THE UNIVERSITY OF NAIROBI

ANALYSIS OF BIOLOGY SYLLABUS OVERLOAD ON STUDENT FORMATIVE AND SUMMATIVE ASSESSMENT TESTS RESULTS IN KENYA SECONDARY SCHOOLS

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DECLARATION

I declare that this research work is authentic and that it has not been presented in any forum or any institution for academic consideration.

All reference sources in this project have been duly acknowledged whether in form of web links, published texts, primary or secondary data or photos have been appropriately accredited with strict compliance with anti-plagiarism rules.

Signature…….. Date…20 / 09 / 2021……...

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This thesis has been submitted for appraisal with our approval as university supervisors.

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Date…20 / 09 / 2021…….....

DEDICATIONS

This research work is dedicated to the fraternity of Scholars who have sought to expand the body of knowledge through interrogation of facts, methodical research and logical conclusion of their findings.

I also dedicate it to all my family members, friends, work mates who have supported me intellectually, materially, financially, emotionally and in any other way to ensure my studies are a success. In particular, my dear wife Cynthia Akinyi and son Caesar who inspire me to work hard to reach the pinnacle of my abilities

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LIST OF ACRONYMS & ABBREVIATIONS

KCSE	Kenya Certificate of Secondary Education
KICD	Kenya Institute of Curriculum Development
COK	Constitution of the Republic of Kenya
8-4-4	8 years of Primary school, 4 years of Secondary education, 4 years of university education
KCPE	Kenya Certificate of Primary Education
ROK	Republic of Kenya
INSET	In Service Training for Teachers
SMASSE	Strengthening of Mathematics and Sciences in Secondary Schools
KNUT	Kenya National Union of Teachers
ICT	Information Communication Technology
UN	United Nations
KNBS	Kenya National Bureau of Statistics
MOE	Ministry of Education
KNEC	Kenya National Examination Council
STEM	Science Technology Engineering and Mathematics
KEPSA	Kenya Private Sector Alliance
MDGs	Millenium Development Goals
UNESCO	United Nations

CHAPTER 1

Introduction

1.1 Background of Study

Educational curriculums around the world seek to empower learners' to be economically self-reliant upon completing their educational endeavours (Julius Nyerere, 1984). Education is therefore the most progressive means by which human capital development can be achieved. It is also an essential strategy for improving citizens' living standards. Through education, Kenya has empowered her citizenry with the appropriate values and skills to succeed in the world of work and employment and also promote the fundamental principles of patriotism, national unity and nationalism (Sifuna, 2009).

The 8-4-4 curriculum aspires to achieve economic prosperity through industrialization, technological advancement, promoting global competitiveness, poverty eradication, and human resource development among citizens (MOE, 2005) The curriculum has further targeted to meet the national and individual economic goals through training and teaching of technical subjects such as mathematics, physics, biology, chemistry, biological sciences, computer and ICT and agriculture (MOE, 2005).
Emphasis on teaching science is traced to the first education commission by Professor Ominde (ROK 1964). The commission proposed the strengthening of science instruction in both primary and secondary schools (ROK 1964). The vocational and technical component of the 8-4-4 curriculum has however faced myriad challenges due to inadequate financing and lack of equipment and facilities. Tutor shortages, learner apathy and poor assessment results have further compounded its effective implementation. To address these emerging challenges facing the 8-4-4 curriculum, the Koech

Commission of Inquiry responded by dropping technical subjects and reverting the education system to an academic model which would be less expensive to run and easier to manage (ROK, 1999).

The government of Kenya has equally implemented myriad reforms in the education sector with the aim of improving its quality. Since independence, two education curriculum changes have been effected alongside several curriculum reviews through education commissions to look into the challenges facing the education sector. It is thus critical that the education sector contributes towards human development through acquiescing learners the necessary skills, values and attitudes. However, this can only be realized if the students can relate and apply in real life what is taught in the schools.

The Kenyan constitution also recognizes the critical role of education in the society. The Constitution mandates the government to provide quality education to all its citizens. The Bill of Rights gives every Kenyan citizen the right to quality education (COK, 2010). The Basic Education Act No_14 2013, Article 4a, further impels the Kenya government to provide every child with quality education and training that is both relevant and accessible regardless of the socioeconomic background of an individual (COK, 2010).

1.2 Statement of the Problem

Learner assessment scores in formative and summative evaluation effectively determine the quality of education (Molbaek, 2018). Summative National examination outcomes are thus principal determinants of learning effectiveness and instruction initiatives within an education system (Tripathi & Kumar, 2018). In the KCSE of 2019, 47% of the examinees scored the D+ grade and below (KNEC, 2019). 22.42% of the examinees scored D- grade while 4.3% scored grade E. The D- and E grades are considered worthless in Kenya since they are not accepted for enrolment in a certificate course, the lowest entry rank in vocational and higher education training. It thus implies 26.7% of learners did not benefit from their secondary education since they cannot enrol for higher education training. This group of learners have returned zero value for their time and money spent in secondary education.

The mean grade for the Biology subject in KCSE 2019 was a D-. This result implies that majority of the learners' did not benefit from studying the subject. The examination outcome further revealed little learning took place in the classrooms and that most students only undertake learning as a formality.

An assessment by the researcher reveals an overcrowded Biology syllabus in the 8-4-4 curriculum which is an impediment to attaining good grades by learners. The greatest indicator of an overcrowded curriculum is universal remedial lessons taken outside the prescribed teaching hours to complete the Biology syllabus. Many Biology teachers contend that the subject is too broad to be completed within the prescribed teaching hours. The Biology text books used for secondary education are also loaded with several difficult concepts that learners and teachers struggle to understand. Many learners have developed apathy towards Biology terming it boring and unpleasant subject to study. Students also don't get adequate time to rest during their holidays as they cover school work and completing assignments. Teachers and parents also emphasize the urgent need to pass examinations and the need to prepare for it by memorizing information from text books.

The tutors thus resort to rote learning to prepare the students for examinations. Majority students decry the limited time available for revision compelling their parents to pay for holiday tuitions to enable their children perform better in examinations.

Curriculum load encompasses the educational content in terms of its quantity and the scope that is delivered to students during their learning course. The aspect of curriculum load remains a pivotal variable in learner educational outcomes. Content overload is one of the characteristics of a curriculum that is not learner centred. Such a curriculum presents teachers with implementation challenges hence ineffectively rendered. Unfortunately many of the educational committees tasked to look into the challenges of the Kenyan education systems have failed to pinpoint the actual role of the subject content in learner educational outcomes. A curriculum that is aligned to the realities of the external world breeds a sense of relevance among the students and promotes high levels of motivation. Whereas the 8-4-4 curriculum was designed to impart into learners technical and vocational skills for self reliance, it has been transformed into a subject and examination centred curriculum that is focused on preparing learners to pass examinations.

Students are thus more likely to benefit from learning if only they can see its purpose and relevance vis-a-vis relate what is learned to the actual world realities. It is only such students who will be more motivated to gain from the education process thus translating to better learning outcomes.

1.3 Purpose of Study

To what extent is the Secondary school educational curriculum overloaded? Is it a real overload or perceived overload? Among the curriculum overload dimensions, the content dimension features prominently in the Kenyan context. Content overload refers to the excessive amount of subject content being learned and taught in relation to the amount of time available for instruction. A curriculum is not only what students learn while at school, but the ability of schools to promulgate learning for life (Abiko, 2019). This research study is conducted at a period when the Ministry of Education is rolling out a novel Competency Curriculum. Majority of Kenyans had suggested a comprehensive curriculum review in the Kenyan educational system that fundamentally alters the teaching and learning philosophy in the educational system (KICD, 2016). At the beginning of 2018, KICD initiated a curriculum change by inaugurating the competency curriculum. Despite the ongoing reform process, a significant portion of the education system is still under the 8-4-4 education system. It is critical to note that curriculum review is a continuous activity which should not be premised on a momentous curriculum change which takes many years while learners are losing value in an non progressive curriculum framework.

