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Secondary School Teachers' Perceptions of a Biology Constructivist Learning Environment in Gem District, Kenya

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ABSTRACT
This study investigated the teachers' perceptions of actual and preferred constructivist biology learning environment. The study adopted a survey design. Data were collected from a sample of 41 biology teachers from Gem District, Kenya using a 20-item Teacher Perception Questionnaire (TPQ) which is a modified version of Constructivist Learning Environment Survey (CLES), the teachers' version. The TPQ consisted of two forms which are "Actual" and "Preferred". While the actual form assessed the current biology learning environment, the preferred form assessed the teacher perception of a constructivist learning environment. The data were analyzed using paired t-test. The results showed that the teachers' scores on the preferred form of some scales (Personal relevance, uncertainty and student negotiation) were significantly different from the actual form ($p< 0.05$). On the other hand the teachers' scores for scales of critical voice and shared control scales of actual and preferred forms of TPQ were not statistically significant ($p< 0.05$). The implications of the study for practice and further research are discussed.
Key words: *Constructivism, Teacher perceptions, Learning environment, Biology*

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INTRODUCTION

Biological knowledge has played a very important role in the society. It has been used to solve problems of diseases and poor yields in agriculture by production of disease resistant and high yielding plants and animals; overpopulation through the development of hormone based contraceptives; protection and management of the environment. (Maundu, Sambili & Muthwii, 2005;Campbell & Reece, 2002). Despite this importance, the performance of students in Kenya in the Kenya National Examinations Council (KNEC) has been poor. For instance, the students scored a mean of 29.23% in 2010. This underachievement in Biology has been attributed to student related factors (KNEC, 2011), teacher related factors (CEMASTEA,2011) and Physical factors of the learning environment (UNESCO,2012). Of these groups of factors, the teacher plays a pivotal role in creating conducive learning environments that can enhance student cognitive and affective outcomes.

Many scholars in science education believe that teachers have a crucial role in implementing reform in schools and classrooms. Paradoxically, they are also viewed as the major obstacles to change due to their traditional beliefs (Prawat, 1992; Levitt, 2002; Funda, 2009). Aubusson and Watson (2003), observe that teachers are a critical influence on the quality of teaching and learning that occurs in the classrooms. If teachers are willing and positive about trying new initiatives, the chance of successfully employing an innovative curriculum is increased. According to Pekel, Demir and Yildiz (2006), Teachers are pivotal to student perceptions of learning, inhibiting or facilitating student learning. They continue to posit that some of the teacher qualities that lead to effective relationships are positive affection, warm attitude, tact of teaching, teacher immediacy, teacher power, teacher assertiveness and responsiveness and low differential treatment. Donping (2009) holds that teachers tend to teach the way they were taught, therefore to implement teaching innovation, there is a need for conceptual change of their teaching philosophy. According to Stofflett (1999), a majority of teachers at all levels have been educated in traditional fact-based science classrooms. In such classrooms, the knowledge structures are transmissionist in form and didactic pedagogies remain the norm. According to Adeyemo (2011), the perception of teachers' teaching, to a large extent determine the level of understanding reached by his/her students at the same time; the teachers' perception is the most important educational input predicting students' achievement.

The classroom is a psychosocial environment which has been researched with results showing it is a determinant and predictor of student learning, cognitive outcomes, motivation and attitude. (Green et al, 2004; Pekel, Demir & Yildiz, 2006; Arisoy, Cakiroglu & Sungur, 2007; Mucherah, 2008; Igwebuike & Oriaifo, 2012; Ozkal, Tekkaya & Cakiroglu,2009). UNESCO (2012), in an assessment for improving learning environments in USA, Canada, Australia and India documented that the characteristics of learning environments that most frequently correlated positively with learning gains were cohesiveness, satisfaction, task difficulty, direction, democracy and material environment.

The classroom learning environment is a complex scene of interactions that occur rapidly. According to Moore (1989), there are important interactions that occur in the learning environments as learner-content, learner-learner, and teacher-learner. During the learner-content interaction, they pass information to transform it from long term memory to long term memory. As this happens, the students find the need for support which takes the form of learner to learner and learner to teacher. The teacher-learner interactions provide feedback and dialogue between the student and the teacher. The learner-learner interactions facilitate the exchange of information, ideas and dialogue among peers. Implicit in these interactions is that the teacher is an important player in the learning environment whose role is to improve on the quality of the interactions in the context of the learning environment.

