

Research article

Learner characteristics that Support Integration of Information Communication and Technology in Biology instruction in secondary schools in Migori County, Kenya

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Abstract

The study investigated Information Communication and Technology (ICT) use in teaching and learning of Biology and how it enhances students' achievement in Migori County, Kenya. It employed descriptive survey design which utilized stratified, simple random and purposive sampling techniques. The theoretical underpinning for the study was that learners conceptualize and internalize best their surroundings through interactive learning. The study targeted teachers, students, principals, Sub County Education Officers and County Director of Education. A sample size of twenty four (24) secondary schools was used. The objective was to investigate challenges students face in ICT integration in Biology instruction. Research instruments included; questionnaire, Observation schedules and ICT resource checklists. Data was analyzed through Descriptive and Inferential statistical procedures. The major findings included: students did not use ICT, poor ICT infrastructures, inadequate resources and lack of streamlined guide to ICT use. Major conclusions made included: large number of students in classes, inaccessibility to ICT resources, absence of streamlined guide to ICT integration, lack of digital content, information overload and pace of change, inadequate modeling of pedagogical uses of ICT integration.



Key word: learner, characteristic, support, technology, integration

Introduction

Information technology is playing a big role in increasing learning opportunities in all parts of the world, to students the world over. It is widely recognized that information technology is a vital resource in development in all sectors including economic, social and political. The skills of information technology are in great demand in all sectors in today's world (Rumpagapon, 2007).

People the world over need modern information technology to do their jobs effectively in various sectors though in the past electronic technology was very mystified. It seemed to be extra-ordinary and belonged to only the experts and specialists in that area. There has been transformation of instruction through technology in all levels that has removed inhibitions, obstacles and challenges in the recent past (Maleki, Majidi, Haddadian, Rezai and Alipour, 2012).

Computers have wrought many changes in the production, processing and transfer of information, primarily because of their ability to handle a large amount of data within a very short time. Computerization has set off new image identities and subjectivities in instruction environment. The main use of ICT, regardless of the application area, is handling of data fast and efficiently in order to obtain information that is complete, accurate, timely, economic and relevant.

It is therefore not surprising that modern curriculum, instruction and education thinkers and practitioners all over the world have been swept off-balance by the new technological transformation taking place around the world. According to Rumpagapon (2007) many learners are more informed about the possibilities that a computer can provide more than their instructors. Jesse (2010) says that, integration of ICT in education has been mandatory in the developed nations since 1980s though this has not been the case in developing world nations like Kenya, where ICT featured in 2005 as one of the priority areas identified by the government.

According to Musyoka (as cited in Jesse, 2010) students' achievement in science subjects remains poor as reflected in the feedback from formal/national examinations and observations by stakeholders constantly indicate low performance in these subjects. This poses a great threat to all the stakeholders in education given that the same subjects are expected to assist Kenya achieve its vision 2030 of becoming an industrialized country of middle level income providing quality life for its citizens (Jesse, 2010). Table 1.1 shows Migori County students' performance in science subjects as compared to other curriculum subjects for the last four years. The other subjects beside Biology have been included to contextualize the problem in Biology which was the interest of this study.

Table 1.1: Migori County KCSE performances from 2010-2013 (Percentage mean score)

Year	Biology	Chemistry	Physics	Mathematics	English	Geography	C.R.E
2010	25.2	24.0	36.6	24.5	41.3	42.0	46.7
2011	22.3	27.0	39.6	21.1	44.0	44.1	47.1
2012	22.6	25.0	40.3	18.9	37.2	47.0	46.5
2013	21.3	28.1	42.1	20.0	43.4	49.0	52.1

Source: C.D.E's Office, Migori, May 24th, 2014

On average, sciences were poorly done compared to the other subjects though the interest of this study was in Biology only. Despite the determination shown by many classroom teachers, administrators, curriculum developers, educators, Biologists and policy makers, persistent poor achievement in Biology makes it clear that many students may not be learning the Biology that they are expected or needed to learn. The constant low achievement in Biology



which was a concern of this study is a problem to parents, teachers and the school administration and therefore appropriate intervention strategies need to be devised to enhance learners' performance in Biology in Migori County.

According to Kenya National Examination Council (2006) reports, various weaknesses were identified in Biology as candidates' responses to a large extent showed poorly taught and remembered concepts; details of process and expectations were lacking leading to superficial answers and loss of marks. The report concluded by stating that the testing of Biology by three papers means that questions will come from all the topics in the syllabus and therefore all topics should be covered adequately during teaching. From the results of the performance in Biology and the comments of KNEC reports, it is possible to conclude that there exists a problem in Biology instruction.

