Original Research Article

PERCEPTION OF CONSTRUCTIVIST LEARNING ENVIRONMENT: GENDER AND SCHOOL TYPE DIFFERENCES IN SIAYA COUNTY, KENYA

ABSTRACT

Aims: The study aimed at investigating gender and school type differences in perception of Biology constructivist learning environment.
Study design: The study adopted a survey design.
Place and Duration of Study: The study was carried out in Siaya County in Kenya between October and November 2013 during the school term.
Methodology: The study sampled 815 grade 12 students (466 boys, 349 girls, 399 high achieving students and 416 low achieving students). Two instruments were used viz. Student Perception Questionnaire (SPQ) and Student Interview Guide (SIG). The data were analyzed using descriptive statistics, independent sample t-tests, two-way MANOVA and two-way ANOVA. The qualitative data were used to explain quantitative data.
Results: The findings show that there existed statistically significant difference in perception between the low achieving schools and high achieving schools in favor of the low achieving schools in all the subscales of SPQ (p =.00) and statistically significant gender (Wilks' Lambda = .884, F = 21.19, p = .00), and school type (Wilks' Lambda = .788, F = 43.45, p = .00) differences in perception with respect to the collective dimensions of the SPQ.
Conclusion: It is concluded that low achieving schools have higher preference for a constructivist learning environment than high achieving schools and there exists gender and school type differences in perception of constructivist learning environment in favor of girls and low achieving schools respectively. The implications of the findings are discussed.

Keywords: (Perception, Constructivist Learning Environment, Gender, School type, Kenya)

1. INTRODUCTION

One of the global concerns in science education is the declining interest in science and science related careers. Fensham [1] has documented some of the reasons leading to this state of affairs as learning environments characterized by transmission; science knowledge that is dogmatic and correct; abstractness and irrelevance of science content just to mention a few. The declining interest in science has attracted much attention in terms of research on the learning environment due to its influence on the cognitive and affective outcomes of student learning. The learning environment has been a subtle concept in the past but recent research has made great strides at conceptualizing it. It is now understood as a psychosocial and pedagogical context in which learning takes place and influences cognitive and affective components of learning. The learning environments in which the learners are active participants in the learning process are focal point of contemporary educational systems [2, 3, 4, 5, 6]. Within the continuum of active learning strategies, the constructivist theory of learning

is gaining traction across the globe as a panacea to disinterest in science learning and science related disciplines [2, 7].

Constructivism is a learning theory that describes a process of knowledge construction as an active rather than a passive one. It is a theoretical position which holds that knowledge should not be imbibed by the learners' minds but a socially constructed by the learners through interaction with text, dialogue or physical experiences [8, 9]. According to Kim [6], in the constructivist epistemology, knowledge is constructed out of sensual and perceptive experiences of the learner. Secondly, knowledge is the personal understanding of the outside world through personal experience. Thirdly, the internally represented knowledge becomes the basis of other structures of knowledge and a new cognitive structure of the person. Fourthly, learning is an active process of developing meaning based on individual personal experiences.

According to Singh and Rajput [10] constructivism is not a unitary theoretical position but a representation of a continuum of cognitive or radical constructivism and socio-cultural or social constructivism. 'Cognitive constructivism' was based on the earlier work of Jean Piaget and emphasizes the importance of cognitive processes that occur within individuals. Proponents of this view [11, 12, 13, 6], argue that individuals always strive to make sense of the world around them by physically interacting with objects in their environment, thinking about things that have been observed. Individuals interpret these experiences in order to make meaning and develop personal understanding. Cognitive constructivism therefore emphasizes the personal construction of knowledge. The teachers' role with regard to this view is therefore peripheral to provision of suitable experiences that will facilitate learning. It implies that the teacher should be conversant with the prior knowledge of the learners; use these prior conceptions to define conceptual goals for the learners and understand the processes needed to achieve these goals; help the learners to be aware of the alternative frameworks and provide opportunities for trying out their new ideas.

On the other hand, 'social constructivism' developed from the ideas of Lev Vygotsky and emphasizes the importance of society, culture and language [14, 15, 16, 17]. According to this perspective, knowledge is socially constructed and learning takes place in particular social and cultural contexts. Social interaction provides learners with ways of interpreting the physical and the social world. The students thus become enculturated into ways of thinking that are common practice in that specific community. Much learning occurs when learners interact with more competent individuals such as teachers. Through a process of scaffolding, a teacher can guide students to develop their knowledge and skills while making connections with students' existing schemes. Through language, students are able to share ideas and seek clarification until they understand. The emphasis is on a communication rich environment in which students are given opportunities to interact with adults and peers to negotiate meaning. The teachers' central role is providing guidance and support to learners. In other words, 'social constructivism' places emphasis on the community and social interaction rather than the individual.