Constructivist Learning Environment

A constructivist learning environment is characterized by learners constructing knowledge out of their experiences which are associated with pedagogical approaches that promote active learning. (Afolabi & Akinbobola, 2009). Constructivist learning environments place much premium on students' prior knowledge which is also referred to as alternative framework or alternative conception. According to Neo and Neo (2009), a constructivist learning environment play an important part in achieving meaningful and retentive learning since it allows students to improve their problem solving , creative thinking and critical thinking skills. It is premised on an epistemology whose precepts, according to Driver and Bell (1986) and Driver and Oldham (1986), are: Individuals are purposive; Prior knowledge matters a lot; Knowledge is socially constructed; Meaningful learning involves the construction of links with prior knowledge; and Learning science involves conceptual change.

According to Akinbobola and Afolabi (2010) in a constructivist learning environment, the teachers' role is to serve as facilitator of learning in which students are encouraged to be responsible, autonomous, and construct their own understanding of each of the scientific concepts. Hence the activities are learner-centered, democratic, and interactive. The teacher provides students with experiences that allow them to use science process skills. Pintrich, Marx, and Boyle (1993) hold a view of the classroom that is constructivist and is defined by six contextual structures as task structures, authority structures, evaluation structures, classroom management, teacher modeling and teacher scaffolding. According to Olorundare (2000), the teachers' responsibility in a constructivist learning environment involves taking into account students' prior knowledge and understanding the nature of the concepts to be learned and the learning outcomes expected, conceptual demands made on the child and the strategies available to the teacher. Akinoglu and Tandogan (2007) posit that the role of the teacher is to initiate and guide the learning process. Implicit in these arguments is the important role of the teacher in a constructivist learning environment again the role of the teacher is not to dominate the learning environment.

It is important for teachers to create learning environments that ensure that students play an active role in their own learning process and access knowledge through investigation and questioning. Constructivist teaching strategy has been known to create learning environments where the learners are actively involved. According to Constructivist approach, individuals' behaviors and ideas that develop later are based on their previously constructed ideas, and that learning is a process involving an association established by learners between their existing knowledge and new ideas and experiences (Oludipe &Oludipe, 2010; Palmer, 2005). This approach therefore suggests that when students construct new ideas and new concepts, they learn using their previous knowledge after a process of mental balancing, rather than by directly eliciting information from their teachers (Ben-Ari, 2001; Hsu, 2004).

Statement of the Problem

The domain of learning environment research has produced many promising findings leading to enhancement of teaching and learning process in many countries. Research on learning environments has dominated western and Asian countries (Ozkal, Tekkaya & Cakiroglu, 2009) with most of the studies focusing on the students' perception of the learning environment. For example the studies have focused on relationship between perception of learning environment and attitude (Cakiroglu, Telli, & Cakiroglu, 2003; Ntow, 2009; Chuang& Cheng, 2003); Perception of learning environment and Motivation (Wei & Elias, 2011; Okurut-opolot, 2010). However studies on the perception of the constructivist learning environment from the teachers' perspective are few in the global scene and in Kenya to be specific. Therefore, there is need to do more studies on perceptions of the constructivist learning environment

which has been associated with positive cognitive gains particularly from the perspective of teachers in Kenya where teaching is transmissionist in nature.

Purpose of the Study

The purpose of the study was to investigate teachers' perception of actual and preferred constructivist biology learning environment in Gem District, Kenya. The specific question of the study was: Is there a statistically significant difference between teachers' perceptions of actual and preferred constructivist biology learning environments?

Theoretical framework

This study was based on Moos theory of educational environments (Moos, 2002). According to this theory, learning environments consist of three domains as relationship, personal growth and system maintenance and change. The relationship domain is concerned with the nature and intensity of personal relationships, involvement, affiliation and teacher support. The personal growth dimension focuses on opportunities for personal development and self enhancement. System maintenance and system change dimension assesses the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change. In this study, the relationship dimension was determined by the extent to which the learning environment enhances personal relevance and uncertainty; personal growth dimension was determined by the extent to which the environment allows for critical voice and shared control and system maintenance and change was determined by the extent to which the environment allows for student negotiation.