This research study is timely to elucidate on the curriculum overload issue and its effects on learner educational outcomes. Both formative and summative assessment test results in the recent years in the Republic of Kenya have been on a downward trend. In addition, examinations remain the only means by which learner achievement is measured in the current education context. Success is determined by the number of students meeting the minimum grade for university admission. This method is short-sighted though. This is because the number of students qualifying for university comprises only a small fraction of learners, 18.513% for KCSE 2019 (Uwezo, 2016). Majority of the learners who do not qualify for university entrance either enrol in technical institutions or venture into private business.

The researcher believes that education curriculum should facilitate the maximum number of learners to excel in their studies consequently access higher education opportunities.

1.4 Research Objectives

1. Investigate the extent of Biology subject overload in Kenyan secondary schools
2. Determine the effect of complex biological concepts on teaching and learning outcomes
3. Establish the role of internal evaluation in improving student assessment results
4. Determine the extent to which teachers use practical lessons in Biology instruction

1.5 Research Questions

The overall goal of this study was to investigate the effect of Biology subject overload in learner assessment outcomes in Kenya secondary schools. Thus the study framework was guided by the following questions:

1. To what extent do complex biology concepts hinder learning of the subject?
2. Is the formal instruction time allocated for the study of biology adequate for syllabus completion?
3. What are some the challenges which students and teachers face due to curriculum overload in Biology?
4. What strategies can be used to overcome curriculum overload to ensure effective teaching?

1.6 Justification of Study

The role of curriculum overload and its impact on student examination outcomes is seldom researched in the Republic of Kenya. This research study analyzes the Biology subject overload problem to bring it to the attention of academic scholars who should carry out further research and add more validity to the existing research work. Despite previous education taskforces and commissions reviewing the curriculum content e.g. the Total quality education taskforce report in 1999 which reduced the number of subjects in primary and secondary schools in 2002, it failed to pinpoint the exact role of subject overload on learner outcomes. Whereas, the high enrolment rate of candidates through 100% transition has substantially raised the student teacher ratio, learner participation in education activities has significantly declined necessitating an enquiry into the lethargy.

At the onset of 2019, the government of Kenya commenced the textbook program in secondary schools where all learners received one text book per head in all the subjects. Yet, it is cognizant to note that the textbooks have made little impact on the students' formative and summative assessment results (ROK, 2020). The Kenya government also spends a substantial sum of money to educate its citizens. 31% of the 2020/2021 national budget is allocated to educational activities. The government further direct KES 58 billion towards secondary education. Based on the students' assessment outcomes, it is clear the government is not getting value for the money being spent on secondary education. This is a double loss as learners are not benefitting from their education endeavours while the government equally spends money which it doesn't get returns. Education managers in the Republic of Kenya should urgently address the issue of curriculum overload in the current 8-4-4 curriculum and make the requisite adjustments to make it relevant and applicable both to the learners and teachers.

Similarly, the government needs to regularly audit the education system to ensure it is getting value for money spent on education activities. This requires not only commitment by the political leadership of the country but Kenyan citizens as a whole who through their representatives in parliament who must demand for quality education. This way it shall be easier to advance and make steady progress on preset educational goals. Otherwise, without political commitment, new-fashioned education ideas only remain intentions and thus quality education shall be elusive.

1.7 Significance of Study

The poor national examination outcomes show that majority of Kenyan high school students are merely transiting through the education system as formality rather than as a means to increase their prospects for higher education training. Kessio & Changach (2012) observe that higher education training is a prerequisite for positive socioeconomic improvement through skills acquisition which translate to higher paying job opportunities. Such socioeconomic changes are beneficial both to the individual, society and country at large.

In view of the low transition rate to University and a large proportion of students remaining unplanned for. It is fundamental that the education curriculum is tailored to be responsive to students' educational need that predicates success in a dynamic 21st century (Sifuna, 2009). Furthermore, a curriculum is considered successful if it facilitates both social and economic growth. A curriculum should accomplish the society' education and development initiatives in its mission, vision, skills, knowledge and values for purposes of maintaining continuity and enabling change.

Poor scores in national examination threaten the achievement of vision 2030, the country's blueprint for an industrial middle income status. STEM subjects play a pivotal role in providing skilled workforce for the labour market for a sustained economic growth. This is to be realized through acquisition of market oriented and entrepreneurial skills by learners (GOK, 2012b). Science, Technology and Innovation (STI) have been identified as pillars that will enable the Kenyan Republic realize wealth creation that leads to economic growth. Research by Kenya Private Sector Alliance (Kepsa, 2013) shows a massive deficit in skilled manpower that can power the countrys' economic growth as envisaged in the vision 2030. It is imperative therefore that the ministry of education takes measures to amended the education system to make it more meaningful to learners for better assessment results.

Curriculum innovation should therefore be continuous to reflect the changing needs of society and the realities of classroom learning and instruction. Education stakeholders such as teachers, schools boards of management, teachers unions, schools inspectorate and parents and childrens' guardians whose children should be co-opted in the education reform process. This is the only way the curriculum innovation strategies will ensure high quality education that meets the society's needs.

1.8 Assumptions of Study

This research study was aimed at analyzing the role of Biology syllabus overload on students' formative and summative assessment test outcomes. The study variables include the syllabus content and allocated instruction time as well as the biological concepts versus learner abilities.

It is noteworthy that there exist covariates which exert significant influence on learner assessment test results. These include student exam readiness, exam anxiety, level of student motivation and subject teacher influence.

This study directly measured the quantifiable variables of learning objectives versus learning time. However, being a descriptive study, biasness and inaccurate information from the respondents can affect the preciseness of results (Salaria, 2012). In addition, the variable of learner abilities is best measured by experimentation and empirical analysis for greater correctness.

1.9 Theoretical Framework

A research theoretical framework is the knowledge framework which supports the research problem under study. This research study is premised on the cognitive structural theory of learning. Cognitive-structural theories give more information about how students reason, think and organize knowledge to make meaning of their experiences (Schunk, 2012). It is imperative that curriculum developers remain cognizant of students' innate abilities to construct knowledge to make sense of their learning experience. and use that as the premise of designing a progressive curriculum. In this way, learning is tailored to help the learner utilize the knowledge they interact with to promote lifelong learning (Resnick, 2017).

Piaget cognitive theory of learning explains how children interpret and create mental constructs of their worlds. According to Piaget (Driscoll et al., cites, intelligence is not a fixed characteristic; instead cognitive development grows relative to an individuals' biological maturation and interaction with the environment. Students therefore gain knowledge by comparing what they have learnt versus what they discover in their environment.

Piaget observes that adolescents from age 12 can carry formal operations based on ideas that do not have a perceptive or physical association with the real world. Adolescents can also reason from abstract concepts and generate multiple possible answers from hypothetical problems. Learners can also make reasonable arguments and form logical schemata to test hypotheses. Perry (Bisanz & Voss, 2017) asserts that Biological learning should be participatory and that students grow in the body of knowledge if they are active participants in a community of learned people. In such educational settings, the learners can observe and engage with the knowledge body in multiple contexts, all which will promote pragmatic debates, critical analysis of facts, and the reflection of ideas and information.