Instructional methods play a great role in determining the achievement of learners. Perhaps Biology teachers in Migori County have heavily relied on the conventional instructional methods may be due to limited ICT resources and facilities in schools. The main aim for effective learning should be the development of cognitive domain which involves the sum of all the knowledge the students have already acquired and how the facts, concepts and principles that make up that knowledge are interrelated among others. Learning should bring something new into our cognitive structure and connect it to the knowledge that already exists there. Essentially, this should help the learners visualize and conceptualize learning through ICT integration in Biology instruction that leads to enhancement in achievement in Biology as a school subject.

Even with the use of ICT, one should provide a chance where students can examine and apply their new knowledge since it is used to create responsibility in learning and stimulate thinking. Real knowledge and understanding frequently follow from the discussion and expression of ideas. Use of ICT provides a great opportunity for discussion and expression of ideas across the board. All forms of presentation will be more meaningful if active participation rather than passive observance is the aim (Rumpagapon, 2007). Teachers should acquire proficiency and self-efficacy in ICT use in order to enrich instruction that can lead to higher achievement.

ICT integration is evolving instruction in various ways for with ICT teachers and students are able to confine teaching and learning to suit the needs of the individual learners. Technology requires teachers to be more creative in developing instructional materials in Biology for instance simulations of the blood circulatory system (Hinostroza et al, 2012). ICT enables students to create useful learning materials and this forms part of learning exercise as a way of making learning interesting and more relevant for students.

Further strategies would include establishment of an interactive website and email communication channel, reformation of curriculum to facilitate use of ICT integration, regulation of examinations and certification of ICT learning programs, development of customized computer for learners with special needs, cost reduction for ICT resources and facilities, creation of partnerships that would facilitate greater dissemination of ICT services to rural areas and the building of institutional and human resource to facilitate the use of ICT in instructional process.

Nonetheless, several challenges face ICT integration due to Free Primary Education (FPE) including congested classrooms and few numbers of teachers compared to the number of students. Primary school teachers are required to teach seven subjects of the curriculum although they are not trained in all the subjects. Another obstacle is the high cost of instructional materials for instance; student-textbook ratio remains high in majority of the schools. However, various documents need to be transformed from text to digital format to facilitate ICT use in schools.

Akbaba (2006) has also recognized that there is limited technical expertise and infrastructure for transformation of the national curricula to digital education curricula. Education software are varied and obtained from various manufacturers and therefore should be customized to meet the needs of individual learners. ICT education soft wares are relatively expensive and are prohibitive for various schools in the country. Teachers need to come up with a plan to teach their students in a way which can generate interest and enhance deeper understanding. Sometimes, organizing a field trip is better but this may not always be possible (Becta, 2005).

Time, budget and logistics constraints sometimes mean that you cannot take your class out. But this Kozma (2005) claims that ICTs can help bridge the learning gap in performance between high performing schools and the poor performing schools. The benefits of modern technologies can be harnessed in order to improve the delivery and



quality of instruction, as well as to fast-track the rate at which knowledge is disseminated and learning chances and outcomes equalized.

Maleki et al (2012) have been cautious in emphasizing that when it comes to integrating ICTs in education, each country's reality should be considered, priorities, budgetary constraints and commitment. Technological handicaps have greatly limited the country's ability to achieve its developmental goals and may hamper the realization of high achievement in school subjects if drastic measures on challenges facing ICT integration in science curricula in general and Biology in particular are not taken appropriately especially in Migori County which is the interest of this study.

Webster (1991) says that part of evaluating technology's effectiveness must be looked at on an individual student basis. Students can completely turn around their academic achievements, having failed all their lives to suddenly experience success in an online environment. Other students find it a difficult way to learn. Pelgrum and Law (2003) purports that this can change so that the limitations to ICT use in the instructional process are minimized and maximum or effective learning achieved if the following are adopted; Wearable technology that offers new ways of learning applicable for activity-based learning. The others advocate for learners to carry their own devices to school. Students will begin to feel that they can bridge the gap if their schools can't supply the technology they will be able to use their own.

Mobile education applications are the second most popular type of applications that can be downloaded for use in class. Still other technologies give students a hands-on tie-in to the digital world and this allows teachers and students to repair technological devices in schools and campuses as part of the curriculum. This rather calls for the learning process to be adapted to meet the needs of students through blended learning. Students will be responsible for initiating learning and teachers will have more opportunity to spend time on areas that are challenging to students.