Cognitive and social constructivist perspectives emphasize different paths towards knowledge construction but have a common ground in the sense that the student is still required to access their pre-existing knowledge and beliefs, link these to what is currently being experienced and modify them if there is need. Thus implicit in both views is that construction of meaning requires effort on the part of the learner.

Several constructivist learning environment designs have come to the fore since its foundational proposition. Cosgrove and Osborne [18], Proposed a generative learning model in which the teaching sequence consisted of four phases: the preliminary phase , in which the teacher ascertains the pupils views through surveys; the focus phase in which the pupils' attention is focused on a phenomenon and their ideas about that phenomenon; the challenge

phase, in which the pupils present their views to the group, the teacher presents the scientific view and they are discussed and compared in order to facilitate accommodation; and the application phase in which the students use the accepted scientific viewpoint to solve a range of problems. According to Driver and Oldham [19], the constructivist model consists of five phases as Orientation, elicitation, restructuring, application and review. According to Yager [20], constructivist model of teaching consists of four aspects; inviting ideas, exploring, proposing explanations and solution, and taking action. The designs of constructivist learning environment are characterized by the use of prior knowledge as a primer to new knowledge, active construction of knowledge and ultimately application of the constructed knowledge.

1.1 Statement of the problem and purpose of the study

Research on constructivist learning environment has produced a plethora of findings that could lead to improvement of the cognitive and affective outcomes of science learning. However, literature is mute as regards the gender and school type differences in perception of the constructivist learning environment specifically in the discipline of Biology and Kenya to be specific. The purpose of this study was therefore to investigate the gender and school type differences in perception of the Biology constructivist learning environment.

1.2 Research Questions

The study was guided by the following questions:

- Are there any significant differences in perception of students' actual and constructivist learning environment in low achieving schools (LAS) and high achieving schools (HAS)?
- Are there any significant gender differences in students' perception of the constructivist learning environment in low achieving schools (LAS) and high achieving schools (HAS)?

1.3 Theoretical framework

The study was based on Moos theory of learning environments. According to Moos [21], each human learning environment is defined in terms of three dimensions as the relationship, personal growth and system maintenance and change dimensions. The relationship dimension is concerned with the extent to which people are involved in the setting, support and help each other and express themselves spontaneously, freely and openly. A favorable relationship domain is characterized by open communication, student involvement and teacher support. The personal growth dimension is concerned with the achievement of the aims of education, clarity about learning objectives, relevant learning content and constructive criticism. The system maintenance and system change is concerned with the extent to which the environment is orderly and clear in its expectations, maintains control and responds 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 measured 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.

2. METHODOLOGY

2.1 Research Design

The study adopted a survey design. This is because the study sought to describe the existing degree of perception of constructivist learning environment by the students. The study also

described the learning environment as perceived by the students without manipulating the learning environment [22, 23, 24] A survey has the potential of providing a lot of useful information about the subjects of the study [24]. For example, how they perceive the Biology constructivist learning environment. A survey is also more economical because it makes possible for many subjects to be studied at the same time [25, 26, 24]. In this study the data were collected from high and low achieving form two students of Siaya County in co-educational secondary schools within a reasonably short time.

2.2 Sample Size and Sampling Techniques

The sample size comprised of 815 (466 boys and 349 girls, 399 high achieving students and 415 low achieving students) form 2 students in co-educational public secondary schools. This represented 10.31% of the population. For descriptive studies, 10% of the population is enough to provide a representative sample when the target population is in thousands [27, 25, 28]. This provided a reasonable and representative sample of the population. Table 1 shows the sample characteristics by school type and gender.

Table 1: Sample Characteristics by School Type and Gender.

Category	Population	Sample	Percentage
High Achieving Schools	**3900**	**399**	**10.23**
Low Achieving Schools	**4000**	**416**	**10.40**
Boys	**4450**	**466**	**10.47**
Girls	**3450**	**349**	**10.11**
Overall	**7900**	**815**	**10.31**

A list of 50 high achieving and 50 low achieving co-educational secondary schools in Biology from 2010-2012 in Siaya County were used as the sampling frame. Multistage cluster sampling was used to randomly select clusters of 18(9 from each category) form two classes from the high and low achieving co-educational secondary schools in Siaya County. In schools that had more than one stream, simple random sampling was used to select the stream that participated in the study. Cluster sampling is more feasible in selecting groups of individuals rather than individuals from a defined population [29]. In the second stage of multistage cluster sampling, four students, 2 boys and 2 girls were randomly selected from each of the 18 classrooms for an interview. The interview sample therefore included 72 students.

