Influence of Geo-Technologies Integration on the Learning of Geography among Public Secondary Schools

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Abstract

Technology integration has become critical globally in pursuit of transforming education. In Siaya County, a persistent dismal mean of scores in Geography subjects among public secondary schools from 2016-2022 at Kenya Certificate of Secondary Examination has been blamed on the learning approaches. The data from the seven sub-counties indicated that very little learning occurred. Further, no known study has addressed rote learning in Geography using an explanatory research design about Siaya County. The study sought the influence of integrating geo-technologies on learning in Geography among public secondary schools in Siaya County. This study focused on Geo-technology integration influencing learning among public secondary schools in Siaya County, Kenya. The objective that guided this study was to explore the influence of a geo-technology integrated classroom environment on learning Geography among public secondary schools in Siaya County, Kenya. The study sought to answer the question; during 2016-2022, how did the integration of geo-technology in the classroom environment influence the learning of Geography in public Secondary Schools in Siaya County? The study adopted interviews, questionnaires, and observational checklists to collect data. The study employed social cognitive constructivism theory to envision effective learning. The study sampled 102 respondents from 262 public secondary schools based on Krejcie and Morgan's table. The choice of Siaya County was based on the fact that it is the only county in the larger Nyanza where technology integration was piloted by New Partnership for Africa's Development (NEPAD) for quality learning. This study employed a mixed method and explanatory design to carry out the study. The study adopted interviews, questionnaires, and observational checklists to collect primary and secondary data.

Keywords: classroom, geo-technology, integration, learning, secondary school

Introduction

Globally technology integrated education has been used as a means for students to acquire the right attitudes, skills, competencies, and many other educational achievements, as stated by Fleming (2017) and Olunguju (2015). Ayere and Odera (2010) reported that integrating technology while teaching and learning have produced enormous educational achievements. Many countries have adopted national examinations as a tool for measuring and confirming the quality of learning, as revealed by Mutua (2014), who also alluded that the national examining bodies are mandated by their Countries to judge how students go through their learning process.

The current study about Geo-technologies' influence on learning Geography is critical in learning. Internationally, it has been established by Ochieng et al. (2016) that Geography graduates place themselves fit for the competitive job markets which are either industrial-based or service based in the nation or community due to quality learning. The article also alluded that such graduates would participate in resource utilization as one of the principles of Geography.

In Brazil, studies were conducted by Sarkar et al. (2017) on technology integration on students' learning outcomes. The study findings revealed that the approach confirmed the positive explanation relationship with constructive learning within the technology-embedded classroom environment.

In China, the examination outcomes showed that quality learning in Geography depended on the type of technology integrated into Geography classrooms. The result was according to the findings of Abdollahi and Nottemeyer (2018) and Yanyan et al. (2019) studies. The study indicates desirable feedback arising from the way Geography rooms were displayed.

In Malaysia, the examination outcomes revealed poor learning approaches in Geography among secondary schools despite well-staffed Geography teachers, as highlighted in Nasser (2019). The findings show that teacher education graduates did not implement the ideals of providing Geography rooms, enabling a technologically conducive environment for meaningful learning in Geography. This problem requires teachers who are positive to change and embrace technology-based approaches because there could be some Geography trained teachers described by Kodero et al. (2011) as trained and qualified but ineffective in the preparation of Geography rooms. The effectiveness of teaching in the 21st century in any subject was revealed to be embedded in innovative approaches compared to ordinarily traditional teaching and learning environments.

A study in South Africa by Kiwanuka et al. (2015) indicated that the adoption of new technology in the teaching of Geography

posted above-average improved performance results among Secondary Schools in South Africa. The big question that remained unanswered was, from 2016-2022, how was the Geography classroom integrated with geo-technology to influence learning about Geography in public Secondary Schools in Siaya County?

Technology integration in organizing a Geography classroom for learning in Nigeria was cited by Pau and Pendroza (2019), who conducted a comparative study on Geography learning centers of interest in two classrooms: One in stream A and another in stream B. After three months of learning, both groups were subjected to a similar assessment test. The study revealed that the room whose displays included smart boards for geographic simulations, geographic model displays, digitized topographical maps, and graphic charts yielded better results than the counterpart class with ordinary displays like two-dimensional charts. The current study examined the different integrated technologies and yielded varied outcomes. This variation in the learning process makes the present study on technology integration desirable.