Learners need to look for flexibility as the number of online learners grows from organizations that create more structured programs and measures for their effectiveness. Better still, the uppermost measures or learning objectives should be Retention and Comprehension and finally through Retention (Ajelayami, 1990). Retention increases when the students are attentive in class and should increase the motivation to learn in the classroom which eventually translates to higher performance.

Research Methods

The study was conducted in Migori County which is one out of the forty seven (47) Counties of Kenya. Migori County is on the Western part of Kenya, about 500 kilometers from Nairobi. It borders Homa-bay County and Tanzania as a neighboring country. The choice of this area was purposive due to poor achievement in Biology in particular and science in general at KCSE levels.

It should be clarified that Migori County is not the only county displaying low achievement in Biology but unlike the other poor performing counties such as Wajir, its choice was determined by the fact that Migori County is a cosmopolitan county comprising a number of ethnic communities with different socio-cultural backgrounds that provided the various expected differences in the respondents. It was also convenient to the researcher in terms of financial, time constraints and also the researcher's familiarity with the geography of the area ensured effective collection of data.

The study employed descriptive survey design which utilized stratified, simple random and purposive sampling techniques. The study targeted all secondary school teachers, students, principals, Sub County Education Officers and County Director of Education. The study used a sample size of twenty four (24) secondary schools. The main objective was to find out the extent to which ICT is used in Biology instructional processes in Migori County. Pilot study was conducted prior to data collection in three schools in order to find out the weaknesses in the research instruments.

Research instruments included; students' questionnaire Observation schedules and ICT resource checklists. Data was analyzed through Descriptive and Inferential statistical procedures. The findings were presented in tables,



frequencies and percentages. Responses from close-ended questions were organized, coded and analyzed quantitatively using Statistical Package for Social Sciences (SPSS). Qualitative Analysis was used in responses from open ended questions. Inferential statistics, specifically test of significance, was used in order to determine whether the respondents' scores regarding their views towards ICT integration in Biology teaching and learning differed depending on their positions and role in schools.

Results and Discussions

Table 1.2 Students' Responses on extent of ICT use

Statement	Percentage (%) on the Extent		
	< 20%	30-50%	> 50%
Students use ICT resources in class in the absence of teachers	87	13	-
To what extent does your school manage students' records using excel and spreadsheet in administrative tasks	67	22	11
To what extent do you have access to ICT resources in our school	80	14	6
Use of ICT in class is a waste of time since it is not important	89	9	2
To what extent do you learn Biology using ICT in class	89	8	3
We do not use ICT in learning though it engages Biology students in meaningful inquiry and deep understanding of the subject	83	13	4
ICT resources for instruction are inadequate in our school	5	23	72
Extent of use of ICT resource(s) available in the school	76	24	-
ICT has a positive impact on the learners' academic performance	5	9	86
Our school management supports ICT use	23	54	23

Learners use ICT resources in class in the absence of the teachers

When the students were asked whether they used ICT in the absence of the teacher, majority indicated that the extent was less than twenty percent. Perhaps ICT use by some of the students may not be realized since the students could be using the ICT for other purposes which are not purposively academics. Reid (2002) argues that ICT use is varied and depends on the type of information the users may be looking for. Based on such an argument, some students in Migori County may be exposed to ICT applications but not specifically for academic purposes.

ICT use impact on the learners

More than three quarters of the students thought that ICT engages them in meaningful learning that results in deep understanding of the concepts presented. Similarly, majority of the students also thought that ICT use has a positive impact on their learning. In fact, Rumpagapon (2007) confirms that schools with sufficient ICT resources enhance learner's achievement for the learners get exposed to various sources of information.

He further explains that using ICT enables students to contextualize learning because ICT facilitates identification of relationships within the content (Maleki et al 2012). Perhaps, this explains why most students reason that ICT use

improves their learning in general and therefore majority of the students indicated the extent of impact to be more than fifty percent. Migori County as a whole should embrace ICT to realize any improvement in the students' achievement in Biology.

Extent of use of ICT resource(s) available in the school

When the students were asked about the extent of use of the ICT resources available in their schools, majority responded that the extent was less than twenty percent. This shows the non-use of ICT in Biology instruction. The improvement needed in Biology achievement cannot be conveniently achieved if both the teachers and students do not embrace ICT integration.