2.3 Instrumentation

The study used two instruments namely Students Perception Questionnaire (SPQ), and Students Interview Guide (SIG).

2.3.1 Student Perception Questionnaire

The Student Perception Questionnaire (SPQ) was adopted from Johnson and McClure (2004) and modified to suit the study by the researchers. It is a five point response scale of Almost always, Often, Sometimes, Less often, and almost never. The instrument consists of two forms that are 'actual' and 'preferred' forms. The actual form assesses the current learning environment of the classroom and the preferred form assesses the students' preferences about the constructivist learning environment.

The instrument has 20 items, with 5 scales (4 items on each scale). The scales are Personal relevance, uncertainty, critical voice, shared control, and student negotiation. The scale on personal relevance is concerned with the extent to which the teachers relate science to out of school experiences. Uncertainty is concerned with the extent to which opportunities are provided for students to experience scientific knowledge as provisional or tentative, involving human experience and values. Critical voice is concerned with the extent to which a school climate has been established in which students feel it is beneficial to question the teachers' pedagogical plans and methods to express concerns about any impediments to their learning. Shared control is the extent to which students are invited to share with the teacher in the control of the learning environment. Finally, Student negotiation is concerned with the extent to which opportunities exist for students to explain and justify to other students their newly developing ideas.

2.3.2 Student Interview Guide

Student Interview Guide (SIG) was developed by the researchers and used to triangulate data collected from SPQ. The questions were generated from each of the subscales of the instrument. SPQ had 5 questions generated from it to form SIG. For each class of students where questionnaires were administered, 2 boys and 2 girls were randomly selected to be participants in the interview.

2.4 Validity and Reliability of Instruments

The instruments SPQ and SIG were subjected to validation before piloting. After piloting of the instruments in a school with the same characteristics as the sample, the results were subjected to reliability tests.

To achieve construct and content validities of SPQ and SIG, the instruments were presented to experts in science education in the faculty of education for examination and recommendation. This allowed for the checking of the appropriateness of the language used so that students were able to comprehend them. It also allowed for the rewording of items perceived to be ambiguous and checking of the items to ensure they measured what they purported to measure.

The SPQ and SIG were pilot-tested in a Form two class similar in characteristics to the schools in the sample but not taking part in the study. Rewording of SIG items was done based on the findings from piloting. The Cronbach's Correlation Coefficient alpha (α) formula was used to test for the reliabilities of SPQ-actual and SPQ-preferred. Cronbach's correlation coefficient alpha is considered appropriate for both essay and structured questions, especially where the items are of varying difficulty [30, 31]. A reliability coefficient of 0.7 and above was acceptable [31, 32, 29]. SPQ-actual and SPQ-Preffered had reliability coefficients of 0.823 and 0.855 respectively.

3. RESULTS AND DISCUSSION

3.1 Research Question 1

Are there any significant differences in perception of students' actual and constructivist learning environment in low and high achieving schools?

To answer the research question, independent sample t-tests were carried out to find out whether there were differences in perception of the preferred learning environment among the low and high achieving schools. Table 2 shows the output of this analysis.

Table 2: Perceptions of Preferred Learning Environments

Group 1= High Achieving Schools, N = 399,Group 2 = Low Achieving Schools, N = 416

Variable	SPQ Scales	Group	Mean	SD	*t*-value	df	*p*-value
School Type	Personal Relevance	1	3.830	0.528	10.362	813	.000*
		2	4.164	0.375			
School Type	Uncertainty	1	3.765	0.523	11.881	813	.000*
		2	4.151	0.393			
School Type	Critical Voice	1	3.680	0.639	13.936	813	.000*
		2	4.212	0.422			
School Type	Shared Control	1	3.917	0.441	10.304	813	.000*
		2	4.203	0.343			
School Type	Student Negotiation	1	3.859	0.487	10.364	813	.000*
		2	4.189	0.410			

*$p < .05$

Table 2 indicates that the preference levels for Biology constructivist learning environment are higher among the low achieving schools than the high achieving schools for all the scales of SPQ as depicted by the mean scores. At the same time, there existed a statistically significant difference between the low achieving schools and high achieving schools in favor of the low achieving schools at an alpha level of 0.05.

The findings in table 2 indicate that the students in low achieving schools have high preference levels for a constructivist learning environment compared to the students in the high achieving schools. This could be due to the fact that the students in the high achieving schools score higher on achievement tests and therefore naturally attribute this to a positive learning environment. The low achieving students are likely to attribute their low scores on the nature of the learning environment leading to high preference levels for a constructivist learning environment.