In Kenya, the outcomes in Geography at the Kenya Certificate of Secondary Education (KCSE) during the running years from 2016-2022 were revealed to be dismal and below average, as shown by the study carried out by Barmao et al. (2022). The present researcher observed this problem that the type of education must have been examination oriented without any known technology integrated with the Geography rooms during the learning process as compared to the 8-4-4 syllabus launched in 1985 to spearhead the trend towards self-reliance due to some technology involved as insinuated by Ambaa (2015). When the essence of the 8-4-4 curriculum began to dwindle with time, quality learning in Geography declined in Siaya. The academic gap was identified in the literature review and became the reason for pursuing the unknown the current study proposes to examine and explain the influence of geo-technology integrated classrooms in Geography among secondary schools in Siaya County.

The study by Odera (2016), while analyzing policy issues for the implementation of technology integration, provided the information that Kenya instituted this powerful project in six secondary schools and branded them New Partnership for African Development (NEPAD) e-schools. Only two schools in the larger western region were selected for the pilot study. One was in Siaya County or Siaya District, and the other was in Vihiga District.

The study by Tzavara and Wilczek (2019) on Technology-Based Education as a new way of learning reported that the United Nations initiated integrating technology in education under its agency, the United Nations Educational, Scientific and Cultural Organization, to roll out the technology in education to Africa. The move was welcomed by African Union (AU) under the project NEPAD. Many African nations adopted the project, which started with pilot schools, as stated by Okoth (2017). In that way, Kenya became a beneficiary. The present study is obliged to find out the variety of technologies that were piloted in the NEPAD Secondary Schools in Western Kenya, where Siaya County falls.

Geography is described by Osodo (2010) as a discipline all about space and place relationships with human interactions. This was echoed by Jinadasa (2015) that Geography plays a crucial role in societies' cultural, social, scientific, and technological development. The researcher also perceives Geography as the utilitarian subject of space and place for technological, economic, educational, social, and political gain.

Geographical technology is what the present study has identified from several kinds of literature as an area not adequately explored for eminence learning in Geography. Learners globally, regionally, nationally, and locally must study well, thus benefiting from the available technologies to connect students to where and how to explore knowledge and skills necessary for competencies now and survival in the future.

The Table 1 illustrates a policy from Kenya National Examination Council KNEC that guides the grading system within the KCSE examination results analysis. Siaya County had many public secondary schools whose academic achievements in Geography were measured by KNEC from 2017 to 2022. It indicated that they scored below Geography expectations, as shown in Table 2.

Table 1
Kenya Certificate of Secondary Education (KCSE) Index Grading System

	1	2	3	4	5	6	7	8	9	10	11	12
A												■
A-											■	
B+										■		
B									■			
B-								■				
C+							■					
C						■						
C-					■							
D+				■								
D			■									
D-		■										
E	■											

Note. Adapted from KCSE Grading System Per Subject 2022/ 2023 – Official KNEC Grading. (https://educationnewshub.co.ke/kcse-grading-system-per-subject-2022-2023-official-knec-grading/). Copyright KNEC News.

Table 2
A Report on Verbatim Data Analysis

Year	Statement	True	False
2017	Above average		√
2018	Above average		√
2019	Above average		√
2020	Above average		√
2021	Above average		√
2022	Above average		√

Note. Adapted from "Reports on cluster of mean scores at kenya certificate of secondary examinations," by County Quality Assurance and Stanadrds, 2022, *Siaya County*, *5*(1), p. 102. Copyright 2022 by the County Quality Assurance and Stanadrds.

The current study appreciates technology integration in the learning of Geography as entailing many different areas in geography education that focus on relevant technologies to address the poor learning in Geography. The study by Simatwa and Marvella (2017) concurs with this article that providing quality teaching and learning globalizes education.

Statement of the Problem

More than 20 years ago, Siaya District was on a pilot study for technology integration by the NEPAD, particularly at Maranda Boys' School. Despite this effort, statistics show that Siaya County's academic performance from 2016-2022 dwindled below the acceptable mean score of 6 in the Kenya Certificate of Secondary Examination. This study perceives to blame Siaya County for rot learning. Proof from the statistics provided by Siaya County Quality Assurance and Standards (2022) is indicated in Table 2, showing several cohorts of students' results warranting a study such as this one. No known study has been conducted on the influence of Geo-technology integrated classrooms on learning in Geography. This study will provide a myriad of data to show these outcomes and then offer a conclusion based on the findings. The present study will not generalize to all 47 Counties in Kenya because the conditions or situations are not similar.

Purpose

This article examined the classroom as a variable that can be manipulated to foster quality learning in geography.

Research Question

Which types of technologies were available and integrated in the period from 2016 to 2022 for learning Geography at Siaya County?

