ESI Preprints **Not Peer-reviewed**

Addressing the self-directed learning culture gap in Kenya's competency-based Curriculum Junior School integrated Science post-COVID-19

Cosmas Masega Ongesa
University of Nairobi, Kenya
Joseph Mwinzi
Samson Gunga
Atieno Kili K'Odhiambo
Department of Educational Foundations
University of Nairobi, Kenya

Doi: 10.19044/esipreprint.10.2024.p465

Approved: 17 October 2024
Posted: 19 October 2024

Cite As:
Ongesa C.M., Mwinzi J., Gunga S. & K'Odhiambo A.K. (2024). *Addressing the self-directed learning culture gap in Kenya's competency-based Curriculum Junior School integrated Science post-COVID-19.* ESI Preprints.
https://doi.org/10.19044/esipreprint.10.2024.p465

Abstract

There are varied bodies of research on self-directed learning (SDL), a few of these studies have been done about developing a self-directed learning culture (SDLC), especially in Competency Based Curriculum (CBC) junior schools. The study mainly focuses on how the curriculum reforms for Kenyan CBC junior school integrated science and the current theoretical instructional model have promoted the development of SDLC. The data is gathered, examined using the Kantian critical judgment theory model, and evaluated using the standard reflective self-directed instructional model (RSIM) by Mentz, Laubscher, and Olivier (2021). Key theoretical premises, sub-themes, and themes are developed using the categories scrutinized and analyzed. According to the analysis, no education reform has suggested that schools, teachers, and students in Kenya's CBC junior school should develop the common themes, sub-themes, and learning strategies of SDLC. A novel instructional model that supports the development of the SDLC is thus needed.

Keywords: Self-directed learning, Competency, Competency based curriculum, Junior School, Integrated science

Introduction

Across the world, several changes, innovations, and developments have been implemented to try to accommodate all learners while in classrooms, at home, or in any location of convenience. Most countries rely on the internet, TV, radio, and print media to keep some of their learners engaged with the content. However, the pattern of take-up of such strategies varies from country to country and their effectiveness remains unknown to a great extent (Reimers, 2022). Poor and middle-income countries 'like Kenya frequently rely on one-way learning or communication strategies mainly TV and Radio; a very small number use online learning and meeting applications especially YouTube, zoom, Google Classroom, and Google Meet (Ng'ang'a, 2021). Rich countries like the United States of America (USA) rely on online classes through online learning platforms and take-home packages of educational learning materials.

Households too are important in the learning process during school closures. Those from the able background (about 30% for the Kenyan case) have access to media, internet-enabled computer-based tools, books, time, and enough space for study (Ng'ang'a, 2021). What their learners lack according to Reimers (2022) and Punjani & Mahadevan (2021) are 21st-century soft skills, knowledge, and dispositions to study independently and remotely. Other learners (about 70% in Kenya (Ng'ang'a, 2021; UNICEF, 2020) can hardly access those devices let alone skills and on the higher side, they can only access radio and TV with minimal or no guidance from their households (Punjani, & Mahadevan, 2021). It is in such regard that this study proposes to investigate a possible place for self-directed learning culture (SDLC) to allow learners, especially at CBC junior school levels in Kenya, also, study anywhere anytime with or without the help of real-time instructors.

Before COVID-19, secondary school learners in the 8-4-4 curriculum were not taught key critical thinking dispositions. The Competency-Based Curriculum (CBC) learning outcomes for grade (VII) and grade (VIII) in junior school (KICD, 2023) mostly demand learners to identify, remember, list, and apply while confined in a classroom. These are lower-order thinking skills according to Bloom's taxonomy (Ongesa et al., 2023). Competency based curriculum has only listed skills and knowledge a learner is supposed to attain. CBC does not teach dispositions that are a core part of critical thinking in teaching-learning at any level of the education continuum.

MOE's (2020) emergency response to COVID-19 listed nine objectives to help mitigate the effect of the pandemic in the education sector. They included the following among others: Prevention of COVID-19 in schools; provision of equity, quality, and inclusive education for all learners; facilitation, production, and transmission of TV, radio, and online teaching-learning content and provision of psychosocial support for educational officials, teachers and learners. There is nowhere in the emergency response that MOE has mentioned the development of critical thinking for learners and teachers as an emergency intervention in the COVID-19 transition period. Critical thinking and most especially critical thinking dispositions are thus lacking in the instructional delivery of the COVID-19 response plan. Digital or online content, TV, and radio programs were rolled out without the training of parents, teachers, and learners to understand the need for continued learning during the COVID-19 transition period. Additionally, remote learning is limited in low- and middle-income countries, whereas in Kenya, is partly due to limited knowledge, skills, dispositions and computer-based learning resources (Alzahrani et al., 2021; Ng'ang'a, 2021; Ongesa, 2020).

Assessment of impacts like awareness of the COVID-19 pandemic, computer-based self-efficacy, curiosity, and online teaching-learning on the perceived net benefits that accrue to learners and which form the basis for a self-directed learning culture is an objective of this study. Given the experience in the Kenyan basic education curriculum and the ongoing education reforms during the post-COVID-19 transition period, a study on skills and dispositions that would impact the adoption of a self-directed learning culture is necessary for learners, parents, teachers, the government, online service providers and companies that provide the needed technology and digital infrastructure. The study critically analyzes and investigates whether it is possible to develop a self-directed learning culture (SDLC) in Kenya's CBC for junior school integrated science curriculum.