The findings from this study support earlier classroom learning environment research that students' generally prefer a more favorable learning environment compared to the actual one they are actually experiencing [33, 34, 35]. In this study, the students tended to prefer a more constructivist learning environment in which they have more opportunities to relate Biology to with the real world, experience the formulation of biological knowledge, offers them chance to question what is going on in the class freely, take role in the decision making process of what will go on in the lesson to be more beneficial to them and finally a learning environment where they can negotiate ideas with fellow students.

The findings from this study also indicate that the high achieving students perceive their actual learning environment more favorably compared to the low achieving ones. On the other hand, the students in low achieving schools have high preference levels for a constructivist learning environment. This also confirms the findings from studies in learning environment [34, 36]. For instance Otami, Ampiah, and Anthony [37] carried out a study to investigate factors influencing perceptions of science students' Biology classroom environment in low and high achieving secondary schools. The findings indicated significant differences in favor of low achieving schools in terms of teacher support, cooperation and equity.

3.2 Research Question 2

Are there any significant gender differences in students' perception of the constructivist learning environment in low and high achieving schools?

To answer the question on whether there were gender differences in perception of constructivist learning environment in low and high achieving schools, descriptive statistics, a two-way multivariate analysis of variance (MANOVA) and a two-way ANOVA were conducted. Analysis of interview data was also carried out. In this analysis, gender and school type were considered as independent variables and the dimensions of SPQ were considered as the dependent variables. The analysis was performed with the significance level of 0.05.

The descriptive statistics for students' perceptions of Biology constructivist learning environment according to gender and school type are summarized in table 3.

Table 3: Descriptive Statistics for Perception of CLE in HAS and LAS

Boys, N= 466; Girls, N = 349		High Achieving Schools		Low Achieving Schools	
SPQ scales	Gender	Mean	*SD*	Mean	*SD*
Personal Relevance	Boys	3.648	0.510	3.648	0.362
	Girls	4.188	0.362	4.136	0.392
Uncertainty	Boys	3.538	0.416	4.151	0.393
	Girls	4.100	0.485	4.144	0.394
Critical Voice	Boys	3.424	0.583	4.230	0.391
	Girls	4.059	0.522	4.190	0.459
Shared Control	Boys	3.783	0.420	4.212	0.423
	Girls	3.917	0.441	4.185	0.343
Student Negotiation	Boys	3.628	0.346	4.224	0.404
	Girls	4.149	0.521	4.442	0.415

Table 3 indicates that the girls in high achieving schools have higher mean scores for preference of a constructivist learning environment than boys in the same schools. In the low achieving schools, the boys have higher mean scores for preference of critical voice, shared control and uncertainty. On the hand, the girls have higher mean scores for preference of student negotiation and personal relevance than the boys in the same schools.

The mean scores suggest that girls in the high achieving schools on the whole have more positive perceptions of Biology learning environment characterized by constructivism than boys. On the other hand among the low achieving schools, the boys have more positive preferences for a learning environment providing for critical voice, shared control and uncertainty. The girls in the same environment have positive preferences for a learning environment providing for student negotiation and personal relevance. The girls had strong preferences for an environment providing for student negotiation where clarification of ideas from other students would occur. This would imply the girls prefer a relational, cooperative and friendly learning environment.

A summary of Two-way MANOVA results comparing mean scores according to gender and school type with respect to the collective dependent variables is shown in table 4.

Table 4: MANOVA Summary for Variables by Gender and School type

Source	Wilks' Lambda	*F*	*p*-value	Eta^2
Gender	.884	21.19	.000	.116
School	.788	43.45	.000	.212
Gender * School type	.850	23.40	.010	.150

α = .05

The results in table 4 show that there were statistically significant gender (Wilks' Lambda = .884, F = 21.19, p = .000), and school type (Wilks' Lambda = .788, F = 43.45, p = .000) differences with respect to the collective dimensions of the SPQ. The results also revealed that there was an interaction between gender and school type and vice versa with respect to collective dimensions of the SPQ (Wilks' Lambda = .850, F = 23.40, p = .010).

The results in table 4 confirm the presence of gender and school type differences in perception of a constructivist learning environment. The results also indicate that there was an interaction between gender and school type. This implies that the effect of gender depends on school type and vice versa.

Table 5 shows a corresponding Analysis of Variance (ANOVA) with school type and gender as independent variables for each of the CLE scales of SPQ as follow up tests for MANOVA
.

