectly diminish the perception of underachievement. This is important because a number of studies have shown that expectations based on perception of students are important for student learning.

6.0: Conclusion

The school management 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 management needs to support teachers especially when they need financial assistance and experts or resource persons. There need to be pre-planning 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.

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