METHOD

The study adopted a survey design. This is because the study sought to describe the learning environment as perceived by teachers without manipulating it. A survey is more economical because it makes possible for many subjects to be studied at the same time (Fraenkel & Wallen, 2008). A total of 41 teachers teaching in public secondary schools in Gem District were sampled for the study.

Research Instrument

Teacher Perception Questionnaire (TPQ) was used to assess the teachers' perceptions of the extent to which the learning environment in their classrooms was constructivist in nature. TPQ was derived from the Constructivist Learning Environment Survey by Johnson and Mclure (2004) and modified to suit the study. The instrument had 20 items 5 scales that had 4 items in each scale. The scales were personal relevance, student negotiation, shared control, critical voice and uncertainty. This instrument is a 5- point response scale of "Almost always, Often, Sometimes, Seldom, Almost never". The actual form of the instrument assesses the present learning environment of the classroom and the preferred form assesses the teachers' preferences about the learning environment. The instrument was pilot tested among teachers not taking part in the study to determine its reliability. The various scales had different Cronbach's reliabilities viz: Personal relevance (0.62), Uncertainty (0.65), Critical voice (0.71), Shared control (0.68), and student negotiation (0.74) for the actual form. For the preferred form; 0.73, 0.75, 0.78, 0.72 and 0.76 were the Cronbach's reliabilities respectively. Table 1 below shows the scales of TPQ and their descriptions.

Table 1: Scales and Scale descriptions of TPQ

Scale	Scale description
Personal relevance	Extent to which the teacher makes learning relevant to students' lives
Uncertainty	Extent to which teachers make students know the provisional status of biological knowledge
Critical voice	Extent to which the teacher allows a criticism of his pedagogical plans
Shared Control	Extent to which the teacher allows students to participate in planning, conducting and assessing of biology learning
Student Negotiation	Involvement with other students in assessing viability of new ideas in the biology classroom

Scale descriptions derived from Johnson and Mclure (2004)

Data Collection and Analysis

The author collected data in February 2013 during a gathering of biology teachers from Gem, District. The necessary clarifications were given to the teachers before they responded to the items of the questionnaire. The data collected were analyzed using the program Statistical Package for Social Sciences (SPSS). To determine whether a statistically significant difference existed between actual and preferred forms of TPQ, paired t-tests were performed on the scores of each of the scales of TPQ.

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RESULTS

The descriptive and inferential statistics for each of the scales of the actual and preferred forms of TPQ are given in table 2 below.

Table 2: Perceptions of Constructivist Learning Environment as assessed by TPQ Actual and Preferred forms by Biology Teachers (N = 41)

	Actual (A)		Preferred (P)		Mean Difference	t-value	p-value
TPQ scales	M	SD	M	SD	(A-P)		
Personal Relevance	12.268	1.581	13.467	1.185	-1.195	-6.442*	0.000
Uncertainty	10.658	1.479	11.365	1.510	-0.707	3.080*	0.004
Shared control	10.073	1.330	10.317	1.649	-0.244	1.376	0.177
Critical voice	7.024	1.369	7.170	1.430	-0.146	-1.000	0.323
Student negotiation	13.195	1.615	14.609	1.594	-1.414	16.571*	0.000

*$P < 0.05$

Table 2 shows that the teachers perceived the actual learning environment as relating biology to the real world (M = 12.268), Making students know the provisional status of biological knowledge (M = 10.658), allowing students to participate in planning, conducting and assessing of biology learning (M = 10.073), giving students the opportunity to question the teachers' pedagogical plans and methods(M = 7.024), involving other students in assessing viability of new ideas in the biology classroom(M = 13.195). The Teachers preferred learning environments that, are characterized by relating biology to the real world (M=13.467), the fact that biological knowledge is provisional (M = 11.365), allowing students to participate in planning, conducting and assessing of biology learning (M= 10.317), giving students the opportunity to question the teachers' pedagogical plans and methods(M = 7.1707) and finally involving other students in assessing viability of new ideas in the biology classroom(M = 14.609).