Whereas, the 8-4-4 education curriculum recognizes the sequential development of knowledge (KICD, 2019) and designs a subject curriculum that promotes knowledge development along the stages of learning, the overload in the curriculum denies learners the opportunity to interact with the curriculum content such as to build their versions of reality (Driscoll et al., 2005). When learners fail to internalize the relevant biological knowledge to make meaning of it, they do not to achieve the subject course requirements. One of the learning objectives requires students to apply biological knowledge and understanding to solve social and economic challenges in both rural and urban settings. It is worth noting that an overloaded curriculum hinders learners from effectively communicating biological information in precise, clear and logical manner.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In this chapter, literature Review is conducted on the concept of curriculum overload, foundation of science practical lessons, and the role of internal evaluation in improving student performance.

2.1 Concept of Curriculum Overload

Curriculum overload is defined as the excessive amount of content that is taught or learned relative to the time set aside for instruction (Boersma, 2001). Excessive content is usually measured according to the instruction time allocated per subject and the content to be learned. The content overload emanates in the curriculum design and is manifested by the number of subjects, size of curriculum documents, topics and subtopics, concepts as well as the quality and quantity of learning time. Boersma (2001) notes that cognitive overload increases learner's mental stress leading to poor learning outcomes.

Curriculum content overload has the properties of breadth and depth. Breadth is determined by the quantity of subjects and the number of topics which are taught within the subjects. Depth implies the extent to which learners have to explore the subject matter to get meaning from what they are learning.

2.1.0 Balancing curriculum width and depth

Schimdt & Houang (2012) assert that majority curriculums prioritize broad knowledge content above in-depth learning. This leads to quantitative learning rather than qualitative learning. While (UNESCO, 2002) makes it clear that covering fewer topics in a curriculum could potentially lower student achievement outcomes, (Coker et al., 2016; Laird et al., 2008; Schwartz et al., 2009) note that studying fewer topics in greater detail enables learners to acquire a better understanding of content. It also promotes higher-order thinking that can be 'transferred' beyond the related subjects to solve new problems and challenges in education. Not only will student improvement will be improved as well, but also higher levels of satisfaction will be reported.

Different countries and jurisdictions have different curricula with varying subject repertoires. The Kenyan secondary school curriculum has a total of 31 subjects clustered in different groups to enable learners to select a minimum of seven for terminal examination. At the subject content level, a high number of topics within subjects has been fingered as a principal source of curriculum content overload in the Kenyan education system. The STEM curriculum in the Republic of Kenya has been criticized as both deep and wide (KICD, 2016). This curriculum arrangement has lead to poor outcomes in terms of student achievement both in formative and summative tests.

Whether the overload is perceived or real, the student learning outcomes are vital indicators of an overloaded curriculum. This research study explores the two dimensions of curriculum overload namely, the curriculum content and breadth. The perceived overload refers to how teachers and students experience the curriculum. Content overload is the real amount of subject content learned and taught in relation to the time allocated for instruction. Curriculum overload also referred to as

curriculum overcrowding has been documented in both developing and developed countries (Majoni, 2017; Voogt et al., 2017).

2.1.1 Perceived Curriculum Overload

Voogt et al. (2017) posit that a high amount of curriculum content can create the perception of overload among teachers and students. Students fail to grasp the concept of the curriculum overload, however the load aspect becomes a burden for the teachers. Voogt et al. (2017) asserts that high volume of curriculum content automatically creates an impression of curriculum overload as it breeds negative reactions from the learners. Particularly when textbooks are not reader friendly coupled with overloaded content, teachers and learners get frustrated and overwhelmed. Textbook content and volume can also be excess and not designed to the specific needs of learners.

Whereas several topics and subtopics can lead to content overload, the end-user feedback, that is teachers' and students' perception of having too much to teach or learn within the instruction time is one of the main 'criteria' for determining curriculum content overload (Australian Primary Principals Association, 2014). An overloaded curriculum may implore teachers encountering many topics in their subject areas to get out of their way to deliver extensive content coverage as required by the curriculum. This kind of perception yields myopic rather than in-depth learning for the students. Teachers in such settings lose motivation, purpose and are frustrated in the process.

Teachers facing an overloaded curriculum may take personal decisions on what can be realistically taught within the learning period in turn leading to discrepancies in the curriculum implementation (OECD, 2019).

2.2 Definition and foundation of Biology practical training

The phrase 'practicals' implies any learning activity or student teaching involving the manipulation and observation of materials. Whereas the practical activities are associated with a laboratory building in learning institutions, the location of the practical activity is not a critical determinant of the term (Bradley, 2005). This is because the manipulation or observation of objects can occur both in a school laboratory and in a non school setting such as the fields

The principal function of practicals in the teaching and learning of sciences is to enable students draw associations between the different domains of ideas and the domains of observable phenomena and objects. In practice this is realised depending on the planned learning objectives of an intended practical activity. According to Millar et al. (2002) the learning objectives of a practical task should help students to: (a) identify phenomena and become familiar with them (b) learn facts (c)learn a concept (d) establish a relationship (e) Deduce a theory/model

The nature of the science subject in the material world demands that learning must involve certain aspects of manipulation seeing and handling real materials and objects. Construction of scientific concepts is predicated on Piaget's theory of cognitive development. According to Piaget (Amalia & Suharno, 2020), humans construct powerful and sophisticated representations of the world by creating images of observed phenomena according to their understandings and then modifying them according to data they generate. By acting on the external stimuli, sensory information is generated which can either be assimilated into existing 'schemas' or demand that they are altered to create room for new data, in order to achieve a balance between the internal and external realities (Amalia & Suharno, 2020; Bradley, 2005). In such action, people are able to construct views of objects existing in the world, their internal structure and what can be derived from them, what they can do and the

modifications which can be done to them. This explanation underscores the significance of practical activities whether conducted by observation or manipulating objects.

The goal of science education is to improve students' scientific knowledge and their understanding of science as a form of enquiry. These two aspects should be integrated and synergistically combined into one whole. This necessitates students to 'carry out' their own scientific enquiries and as a result obtain scientific knowledge. This underscores the central function of practical world in any science education endeavour (Baloyi, 2017).

Allowing students to chase their enquiry initiatives help stimulate natural curiosity. When learners make discoveries by their own efforts, learning occurs naturally hence facilitating better retention. Knowledge is thus accepted on the basis of evidence rather than coercive authority (Amalia & Suharno, 2020; Bradley, 2005). The liberating aspect of science is brought about when the individual observer interacts with the natural world can challenge existing prejudice and tradition by countering it with evidence.

An enquiry-based mechanism to learning also motivates the students to be more self reliant and independent towards their educational activities. Such a disposition contributes towards supporting the broader education goals of inculcating autonomy and capacity for purposeful action.

The practical lessons are about discovery learning which is premised on the empirical nature of science and its inductive analytic methods. Scientific facts just as other forms of knowledge emanate from observations and the resulting explanations and generalizations are valid since they are derived from and are supported by observations. Through measurement and observation, students can collect data from the actual world. In addition to using conjectural explanations about how behaviours in the real world can be. In case of any predictions that are made they can be compared with obtained data.

2.2.1 Teaching and learning Biology practical skills in Kenya

Biology belongs in group 2 of the sciences. Students select a minimum of two subjects and a maximum of three subjects in the science cluster. The national enrollment for Biology for KCSE 2019 was 97% (KNEC, 2019)

Biology is accorded 200 minutes of instruction per week for form 3 and form 4 classes and 160 minutes of instruction for form 1 and form 2 classes. The instruction time encompasses both theory and practical lessons. Principally, 80 minutes is reserved for practical classes each week (KICD, 2019).