Methodology

This study adopted a mixed research method and explanatory research design as recommended by Johnston, Gregory & Smith (2018) for this type of research. The population was 262 classrooms, and 102 were sampled based on Krejcie and Morgan's (1970) table. According to Creswell (2014) and Ayiro (2012), research designs are professionally organized plans and procedures for data collection, analysis, and interpretation. The study employed this design to form a basis for describing the existing problem within the learning process in the secondary school in Siaya County under inductive approaches, as insinuated by Kelly (2011). This study cited this approach because it enabled the researcher to collect and analyze observations that would project a tentative, predictive, or descriptive conclusion. Descriptive statistics was adopted because of the type of instruments applied and data collected in this study; questionnaires, interviews, and observation checklists which were relevant to this study (Kothari, 2010). The researcher was enabled herein to acquire relevant opinions from participants regarding the influence of geo-technologies integration on the learning of geography among public secondary schools. The opinion specifically pointed at the acute unavailability of relevant technologies in the Geography classrooms to support learning and the school's administration to prioritize classrooms enabling an environment for learning.

Locale of Siaya County

Siaya County is geographically located 74 kilometers Northwest of Kisumu town. It borders Vihiga County in the Northeast, Busia County in the North, and the Republic of Uganda in the West. The county lies from latitudes 0^0 26' to 0^0 18' of the Equator and longitudes 33^0 58' to 34^0 33' East of the prime meridian. Fishing and farming constitute the main economic activities in this county.

The economic base of this county is majorly from mixed farming activities that include growing sugar cane, maize, legumes, root crops, and raring original African breeds of livestock animals. The county has been generous and adopted inclusivity trading activities to attract investors from other communities.

The researcher selected Siaya County on three accounts; According to ServeAfrica.info.com (2022), which provides analyzed feedback information on national examinations in Africa, revealed that Siaya County at most registered only one school in the top 10 schools at KCSE results as shown in the table that indicated the academic performance of students in Siaya County.

The schools did not attain the mean score that could place them in the above-average column, which triggered the current researcher to conduct a study. This was also echoed in the Standard Newspapers (2016, 2017, 2018, 2019, 2020, 2021 & 2022) issued in December. This was undesirable for a County with a history of producing great leaders of this nation.

The other reason is captured from the only secondary school in Siaya County that has consistently produced outstanding academic performances for the last six years. This school is still on record as having been the technology integration pilot center initiated by the NEPAD, according to Agak et al. (2010). Therefore, quality learning probably occurred due to the integrated technology in the academic program.

The third reason was the basis of the county bordering the Republic of Uganda, whose learning in Geography is technology based, as observed by Ahikie (2008). Siaya could have quickly emulated the neighbor. The data were analyzed using a descriptive approach and summarized in tables/figures generated by the Statistical Package for Social Sciences version 17 computer program.

Results and Discussion

The question: During the period 2016-2022, how did the integration of geo-technology in the classroom environment influence the learning of Geography in public Secondary Schools in Siaya County? Was answered by the data that was analyzed as follows:

Firstly, the study sought to establish the level of geo-technology integrated with the school and then followed by data on how the very technologies were integrated with the Geography classroom.

Based on the question: Which technologies were available and integrated from 2016 to 2022 for learning Geography at Siaya County?

This question sought to establish the type of Geo-technologies available and integrated with the learning of Geography in public secondary schools in Siaya County. The researcher's observational checklists confirmed the responses by Deputy Principals and Geography teachers. The instrument used to collect data had eight items, as indicated in Annexure 1. The data are summarized in Table 3.

Table 3

Technology Integrated Geography Classroom

Items	Sum of yes	Sum of no	Sum of total
Did you have good computers for the Geography class?	25	77	102
Does the school have Geography Lab	2	100	102
Has the school installed GIS for integrating learning?	1	101	102
Was GPS integrated into the learning of Geography?	5	97	102
Did students for learning geography integrate Remote Sensing (RS)?	2	100	102
Was the school equipped with Wireless Fidelity (WIFI) to access UTM?	98	4	102
Were smart boards available in classrooms for computer simulation (CS)?	1	101	102
Total	134	580	714

Note. Data collected by the author in 2022.

The responses to the inquiry about the adequacy of computers in the school reported that only 25 schools had adequate computers to simulate the geographical phenomena. This translated to 24.5% of the total number of Geography classrooms. With these findings, it can be concluded that very little learning takes place in most schools of Siaya County because the rooms lack an adequate conducive environment created by computers, as stated in the study by Felisoni and Godoi (2018). The researcher then proceeded with an observational checklist and discovered that the 25 schools with adequate computers were idle. It was one thing to have computers but another different thing to use them and promote learning.