To investigate the differences between teachers' perception of the actual and preferred learning environment, paired t-tests were carried out as in table 2. Paired t-tests showed that the teachers' scores on the preferred form were higher than those of the actual form on all the scales. However the differences were only significant in the scales of uncertainty, personal relevance and student negotiation. The differences were not significant with regard to the scales of shared control and critical voice. In other words the teachers preferred a constructivist learning environment where the students have to relate biology to the real world, have more opportunity to experience biological knowledge as arising from inquiry and where students explain and justify to other students their developing ideas. On the other hand the teachers did not strongly prefer environments where students are invited to share with the teacher control of the learning environment and also environments where the students have to question their pedagogical plans and methods and to express concerns about any impediments to their learning.

DISCUSSION

In this study, teachers' perceptions of the actual and preferred constructivist biology learning environment were investigated. Concerning teachers' responses to the actual form of TPQ, the highest mean score was obtained for student negotiation indicating that the learning environment in biology classrooms gives the students opportunities to explain and justify to other students their new developing ideas. This is very important in the sense that it puts the students at the centre of the learning process. It also makes the learner active and involved in the process of learning. The next highest response of the actual form of TPQ was obtained for personal relevance. This indicates that the teachers relate biology learning to what happens out of the school. Relating biology learning to what happens outside the school makes the learning of biology more meaningful. The results also indicate that the teachers had a less positive view of critical voice and shared control. This implies that the teachers do not allow the students to question the teachers' pedagogical plans and methods to express concerns about impediments to their learning and at the same time, do not allow students to share with them the control of the learning environment.

Regarding their responses to the preferred form of TPQ, the highest mean score was observed for student negotiation, indicating the teachers prefer that students share with each other their developing knowledge and ideas. The second highest was personal relevance. This shows that the teachers preferred a learning environment where they relate the biological concepts to the out of school experiences. The lowest response levels were from the scale of critical voice and shared control. This is not very surprising since in the African context, questioning the teachers' pedagogical strategies is likely to be perceived as indiscipline by the teachers and in such an environment; teachers are less likely to share authority in the classroom.

In general, the teachers' scores on preferred form were higher than those on actual form. However, the differences were only statistically significant for the scales of personal relevance, uncertainty and student negotiation as shown by the paired t-tests in table 2. There were no statistically significant differences between the actual form and preferred form of TPQ for the scales of critical voice and shared control.

The findings of the present study are similar to those reported in literature (e.g Beck et al, 2000; Roeloffs & Visser, 2001; OECD, 2009). For example, Beck et al.(2000), conducted a study consisting of 203 teachers having different backgrounds and teaching experiences to identify the factors that influence science teachers' implementation of constructivism in their classrooms. They found out that teachers were positive about teaching for personal relevance, student negotiation and scientific uncertainty. On the other hand they had concerns that the students might misuse the opportunity of critical voice due to their immaturity at the same time, they felt the students are inexperienced to use shared control thus causing classroom management problems.

CONCLUSION

Based on the findings of this study, the following conclusions have been reached: that the biology teachers in Gem district prefer some aspects of the constructivist learning environment as personal relevance, scientific uncertainty and student negotiation. However the preference levels for these aspects are just moderate. On the other hand, they do not prefer a learning environment characterized by critical voice and shared control.

IMPLICATIONS

The findings of this study have implications for practice and further research: In Kenya, the current biology curriculum recommends the use of inquiry approach to teach the concepts of biology. The constructivist philosophy would be very useful in employing the inquiry approach. The current study has indicated that teachers have moderate preference levels for a constructivist learning environment. In this regard, there is need for programs to strengthen these preference levels which will lead to the application of constructivist approach in the biology classrooms. This is likely to improve performance in the subject.

Secondly, the study is limited because of its reliance on self-reported data. A follow up research is needed to verify the consistency of the present findings by use of multiple methods. Similarly, this study is limited to 41 teachers from Gem District. The results may not be reliable if generalized beyond Gem District. For further research, the relationship between teachers' perceptions of the learning environment and other variables such as achievement of students, and teacher attitude should be examined. A study should also be done to investigate students' perception of biology constructivist learning environment to enable comparison of teacher and student perceptions.

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