Biology is examined in three papers: Paper 1, Paper 2 and Paper 3. Paper 1 and paper 2 are theory and each marked out of 80 while paper 3 is practical and marked out of 40. Paper 1 assesses biological concepts learned across the syllabus. The questions are simple structured and all compulsory. Paper 2 has 8 questions; split in two sections, A and B. Part A consists of five compulsory questions spread from topics across the syllabus carrying a maximum of 40 marks. Section B carries 3 questions bearing 20 marks each. The first question 6 of section B is compulsory requiring learners to demonstrate data interpretation and manipulation skills. Questions 7 and 8 are essay based where learners choose either of the two.

Paper 3 is practical based. It has a maximum of three questions drawn from any part of the biology syllabus. Students must answer all the questions and obtain a maximum of 40 marks. Practical lessons constitute a vital part of the O-level science instruction. Science is empirical and must be corroborated with observed phenomena or experimentation. Learners should be able to observe and manipulate all that pertains to learning biology to complement theoretical learning (Bradley, 2005). The practicals are given prominence in the biology curriculum, making up to 40% of national examination assessment scores.

Biology involves the study of living organisms in whole or in parts. Thus it is imperative that the practical lessons should take place within the laboratory building and also outside in nature. It is imperative that learners make observations and investigate various experimental variables and arrive at logical conclusions. The practical activities help reinforce theoretical concepts while promoting learning through discovery.

Biology teachers must integrate practical lessons in their instruction schedules by allocating adequate time within the lesson periods. Normally a double lesson of 80 minutes is set aside for the practical sessions. Students in groups are allowed carry out experiments following laid down procedures and instructions.

Teachers are required to conduct the practicals in advance before the students. This is designed to ensure the practical outcomes are aligned with the expected results. The teacher also eliminates possible errors that may arise due to incorrect reagents and apparatus which may affect the outcomes (KICD, 2019).

Field trips and excursions are also important aspects of biology practicals. Many biology topics require the learner to either visit sites to observe phenomena or interact with the natural world. For example, to understand Hominin evolution, learners should visit prehistoric sites or museums to observe archaeological evidence in form of excavated sites or skeletons (Book 4 Biology, Kenya Literature Bureau, 2019).

2.2.2 Students competence in observation skills

Observation is a fundamental to practical teaching and learning. Learners should be able to make clear and distinct experimental observations during practical activities. When making inferences, the students should capture the finer details of experimental outcomes such as vivid colour changes, precipitate properties and changes in structure and properties of substances. In this way, they make the correct conclusions and in return post high scores in Biology test results. According to Chieung & Yip (2003), students who have mastered observation skills return better test scores in Biology practicals. Adequate instruction is thus paramount to ensure learners are empowered to make critical decisions on

a broad range of practical activities particularly where examinations are involved. Learners should be able to make informed decisions on measurements and decide on the appropriateness of observations and measurements more so when practicals results are anomalous (Orado, 2009).

According to Orado (2009), Students should be assisted to make the correct observations as a practice by preparing the results table for documenting observations and numerical data several hours before the experiments are conducted.

2.2.3 Students' competence in procedure skills

Mastering procedure skills commences at the beginning of each practical session and proceeds through to its logical conclusion (Ling & Towndrow, 2005). Adhering to practical procedures and data collection are therefore vital for successful implementation of Biological practicals. When learners possess an effective command over complex procedural and manipulative skills, they are empowered to understand the significance of following laid down experimental procedures hence attaining the desired experimental outcomes with higher levels of accuracy during the Biology practicals. In addition, students who have mastered practical procedure skills effectively identify potential error sources and procedural limitations which can interfere with results reliability and concomitantly remediate. Procedures and instructions are thus critical for effective manipulation and eventual success of Biology practical sessions and experimental outcomes. Procedure skills further enhance learners higher order skills such as planning, evaluating and analysis.

2.2.4 Students' competence in practical execution skills

The execution phases comprises implementation and putting into practice Biological procedures and instructions to yield the desired experimental results. Understanding Biology is premised on carrying out the appropriate investigations by following the right procedures to ascertain the learned Biological concepts and theories. According to Lunetta et al. (2007), practicals are indispensable in learning Biology since they augment the theoretical teaching to bring into reality the abstract concepts and knowledge. Through the execution component of practicals, students attain prowess in equipment manipulation while mastering the ability to organize and creatively perform required investigations.

According to Smith et al. (2009), manipulation is central to practicals and as such written Biology practicals negate the foundations and philosophy of experimental science. Presenting learners with written practical activities without the actual engagement in the actual performance denies students the chance to analyze and interpret observed data which is necessary for ascertaining Biological facts and concepts. Student's Biological acumen is appraised whenever they undergo the full process of executing experiments

2.3 Internal Evaluation

Internal evaluation refers to the deliberate practice of using test data and students experiences to generate insights on educational activities (Schildkamp, 2012). Whereas, many processes within a learning institution are aimed at determining the value of educational activities, internal evaluation is distinguished from other assessment methods based on how it is carried out. Internal evaluation is solely conducted by the school's internal staff. The staff may include school leaders, individual teachers or groups of teachers working with designated project staff (Simons, 2013). Teachers can also work with non teaching school employees to interpret data and use it to execute changes in teaching methods. External partners such as research organizations, curriculum support officers, and school inspectorate can also be co-opted by the schools internal team to design internal evaluation instruments used for internal evaluation. Unlike in external evaluation, the teaching staff takes charge of designing the internal evaluation instruments; interpreting the evidence and thereafter reflecting and planning on improvement. In external evaluation, education authorities determine the evaluation criteria alongside the data collection and reporting of evaluation outcomes.

2.3.1 Internal Evaluation Process

There are four stages of internal evaluation

Plan - Teaching staff meet to discuss and decide on the aims of the evaluation

Do - Gathering relevant data for the evaluation process. This can be in the form of examination assessment results, lesson observations, student questionnaire and interviews, class work and any data that is considered relevant to an evaluation process.

Check - Collected data is analyzed and used to assess the extent to which learning needs are being achieved. At this stage, professional development needs for school leaders and teachers may be identified and strengthened.

Act - This involves following up on recommendations and findings from the internal review process and taking requisite action.

2.3.2 Ideal conditions for successful internal evaluation

2.3.2.1 Leadership

Effective leadership is required for successful internal evaluation (Schildkamp et al., 2012). Effective leadership facilitates internal evaluation through collaborative discussions, modelling data use, provision of required resources, and developing an improvement oriented culture. Effective leadership also enables critical reflection on schools practices and the ability to challenge traditional thinking (Karagiorgi,2012).

Principals and head teachers are important catalysts for the early stages of internal evaluation that rely on distributed structure as they design and introduce processes and tools that facilitate data collaboration in schools. School leaders also help to focus the vision of the school staff towards the achievement of the evaluation goals. The leaders also manage human resource by hiring competent staff while also demoting non performing staff. School leaders are expected to promote team learning and discussions based on obtained data through professional learning communities and for monitoring developments and changes in classroom practice (Marsh and Farell, 2015). Collaboration in discussion of data results is thus underscored in improving teaching practices across internal evaluation teams. In the absence of strong leadership, individual teachers end up working separately on data analysis thus losing touch with the overall vision and mission of the evaluation process. .

Supporting the principal is essential to achievement of self-evaluation goals. A head teacher's role and presence is critical to raise expectations and also prioritize internal evaluation. The principal's attitude in sharing the aims of learning from collected data should make it clear that the internal evaluation process is not about judging the schools' performance, rather it's a process for realizing important changes (Schildkamp et al., 2012).

School leaders should convince teachers that the evaluation data is only meant for diagnostic purposes and that it does not pose any threat to their jobs. Schools' leaderships should be committed to using data for improvement purposes.