Table 5: Results of ANOVA as follow-up to MANOVA on sub-scales of SPQ

Independent variable	Dependent variable	Mean^2	*F*	*p*	Partial eta^2
Gender	Personal Relevance	7.930	42.954	0.000	.050
	Uncertainty	15.106	85.878	0.000	.096
	Critical Voice	17.570	71.873	0.000	.081
	Shared Control	4.490	31.583	0.000	.037
	Student Negotiation	8.147	46.812	0.000	.055
School Type	Personal Relevance	16.471	89.226	0.000	.099
	Uncertainty	21.849	124.218	0.000	.133
	Critical Voice	43.645	178.541	0.000	.180
	Shared Control	12.627	88.830	0.000	.099
	Student Negotiation	15.261	87.683	0.000	.098

** Significance level p < 0.05*

This analysis was done to determine the subscales which were contributing to the gender and school type differences in perception of constructivist learning environment. As table 5 indicates, all the subscales of SPQ were statistically significant. The partial eta squared recorded for the subscales indicate that the subscales of uncertainty and critical voice contributed a great deal for the gender and school type differences in the perception of the Biology constructivist learning environment.

The qualitative findings are in support of other findings. The students generally had positive preferences for a constructivist learning environment. However, the girls had strong preferences for the learning environment providing for personal relevance. A situation where what they learn in class relates well with what is outside. When the learners are able to relate what they learn in class with what is outside the knowledge constructed becomes relevant. At the same time the demands of examination system would make the learners to relapse in a learning environment where the learners merely imbibe facts. A girl remarked as follows:

,…"Our classrooms does not compare what is outside in plants and animals to what we read in textbooks. Even if we are to compare what is outside and in classroom it will not matter in exams. The classroom learning should compare what is outside with what is inside the classroom. We can visit places more often where we learn about plants and animals. If this is done I will understand better"….

The girls and boys seem to have high preferences for critical voice, a situation where they question the pedagogical plans of the teacher. The boys too seem to have ideals for the same but unsure of how it can be actualized and at the same time helpless. The girls on the other hand recognize the fact that a teacher is a human being and is prone to pedagogical ineffectiveness. The girl goes further to hold that it is possible to negotiate favorable learning environment without being seen to be undisciplined. A girl and a boy had the following to say.

Girl: "I will be happy to help the teacher plan for our lesson. I will check for the apparatus for the teacher, I will be ready to learn and even read ahead of the lesson and get to know what is to be learnt early".

Boy: "I can help the teacher if he asks me to help him. Remember, he has more knowledge than us. I can help him plan a few times because I also have a lot to do".

The findings of this study have indicated that there are gender differences in preference of the constructivist learning environment in favor of girls. The findings confirm the previous studies on learning environment [38, 39, 40, 41, 42, 43]. This study has specifically indicated that the girls in high achieving schools have higher preferences for constructivist learning environment in all the scales. On the other hand, among the low achieving schools, the girls had higher mean scores for personal relevance and student negotiation. The boys had higher mean scores in the other scales of SPQ in the low achieving schools. The gender differences in favor of girls can be explained in terms the content that the students are exposed to at this stage of their learning. The content areas at this stage include excretion and homeostasis, respiration, gaseous exchange and transport in animals. These content areas are mainly concerned with human Biology which has been known to be more interesting to the girls [43]. This interest is likely to make the girls to perceive the learning environment more positively. The school type differences can be attributed to the nature of the learning environment in the low achieving schools. In an international study by Martin et al [45], it was reported that some of the factors contributing to the low achievement in schools included limited teacher involvement and low student involvement. In such a situation, the students from low achieving schools are likely to have high expectations from the learning environment.

4. CONCLUSIONS

The students from low and high achieving schools have a high preference for a constructivist learning environment characterized by personal relevance, uncertainty, critical voice, shared control and student negotiation than the learning environment they were actually experiencing. It is concluded that there is a difference between the students' perception of the constructivist learning environment and actual learning environment in favor of constructivist learning environment.

The girls in high and low achieving schools perceive the constructivist learning environment highly compared to boys in high and low achieving schools. On the other hand low achieving schools have high preference for constructivist learning environment than the high achieving schools. It is concluded that there are gender and school type differences in the perception of a constructivist learning environment.

The study has the following implications: Firstly, there is need for the teachers to create the learning environments to make it congruent with what the learners prefer in the high and low achieving schools. By looking at large discrepancies between one or two scales when students' perceptions of actual versus the constructivist learning environment are compared, teachers can tailor an intervention in order to bridge this gap. Secondly, teachers need to take gender differences into consideration when planning for teaching in co-educational schools. There is need to maintain the high preference levels among girls and low achieving schools for a constructivist learning environment, and at the same time encourage the boys and high achieving schools to be more oriented towards embracing constructivist learning philosophy.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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