The data revealed that out of 102 County secondary schools in Siaya, only two schools indicated having Geography laboratories supporting the learning process in Geography. The findings on Yes frequency were that two out of 102 schools translated to 2% while the frequency assigned to No hit 98%. This information suggested that the lack of a Geography laboratory implied that most schools did not integrate technology into learning Geography. This condition could quickly be condemned by Marzano et al. (2017).

The data about Geographic Information System (GIS) indicated only one out of 102 schools had GIS, translated to (1%) percentage GIS compliant was minimal in the schools of Siaya County. However, where it was integrated, an indicator of learning was provided in excellent academic performance in Geography at the national examination (Savenye, 2017). The study concluded that poor academic performance was due to the failure to integrate GIS in Geography classrooms.

The data on the availability and integrated classroom with the technology known as the global positioning system indicated that five schools procured while 97 schools did not. This translated to a 4.9% valid rate away from the 100% expected rating. The finding coincides with (Panadero & Alondo, 2014) study on students' performance and technology integration found that the integration of GPS in Geography classrooms enhances survey skills in Geography. This study therefore observed that schools in Siaya County had minimal learning in Geography, hence dismal academic performance at Kenya Certificate of Secondary Examinations during the 2016-2022 periods.

The findings in Table 3 indicated that only two schools out of 102 translated to 2% out of 100%. Geography classrooms had students who integrated Remote Sensing Systems (RSS) in learning Geography because the technology was noted to have been on endowment advantage, but 98% was negative. The larger percentage missed out on the system that deals with mapping resources in the environment, as stated in the studies by Rudent et al. (2017). In this regard, learning was adversely affected.

The findings from the data about the availability of Wireless Fidelity connectivity revealed that this area is well explored. Up to 98% of the sampled schools appreciated as a form of resources expected to be in the Geography classroom environment. WIFI forms an integral part of the Geography classroom, enabling geo-technologies to perform, as Edelson (2014) cited. This was indeed good for the school administrations of the schools. However, this study observed that WIFI competitive advantage was missed to endowed advantage in these many schools. Upon verbatim interview with most Deputy Principals, they said, *'Our WI-FI is of low range coverage and most teachers use it to socialize.'*

The study sought the environment of Computer Simulation with smart boards in Geography classrooms. However, only one out of 102 schools installed the facility and enabled students to carry out computer simulations in Geography. This was translated to 1% out of 100%, making this area unexplored by schools in Siaya County, proving the urgency of this study.

Conclusion

The research paper was about the Influence of Geo-Technologies Integration on Learning Geography among Public Secondary Schools in Siaya County, Kenya. It addressed the dismal academic performance at Kenya Certificate of Secondary Examination, an indicator of unproductive learning.

The approach of the study was to explore the influence of geo-technology integrated classroom environment on the learning of Geography among public Secondary Schools. It was guided by the question: Which type of technologies were available and integrated in the classroom environmentin over the period from 2016 to 2022 for learning in Geography at Siaya County? Based on the overall finding that there was only 18.67 % technology integrated, the study concluded that there was very little and meaningful learning in Geography. As a researcher, I feel it is doable to bring Siaya where it is supposed to be by embracing what is described as productive learning.

Recommendations

1. It was observed that school administration is critical to the promotion of quality learning process and recommended its timely attention to the provision of geo-technology resource materials in the Geography classrooms. The Geography teacher would then enjoy the support from school leaders to implement technology integration accordingly. The study, therefore, recommends that Geography teachers use the available facility and improve learning in the subject.
2. At this point, it would be better if the teacher went through staff development regularly as an ideal step to sharpen pedagogical orientation and deliver on the correctness of learning among Geography students in the 21st century.
3. Equally important, this study recommended empowering learners to participate in the Geo-technology integration by enabling techno-environment in their classrooms and enhancing quality learning at the group and individual levels.

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Annexure 1

Sr. No.	Type of technology integrated	Yes	No
1.	Does the Geography department have a specific room we could call a laboratory?		
2.	Are there adequate computers to be used by the Geography class?		
3.	Is the school equipped with the Wireless Fidelity for students to access the platform known as Universal Transverse Mercator (UTM) and Earth Scanner?		
4.	Are there Smartboards for Computer Simulation (CS) integrated technology in the classrooms?		
5.	Are your Geography students empowered with Remote Sensing Systems (RS) by the school to enhance learning?		
6.	Did your Geography teachers integrate Global Positioning Systems (GPS) in the teaching and learning process?		
7.	Has the school installed the Geographic Information System (GIS) to learn Geography?		

8. In your opinion what would you position the learning of Geography in this school if the Geo-technologies were integrated?...

The encoding of [1] for [Yes] and [2] for [No] was done and the study summarized the data which were collected as shown in Table and Figure 1.