2.3.2.2 Evaluation Literacy

Evaluation literacy is critical for developing teachers' skills in interpreting and evaluating data. Internal evaluation should be conducted by research-savvy staff empowered to take on enquiry-leaning practices (Kallemeyn, 2014). The staff should have the capacity and the ability to utilize their research skills to identify what works well and what is not in their teaching practice. Institutional self review is predicated on schools capacity to reflect on data quality and accuracy while performing accurate analyses that are relevant to their purpose by taking students needs and views.

Teachers need technical expertise in analyzing learner assessment data in order to identify the different learning and scool improvement needs by drawing on different evidence types (Kallemeyn, 2014). Evaluation literacy further improves the understanding of internal evaluation as a critical tool of school improvement rather than just a mere compliance exercise. In addition, evaluation literacy bolsters

teachers' perspectives. They are empowered to view how teaching can be improved to meet students' needs rather than focussing on students failures. Evaluation literacy should thus be advanced along the continuum of facilitating intentional and critical conversations on student data. In this way, internal evaluation goes towards improving school and teaching plans.

2.3.2.3 Resources

Resources are necessary for the attainment of internal evaluation objectives within schools. Two critical resources are data and time. Time is required for the overall realization of internal evaluation goals since it is required for implementing planned evaluation improvements and for making collaborative discussions directed towards internal evaluation (Kallemeyn, 2014). Time inavailability has hindered the responses in identifying learners' needs and also preventing teachers from introducing desired interventions from an internal evaluation viewpoint (Farell, 2014; Marsh & Farell, 2015).

Data is equally an important resource for the realization of internal evaluation goals in a learning institution. Data encompasses data availability, data systems and timelines (Farrell, 2014; Schildkamp et al., 2014). Teachers and staff involved in internal evaluation should be sufficiently trained in both data use and data systems. Schools should be cognizant of the purpose of data tools and the mechanisms hence the ownership of any generated data before electing to use a specific data mechanism. Farrell (2014), notes that lack of adequate data resources remains a barrier to internal evaluation since the extent to which data is used depends on how effective it augments teaching innovations.

2.3.3 Mechanisms of effective internal evaluation

A number of conditions must be met in order for internal evaluation to be successful. In this way, there can be objective examination of the school context and student learning and using the findings to prompt and sustain discussions about school improvement.

2.3.3.1 Interpreting and accepting feedback

Feedback refers to exchanging information between parties within the educational system. In internal evaluation, feedback is generated from collected data which is analysed and shared with the relevant stakeholders. Gaertner (2014) observes that schools which make significant organizational improvements successfully collect data from students which are delivered to individual teachers for analysis and dissemination. Improvements in performance are realized if the data is discussed among teacher collaborative groups. In addition, schools make improvements if the feedback is discussed and measures are taken according to scheduled plans at the onset to improve the quality of education (Schildkamp et al., 2012).

2.3.3.2 Organizational learning and capacity building

This involves setting aside time every week for teachers to engage in professional learning communities to discuss how to use data for the sake of school improvement. There's need for a shared vision for school improvement where professional development and tools for collective identification of goals and needs help improve teaching and learning are discussed.

CHAPTER 3

Methodology of Study, Analysis and Interpretation of Data

3.1 Methodology of Study

The goal of this research study was to analyze the role of biology syllabus overload on student assessment outcomes both in formative and summative test assessments. This chapter deals with the methodology of study, presentation, analysis and interpretation of the collected data from the respondents through the data gathering instruments used in the study. Interview, direct observation, questionnaires, experimentation and document analysis instruments were used in the research study. Both the quantitative and qualitative data gathering methods were used. The quantitative data was gathered from teachers and students through questionnaires, interviews, observations and experimentation. Qualitative data was gathered from document analysis of examination reports, biology text books, and teacher professional documents.

This chapter has three sections. Section 1 outlines the methodology of study; section 2 outlines the characteristics of the respondents while the second section deals with the analysis, interpretation and presentation of the qualitative and quantitative data of the research study.

3.1.1 Research Design

The research design refers to the overall research framework which operationalizes the variables, facilitate sample size selection, and data gathering to be used for data analysis and testing hypotheses. While the goal of the study was to examine the role of curriculum overload in students' assessment outcomes in biology; the study also investigated the perceived roles of practicals lessons and internal evaluation as complementary activities in the learning and teaching of secondary school biology. Therefore descriptive survey was the preferred design

because peoples' opinions, attitudes and behaviours were collected. The descriptive design facilitated concise description of existing educational occurrences with the goal of yielding data that can explain ongoing events within the educational realms. Best & Khan (2006), observe that descriptive research robustly 'describes' or provides more information about a phenomenon, occurrence, attitudes, and problem. This method is the most ideal in this study since the nature of issues sought by the researcher require detailed description and deeper analysis of phenomena by using data to explain the existing conditions.

3.1.2 Population of study and sampling techniques

A total of 2,707 participants took part in this study; 34 teachers and 1,673 students. The populations were selected on the because of their direct involvement with the study topic. The researcher aimed for representativeness to ensure that the sample represented the population from which it was drawn. Teachers and students were purposely drawn from four school categories namely 2 National, 6 extra county, 15 county and 25 day schools. The study was conducted in two subcounties of Gem and Kuresoi South and Nairobi county within the republic of Kenya. Due to limited resources, only these 3 regions were involved in the study.

The school principals interviewed in the study were drawn from different categories of schools, extra-county (6), county (18) and intra-county (26).

3.1.3 Questionnaire

Close-ended questionnaires were used to obtain information from both teachers and students on the role of biology subject overload on learner assessment test outcomes. The close-ended questionnaires were ideal for

the study because they could be administered simultaneously to multitude respondents in a less costly and time efficient manner.

A total of 1000 questionnaires were prepared for students and 150 questionnaires were prepared for the teachers. All the targeted teachers and students were expected to participate in the study. 804 out of 1000 (80. 4%) questionnaires distributed to students were successfully filled and returned while 102 out of 150 (68%) questionnaires distributed to teachers were successfully filled.

3.1.4 Interview

The researcher used interviews to gather additional data to corroborate the information from the questionnaire. The researcher used semi-structured interview questions to address 12 teachers and 64 students on the role of biology subject overload and its effects on assessment results. Data was recorded both during the interview and afterwards. Qualitative methods were used to analyze the data.

3.1.5 Observation

The researcher also used observation method having been a classroom teacher for 3 years to note consequential learner behaviour pertaining to the study variables. He prepared 3 candidate classes for national examinations and has also taught biology in all classes from form1 to form 4. The researcher captured relevant data in the records of work, student observation schedules and assessment reports.

3.1.6 Experimentation

The researcher also used experimentation method to administer test items of the perceived difficult biology concepts. 1,673 students took part in this experiment. The test items were administered indirectly by the subject teachers. The researcher also asked the biology teachers to attempt the perceived difficult test items. 4 teachers directly performed the tests. 9 teachers out of 22 who accessed the tests online returned the results of their performance.

3.1.7 Data gathering process

The researcher used his teaching network to access 102 biology teachers to fill questionnaires and also perform select test items. The teachers also administered the select test items to their learners in addition to delivering questionnaires to their learners where applicable. The questionnaires and test items were shared on the online platforms of WhatsApp and Email. The researcher directly interviewed 12 biology teachers, 8 via mobile phone and 4 teachers face to face. Other than the students under his care, the researcher also interviewed 18 students independently from different schools and also presented them with the perceived difficult concepts. The researcher allowed the teachers up to three months to deliver feedback on the questionnaires and the test items. Through regular communication, the researcher received the results of 804 questionnaires. Majority of the biology teachers supported the researcher as the questions of the select test items helped them to appraise their teaching effectiveness. A total of 1,653 students performed the specially designed test items. The test items were conveniently delivered by teachers as part of continuous assessment tests. The researcher did not incur any cost in the data gathering processes as the teachers were very supportive.