Extent to which students learn Biology using ICT in class

When the students were asked the extent to which they learn Biology using ICT in class, majority of them responded by indicating that it was less than twenty percent. If ICT use is not emphasized especially through vital application then the whole integration process is not meaningful to the learners (Rumpagapon, 2007). The teacher needs to establish activities that should enable the students to apply ICT knowledge gained. If students were to use ICT in Biology learning then their achievement in the subject would be improved.

Extent of students' access to ICT resources in school

When the students were asked about the extent of accessibility to ICT resources in their schools, majority of them responded that the extent was less than twenty percent. The information from literature reviewed indicates that the education process requires necessary ICT changes in order to improve students' achievement (Wachira, 2005) especially in Migori County.

Learners did not meaningfully engage in ICT activities

From the questionnaires, almost ninety percent (90%) of the students did not engage meaningfully in ICT activities. Meaningful engagement in learning activities leads to effective learning and therefore improvement in performance in learning. Migori as a County may not achieve improvement in performance in science subjects in all aspects if learners are engaged in meaningful learning. This is a very small percentage that cannot bring the much needed change in terms of improvement in learning.

Computer use in students' records management and not in instruction

When asked whether their schools used excels and spreadsheet soft wares in students' record management, two thirds of the students indicated that their records including examination results are computer generated. This is due to lack of or inadequate ICT resources and facilities in most schools. Even in the schools where the students' records are managed by use of excel, spreadsheet and other programs used in other administrative tasks, few teachers did use the same for teaching and learning purposes as was observed by the researcher.

According to Wachira (2005) ICT presents the global population with new choices, opportunities and challenges that can help improve students' achievement in Migori County. According to UNESCO (2006) report on ICT use in instruction indicate that there has been a great impact on pedagogy and the global economy as well. Migori teachers are yet to embrace this opportunity in order to enhance students' achievement.

Learners did not interact with any ICT in the instructional process

More than eighty percent (80%) of the learners indicated that they did not use any ICT during Biology lessons. This was confirmed during observation where it was found out that almost ninety percent (90%) of the learners did not interact with any ICT in Biology instruction. This still confirms the non-use of ICT resources and facilities in secondary schools in Migori County and therefore could partly explain low achievement in the subject.

Inaccessibility to ICT facilities and resources in schools

On accessibility to ICT resources in the schools, more than three quarters of the students who responded to the questionnaires indicated that they did not have full access. Moersch (1995) affirms that several studies show us that ICTs improves students' achievement because it allows them to progress at their own pace of learning potential and creativity. This can go a long way in explaining the fact that achievement in sciences in general and Biology in particular is wanting in Migori County.

Unavailability of ICT facilities and resources in schools

Integration process cannot be effective when the ICT resources are not available; most students responded that ICT facilities and resources were unavailable in their schools. ICT promote teamwork among teachers and also improves communication thus increasing cooperation with the students (UNESCO, 2006). This should encourage ICT integration in school subjects in Migori County.

Attitude in ICT use

When asked whether ICT use in Biology was a waste of time, a big number of students responded from the questionnaires it was not. This indicates a positive attitude that learners have towards use of ICT. Increased ICT use in the classroom should encourage Migori County to take in to consideration how technology is changing instruction and make a paradigm shift in use of ICT and testing that is competency based. Teachers should embrace the positive attitude the students have towards ICT use and translate this in effective classroom learning.

Conclusions

- a) Eighty eight percent (88%) of the students did not engage meaningfully in ICT activities during Biology lessons and this could be attributed to the fact that there was unavailability and inadequacy of ICT facilities and resources
- b) Majority of the students responded that they did not use ICT during Biology. This was confirmed during observation where it was found out that learners did not interact with ICT resources in eighty nine percent (89%) of the schools.
- c) Eighty percent (80%) of the students responded that there was inaccessibility to ICT resources in the respective schools
- d) Three quarters of the students responded there was unavailability of resources in schools.
- e) Majority of the students indicated they had inadequate computers in their schools
- f) It was found out from observation that only thirteen percent (13%) of the sampled schools had internet connection.
- g) Most students who were had access to internet did not use the same for academic purposes, uses varied from games to entertainments.
- h) ICT integration can be enhanced by providing relevant and up-to-date digital multi-media teaching and learning resources, guiding the students to use the necessary ICT knowledge and skills, provide ICT advisory services to educational institutions, develop strategy, standards and a quality control system for e-learning in schools and necessary infrastructure and systems to facilitate communication and information exchange should be established.

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