3.1.8 Statistical treatment of Data

Collected data was coded, summarized and transferred to SPSS data analysis software and afterwards analyzed and presented. All the structured items of the questionnaires were analyzed by Statistical Package for Social Sciences (SPSS) version 19.0.

The respondents' profiles, percentages and frequency counts were summarized in the frequency tables. The scores generated in the questionnaires were also fed into the SPSS software to generate descriptive statics. Percentages and frequency analysis were used to determine the number of alternative questions of the respondents. Generated means were used to present differences in the level of concept difficulty and breadth of biology curriculum on assessment outcomes. The statistical significance was set at $p<0.05$.

3.1.9 Validity and Reliability of data instrument

The researcher conducted a pilot test to estimate the reliability of the questionnaires, test items and interview modules to ensure they would deliver their goals. The pilot study helped the researcher to eliminate errors by readjusting the content and formats of the instruments to establish consistency and reliability. The researcher used the network of day secondary schools under the MAHUM group of schools in Gem Sub-county to pilot the data instruments. Through the cooperation of the friendly biology teachers, the researcher improved on the clarity of the questionnaire questions, interview modules and the test items for better delivery.

3.1.10 Ethical factors

The researcher was courteous to the respondents by explaining to them in detail the purpose of the study and that the respondents were not obliged to take part. It was a purely voluntary exercise. The researcher also

provided proof of his research activity for persons who were concerned. The researcher was sensitive not to harm the respondents emotionally of physically by giving as much information as possible.

Respondents' confidentiality was maintained throughout the data collection phase. The respondents did not write their names on the questionnaires. This way the researcher protected the respondents' confidentiality to ensure that they were able to provide relevant and accurate information to this research study.

3.2 Respondents Background

3.2.1 Teachers

A total of 102 Biology teachers, from 36 different schools took part in the study. The gender ratio was skewed toward male teachers 64.51% (N= 102) than females in the schools covered by the research study. This research study reveals a higher ratio of male biology teachers than females. It also important to note that teacher gender did not affect the research outcomes such as to force gender parity in the selection of the respondents.

All the teachers who took part in the research study are qualified graduates of either Bachelor of Education or Post graduate diploma in education and are duly registered with the Teachers service Commission. The minimum teaching experience to participate in the study was two years of active teaching. The teachers' age was not a consideration.

3.2.2 Students

A total of 2,477 students took part in the study. 92% of the students were reached indirectly through their biology teachers who gave them specially designed tests and questionnaires to fill. Only form four students were eligible to

participate in the study. The students filled questionnaires and also performed customised test items. The researcher engaged some of the students in focused discussion groups and also observed others directly. The students were from different school backgrounds i. e. pure girl boarding schools, mixed day schools and pure boys' boarding schools.

3.3 Presentation, Analysis, and Interpretation Main Data of the Study

3.3.1 Introduction

This research study sought to investigate the effect of biology syllabus overload in student assessment tests in both formative and summative assessment in the Kenyan secondary schools. To realize this goal, both teachers and students were asked to rate the extent of syllabus load in relation to subject breadth and scope. They were also to rate their perception of on the effect of practical teaching and internal evaluation. A five point rating scale was used numbering 1-5; 1 implying full disagreement while 5 means full agreement.

The scores of the respondents were entered into SPSS Version 19.0 software to compute **t**-test and descriptive statistics. As a result percentages, frequencies and single sample t-test were used to generate the standard deviations, means and significance differences. Percentages and frequency analyses were done to determine the number of times both students and teachers rated each outcome of the questions. The resulting percentages and means were indicators of the role of the biology subject broadness, scope as well as practical teaching and internal evaluation impact student assessment outcomes in formative and summative assessment tests.

Table 3.1.1 Distribution of students' response on biology syllabus overload and perception on practical lessons and internal evaluation

No.	Items		Frequency and Percentage					One sample t-test			
			1	2	3	4	5	Mean	St.d	t-test	Sig
1.	Rate your attitude towards biology	N	250	327	20	207	0	2.22	1.14	-10.4	0
		%	31.1	40.7	2.5	25.7	0				
2.	Does your teacher explain to you satisfactorily difficult biology concepts?	N	288	348	14	154	0	1.6	1.06	-12.9	0
		%	35.8	43.3	1.8	19.1	0				
3.	Does your teacher complete the syllabus within the scheduled time?	N	0	210	70	444	80	3.48	0.98	7.6	0
		%	0	26.1	8.7	55.2	10				
4.	Did you understand the biological concepts despite the syllabus completion	N	284	445	0	75	0	1.83	0.84	-21.3	0
		%	35.3	55.3	0	9.4	0				
5.	Do you understand difficult biological concepts if you read the biology text books	N	170	564	47	23	0	1.9	0.61	-27.6	0
		%	21.2	70.1	5.8	2.9	0				
6.	What is your most ideal strategy for passing biology	N	430	224	0	150	0	1.83	1.12	-16	0
		%	53.5	27.8	0	18.7	0				
7.	Do remedial classes improve your understanding of Biology	N	507	297	0	0	0	1.36	0.48	-52.3	0
		%	63.1	36.9	0	0	0				
8.	To what extent does your teacher use practical lessons	N	160	300	135	290	0	2.58	1.16	-5.45	0
		%	19.9	37.3	6.6	36.1	0				
9.	To what extent does your teacher use teaching aids e.g. Charts, videos, photos	N	323	323	0	158	0	1.98	1.08	-14.4	0
		%									
10.	Does your teacher revise all CATs and examinations that you have been given	N	347	357	0	100	0	1.81	0.09	-19.3	0
		%	43.2	44.4	0	12.4	0				
11.	Does revision help you to understand difficult biological concepts	N	113	251	20	420	0	2.92	1.18	-0.92	0.36
		%	14.1	31.2	2.5	52.3	0				
12.	Can you list some of the topics and subtopics you consider difficult to understand	N	0	0	50	334	420	4.46	0.61	37	0
		%	0	0	6.2	41.5	52				
13.	Would you enroll for Biology tuition	N	0	0	0	41	61	4.78	0.67	39.3	0
		%	0	0	0	39.9	60				

N.B. (N=804, Sig. (2-tailed) at α =0.05 with degree of freedom 804)

Results Analysis

Item 1 and 2 gauged students' attitude and perception of the Biology subject. The values of 1.68 and 2.22 return a below average mean implying students have a favourable attitude towards Biology. They get discouraged from exploring the subject primarily due to its complex concepts coupled with a broad content which become difficult to master during the learning period. The results are consistent with the researcher's administered Biology tests to students where majority of the learners returned poor test scores.

Item 3, 4, and 5 investigated the roles of curriculum load and scope. Many students reported to complete the syllabus before the onset of National examinations, KCSE. Despite the early syllabus completion, majority of the learners still failed to grasp complex biological concepts. The result is thus consistent with the researcher's hypothesis that most of the biological concepts that learners interact with in secondary biology are too complex for O-level students. On item 5, majority learners reported that they still failed to grasp the biological concepts despite owning and reading their textbooks. The text books do not help them fathom complex concepts.

Item 6 and 7 also were meant to reinforce the hypothesis of the broad secondary biology school curriculum. When learners were asked about the methods used for revising biology, past examination questions was the most prominent method followed by reading class notes, and group discussion. Classroom instruction scored lowest as a means of imparting biological knowledge. Classroom instruction takes the role of a ritual in mediation of learning. Despite the students contending the important role of teachers to enhance successful learning, the instruction time only familiarizes them with the biological concepts which they must restudy to grasp the necessary facts.

High reliance on past examination questions to revise biology is interpreted by the researcher as an escapist study behaviour by learner to evade confronting the biology subject matter. From the focused group discussions and interviews conducted by the researcher, students reported that biology content is too broad to revise all the content successfully.

All secondary schools in Kenya conduct remedial lessons with the main objective being syllabus completion

Item 8 & 9 underscored the role of practical lessons and teaching aids as necessary complements of school science instruction. Around half the students reported a positive rating for the practical lessons. Majority students however noted an overemphasis of practicals for passing examinations as opposed to promoting the uptake of biological concepts during learning. Many students also observed that the practical lessons were narrow in scope, aligning mainly with national examinations predictions as opposed to the practical activities that are recommended in the text books.

Students ranked their teachers poorly in using teaching aids to complement instruction. Students mentioned a wide array of items namely coloured photos, videos, computer animations and computer aided illustrations as well as charts which they observe can enhance the understanding of difficult biological concepts. Students also mentioned that various digital devices such as projectors, laptops, and computers can significantly boost biology learning besides chalk and blackboard.

Item 10 & 11 sought to investigate the role of internal evaluation as a means of improving learning outcomes in secondary biology. Evaluation is a vital education exercise meant to judge the value of all learning activities. Since learning in secondary schools is measured through tests and examinations, it is imperative that testing and measurement are evaluated to sustain quality and also promote a culture of self improvement. According to majority students, their teachers do not lead the revision exercises; instead, they give out marking schemes. Despite having the mark schemes, many students still fail to grasp the biological concepts considered tough. After every test, the subject teacher should undertake a subject performance evaluation to highlight the main areas of concern, principally for improvement, based on student's performance. The examination evaluation report should form the basis of a revision exercise or remedial teaching activity herein the act of self improvement to enhance student understanding of the subject.

On item 12, the researcher tested the hypothesis of subject scope measured in form of a difficulty index. The researcher outlined the topics and subtopics perceived difficult and allowed the students to agree or disagree. The degree of agreement was 93.5% giving a high measure of hypothesis correctness. The agreement was consistent with the previous perceived difficult tests administered to students where the learners avoided test items and also failed in the tests of the perceived difficult topics. In chapter 5 of the research study, the researcher outlines the recommendations on how the perceived difficult topics should be managed.

The feedback in item 13 & 14 informed the researcher on the breadth and scope of biology subject. The revision methods used by learners are an indication on the fundamental nature of the subject. Majority students reported to use past examination questions, followed by individual studying of notes and revision books then group discussion. On the other end, only a handful of learners said they significantly benefitted from classroom instruction to enable them grasp biological concepts. These results however, were not distributed and were limited to two schools where individual teacher traits may have influenced the outcome. With a value of 3.8, the researcher confirms the biology subject breadth coupled with difficult concepts deterred learners from carrying out a structured revision of the subject.

Table 3.1.2 *Distribution of teachers' response on biology syllabus overload and perception on practical lessons and internal evaluation*

No.	Items		Frequency and Percentage					One sample t-test			
			1	2	3	4	5	Mean	St.d	t-test	Sig
1.	Did you complete the Biology syllabus in the last academic year	N	0	0	0	11	91	4.28	.58	39.1	0.00
		%	0	0	0	10.6	89.4				
2.	Did you achieve the desired behavior change in your learners upon syllabus completion	N	39	22	31	10	0	2.44	1.49	-4.90	0.00
		%	37.6	21.7	30.7	10	0				
3.	What are some of the challenges to timely syllabus completion	N	0	0	19	32	51	3.87	0.70	19.3	0.00
		%	0	0	19.1	31.5	49.4				
4.	Do you use remedial lessons for teaching biology	N	0	0	0	0	102	1	0.00	-	-
		%	0	0	0	0	100				
5.	Why do you use remedial lessons for teaching Biology	N	0	0	4	0	96	4.6	.63	39.7	0.00
		%	0	0	4.1	0	95.9				
6.	What are your ideal strategies for passing high school biology	N	0	23	4	38	35	3.84	1.81	6.37	0.00
		%	0	22.8	4.6	37.8	34.9				
7.	How do you rate your application of Biology practical lessons	N	0	44	44	12	0	2.70	0.69	6.57	0.00
		%	0	43.2	43.2	13.6	0				
8.	What kinds of challenges do you experience when implementing biology practicals	N	0	19	21	34	26	3.66	1.16	-5.45	0.00
		%	0	19.1	20.7	34.4	25.7				
9.	To what extent do you use teaching aids e.g. Charts, videos, photos	N	28	56	16	0	0	1.97	1.08	-14.4	0.00
		%	27.4	55.2	17.4	0	0				
10.	Do you revise directly all CATs, and examinations that you have given to students	N	28	56	16	0	0	1.81	0.09	-19.3	0
		%	27.4	55.2	17.4	0	0				
11.	Does examination revision help your students understand difficult biological concepts	N	14	32	2	52	0	3.92	1.18	-.92	0.355
		%	14.1	31.2	2.5	52.3	0				
12.	Can you list some of the topics and subtopics you consider difficult to teach	N	0	0	7	42	51	4.42	0.60	37.3	0.00
		%	0	0	7.3	40.9	51.8				
13.	List some of the topics which you consider broad	N	0	0	3	44	53	4.8	.65	40.0	0.00
		%	0	0	2.8	42.9	54.3				

N.B. (N=102, Sig. (2- tailed) at α = 0.05 with degree of freedom 101)

Results Analysis

Item 1, 2 & 3 examined syllabus completion rate to compare the variables of curriculum load versus available instruction time. Item 1 returned a high value mean score of 4.28 making syllabus completion an important prerequisite for many teachers. Despite successful syllabus completion, many teachers gave an average mean score of 2.58 for the achievement of the desired behaviour changes among their learners. The result is consistent with the student appraisal on the extent of grasping biology concepts which ranks much lower at 1.83. When teachers were asked about the challenges they experienced for timely syllabus completion; broad curriculum content, less study time and slow learners consecutively were the main reasons.

Remedial teaching is not recognized by the Ministry of Education albeit having been integrated into secondary schools' teaching and learning programs. All teachers undertake remedial teaching but at different degrees depending on their school program. Majority teachers contend the broad nature of the biology subject necessitates remedial teaching. This confirms the researcher's hypothesis that the biology content is too broad and cannot be taught successfully within the allocated instruction time.

The researcher tested the role and effect of classroom instruction on learners' ability to grasp critical biological concepts. Majority teachers at 3.84 use drilling tactics such as rigorous practicals and revision of past paper examinations to enable learners score better examination results. Classroom instruction plays a minimal role in facilitating biological knowledge uptake principally due to several complex concepts which cannot be understood by learners within the instruction time.

Many teachers rate their practicals instruction at 2.7. More than half of the sampled teachers are not satisfied with their extent of using practical teaching. When the researcher inquired why they cannot perform as many experiments as practically possible, limited time and shortage of laboratory apparatus and reagents were

prominent. High number of students and too many practicals were also cited. Teachers also ranked themselves poorly in using teaching aid for biology instruction. Teachers universally agree on the importance of teaching aids for effective biology instruction. Majority biology teachers believe the internet and video animations would significantly enhance biology understanding.

Item 10 & 11, underscored the role internal evaluation in improving learner outcomes in biology. Cohen (2017) notes that internal evaluation has the capacity to improve several facets of learning both at individual and institution level. Assessment tests remain the best mechanism to evaluate learner performance in Kenyan secondary schools since they are the only measurable aspects of education activity. This is corroborated by teachers in item 11 who agree that well covered revision exercises improve learner uptake of biological knowledge.

Item 12 directly tested the hypothesis of biology syllabus breadth and depth respectively. The researcher presented the topics and subtopics perceived difficult and long and allowed the teachers to demonstrate their extent of agreement or disagreement. They returned an average of 4.42 for item 12 and 4.8 indicating great levels of agreement with the researchers' hypothesis.

CHAPTER 4

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

4.0 Summary of Findings

The overall goal of the study was to investigate the role of biology syllabus overload on student examination outcomes in Kenyan secondary schools. The research explored the impact of subject width and scope in learners' assessment outcomes. The study additionally examined the roles of internal evaluation and practical activities in biology instruction. Hence, according to the analysed data, the study made the following findings:

4.1.1 Summary of findings on Biology syllabus breadth

a) All teachers use remedial lessons to teach biology. The primary goal of remedial teaching is syllabus completion. This confirms the researcher's hypothesis that the secondary biology syllabus is too broad to be completed within allocated instruction time.

b) Majority of Biology teachers agree with the researcher that the topics of Transport (Form 2), Ecology (Form 3), Reproduction (Form 3) ,Response, Reception & Coordination (Form 4) are overly broad. They spend inordinate time to teach them hence many learners lose concentration.

b) All secondary boarding schools complete the form four Biology syllabus at least by the end of August. The earliest completion month is April. Boarding school teachers explored morning and evening preps for remedial teaching to complete the syllabus. The earliest syllabus completion time in the day schools was end of term 2 in August. Majority of the day schools completed biology syllabus coverage within term 3. Some day schools did not complete the syllabus at all. Sampled day schools reported to have a huge number of slow learners which hinders timely syllabus completion.

c) Cash reward incentives were pivotal in syllabus completion rate. Boarding secondary schools had better incentive programs than day schools. The highest amount teachers earned per remedial lesson was KES. 650 in boarding schools while the lowest amount earned for a remedial lesson was KES. 50. In some schools, teachers were not paid at all for attending remedial classes. The remuneration for the remedial lessons was a motivating factor for syllabus coverage. Day secondary schools monetary incentive programs were irregular and depended on well wishers and their principals' attitudes towards the initiative. Unlike the boarding schools where parents contribute for remedial lessons, the sampled day schools did not make such arrangement hindered by strict prohibition by the Ministry of Education that parents should not pay any other amount than lunch program. The day schools are funded through the free day secondary program where parents only pay for lunch as the only fee.

4.1.2 Summary findings on the Biology syllabus scope

a) Based on questionnaires and interviews with teachers, the researcher confirms the hypothesis of an overloaded biology syllabus with complex terminologies. Teachers experience difficulty transmitting to students complicated biological concepts as desired. None of the teachers successfully completed the test of the perceived difficult questions administered by the researcher. The highest score in the direct test for teachers scored is 62%. Many teachers declared that the test was difficult and needed more time to refer to give back accurate answers.

The questionnaires administered to students also revealed that students have a negative attitude towards biology. The leading reason given by learners is the complex terminologies which require cramming. The students added that the biology textbooks were also not easy to understand despite the government issuing one textbook per head. Whenever they resorted to learn the concepts in the text books, they encountered mental

blocks. This confirms the researcher's hypothesis that the biology Textbooks are written in a language that is not learner friendly.

4.1.3 Summary of findings on the adequacy of practical lessons to enhance biology instruction

a) Majority of biology teachers contend that it is not possible to administer the practical biology lessons as recommended in the teachers' guidebook. Inadequate resources and limited time were cited as two leading constraints. Some teachers preferred to focus the practicals to pass the national examinations.

All students highlighted the need for more practical lessons to reinforce the learned theoretical concepts. Majority of students decried the theoretical nature in which the subject was taught. They observe that the teachers are only interested in completing the syllabus by dictating notes. The students' note that only selected practicals are conducted with a focus on passing national examinations.

Only 4 schools organized fieldworks and biology excursions for their students as standard practice. While other schools organized the field trips, they were not institutionalized and depended on funds availability. In some schools students were asked to contribute for academic trips.

4.1.4 Summary of findings on the effect of internal evaluation

Teachers and students reported minimal evaluation of assessment tests. Teachers cited time inadequacy as hindrance to effective evaluation. Both students and teachers agree that comprehensive revision would enhance uptake and understanding of biological concepts and ideas. Majority teachers also do not follow up with KNEC post examination analysis. The national examination body detail student performance and offers progressive recommendations to improve teaching and learning.

Whereas evaluation should be multidimensional, the subject centred nature of the secondary education curriculum focuses evaluation mainly only on aspects relating to attaining the highest possible scores in the national examinations. As a result, the students emphasised the need for rigorous revision on the widest array of examination papers to improve their odds in the national examinations.

4.1.5 Conclusions

It is worthwhile to note that all education systems face various operational or structural challenges. While no education system is entirely perfect, it is most critical that existent challenges are promptly addressed so as not to hinder the attainment of laid down educational objectives. The principal goal of this study was to investigate the effect of biology syllabus overload on student test outcomes in formative and summative evaluation. Based on the findings, the following conclusions were drawn. These conclusions should serve as guidelines for students of biology, teachers of biology, heads of institutions, and the ministry of education officials in charge of education policy to ensure better learning outcomes in student assessment tests.

4.1.6 Need for secondary syllabus curriculum review

The current secondary education is subject centered. It compels learners to master high amounts of abstract concepts which they cannot immediately make sense of. As a result, many learners with apparent low cognitive capabilities are disadvantaged. This is manifested in national examination tests where almost half the learners score below D+, the minimum grade that one can enroll for certificate training.

Whereas, the Ministry of education is implementing a new curriculum, there are six more academic years remaining to complete the current curriculum. In the spirit of reform, the Ministry of Education should review the syllabus content with aim of reducing the Biology subject scope to a realistic depth and also reviewing its breadth to reduce content while removing repeated content. In this way, learners will internalize the concepts and learning becomes more meaningful.

4.1.7 Use Inquiry based pedagogical methods

It is imperative special attention is given to instructional methods that encourage more learning by participation or practical methods than theory. Teaching of practical skills requires sufficient financial and time allocation in order to give room for adequate experimentation, creativity and innovation. In addition there will be need to further train teachers on the practical methodologies which they can transfer to the learners. According to CEMASTEA (2014), improving learning outcomes in mathematics and physics should be realized from a local position rather than from an ideal perspective that is not compatible with the Kenyan educational context. CEMASTEA proposes two innovative teaching methods namely ASEI (Activity-Student-Experiment-Improvisation) and PDSI (Plan - Do-See - Improve) for progressive learner centered pedagogy. These two methods have been proven to improve learning outcomes in STEM. ASEI and PDSI places the learner at the center of education activities while enabling continuous improvement. ASEI-PDSI framework is constructivist, allowing learners to construct their knowledge from the sets of information they interact with. Teachers in the ASEI-PDSI paradigm facilitate learning as rather than controlling it.

4.1.8 Internal support for Biology

Poor assessment outcomes in biology should inspire school authorities to invest more time and resources to improve the subject results. This is because biology is important for students' career growth prospects. Making the subject the center of attention in educational activities within the school can help shift the negative attitude already built towards it. Some of the methods to popularize the subject include:

a) Create special time and days for the study of biology
b) invest in teaching aids such as animations, computer aided learning, videos, documentaries and illustrative charts
c) Invest in activities life field works and excursions
d) Students should be encouraged to use interactive learning processes such as group discussion and role playing to enhance the mastery of biological concepts.

4.1.9 Review National Assessment grading

The new grading system unveiled by KNEC in 2018 has raised the minimum scores for biology making it difficult for students to pass the subject. The maximum score for grade E is 29% unlike the STEM subjects with lower pass grades. Poor results discourage students who believe the subject is difficult.

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