1.1 Purpose of the study

To critically assess the Kenyan CBC junior school integrated science curriculum post-COVID-19 to establish the extent to which a self-directed learning culture has been developed.

2.0 Literature

To better understand the concepts of self-directed learning and teaching-learning in basic learning institutions during the COVID-19; a wider perspective study is done. An evaluation of relevant theories and methods of analyzing and measuring data to answer the study question is done using a standard self-directed learning model chosen. It's not been

possible to provide an exhaustive range of authors in the field of self-directed learning. Otherwise, the study has created a balance of representation of authors with the strongest influence in self-directed learning culture. Most teachers (over 70%) in the COVID-19 school closure were unprepared for remote teaching-learning (Wambaria, 2023; Willies, 2023). This means that their learners are ill-prepared to take self-directed studies. Digital infrastructure, digital devices, and other appropriate remote digital teaching-learning resources were unreliable in the COVID-19 period (Wambaria, 2023). Learners lack crucial critical thinking dispositional facets (Wairimu & Chilufya, 2022) and competency to study independently (Willies, 2023).

2.1 Assessing the current basic education theoretical teaching-learning approach

The basic education curriculum in Kenya is approached from a largely technical perspective. Curriculum development processes and design in Kenya's basic education are dominantly technocratic and bureaucratic (Heto et al, 2020; Nganga & Kambutu, 2019). The management approach to curriculum preparation and implementation as a branch of the social-behavioral approach tends to involve a predetermined logical process with end goals and activities aligned towards the attainment of those goals. Communication structure is always a top-down affair. Although in the Kenyan CBC junior school education curriculum, various overarching statements tend to refer to skills development and challenges affecting today's world in academics, we find a few examples of skills and competency development identified in the documents, especially the syllabus (Kobiah, 2020).

Decisions concerning the curriculum in Kenyan basic education, education policies, and the need for curriculum change have always been determined by curriculum technocrats/specialists, supervisors at the KICD, and the Ministry of Education (Akala, 2021). These decisions are communicated down the bureaucratic ladder to the basic and important stakeholders (teachers, learners, and learners' parents) (Kobiah, 2020). In school, these decisions and curriculum teaching models are communicated to various departments for implementation by headteachers who act as curriculum managers at institutions. Headteachers lack full autonomy to control the change process in their institutions even though they are key managers in the implementation process (Heto et al., 2020; Nganga & Kambutu, 2017). School managers' main task is to ensure school routines are adhered to. For instance, recording teachers attending classes, marking registers and examination administration among other duties. Teachers, learners, and parents are mere resources of the rational system even though a school is a typical organization that involves the community, learners,

teachers, and school managers. These groups are supposed to interact continuously (Syomwene, 2020). When setting the curriculum, curriculum specialists do not consider these interactions much when making decisions on intended outcomes and goals. Such a curriculum is not evolving, authentic, or learner-centred, and cannot help to develop a personalized study for self-directed teaching-learning.

Developers of the CBC introduced constructivism as a learning model as put forward by contemporaries of Dewey (1966) (Akala, 2021; Ongesa, 2020). Constructivism emphasizes the learner as the centre of knowledge during the learning-teaching process. Contrary to this assertion, Basweti (2019), and Ongesa et al (2024) have observed that nowhere in the teaching curriculum for learners in grades V to grade IX of the new CBC curricula has the constructivism model been applied. Constructivist defines the role of the one teaching as a guide not to teach or be the center of knowledge. According to constructivism, learners' guardians or parents, and learners should play an important responsibility in the teaching/learning process (Lumonya, 2020). Critical thinking and especially key critical thinking dispositions will help those learning, to be free to open up their thoughts and be in a position to apply, analyze, create and accept points of view and information that may on some occasions, not be in agreement with their beliefs and positions held earlier.

Ennis (2018), and Sande's (2020) observations shared by this study note that without learners' involvement in problem identification, content development and designing ways of solving problems identified, then that knowledge is neither, constructive, creative nor critical. Hence the newly introduced 2-6-6-3 curriculum (or the CBC), as well as the 8-4-4 curriculum and other education curricular reform reports before, have not properly articulated how a self-directed learning culture is to be developed. This is because the social-behavioural model or the top-down management model applied in education has failed to involve key stakeholders in curriculum development and delivery. The model is not reliable in tapping skills needed for developing a self-directed learning culture in schools.

2.2 Critical thinking-based learning model for quality content delivery

Camilleri & Camilleri (2023), Wambaria (2023), and Willies (2023) observations that this study found useful to focus on theoretical and methodological gaps and learning needs in the COVID-19 transition period. Wambaria (2023), and Willies (2023) have observed that there is a theoretical and methodological gap in critical thinking in the curriculum of almost all developing countries most especially Kenya. Camilleri & Camilleri (2023), and Zhao & Watterston (2021) have noted that learners

across the world can now access a variety of content easily, with little or no charge, from many sources through the web or the internet using digital devices. They now have tools, such as video cameras and smartphones, to collect digital material/content, and data can be easily edited and used in learners' work. This means that the instructor should move away from transmitting and selecting information in large chunks or blocks or giving a single textbook to learners for school assignments. Instead, they should guide their learners to evaluate, apply, find, and analyze information relevant to a specific subject domain (Bozdağ & Gökler, 2023; Zhao & Watterston, 2021). This relevance will become more negotiated between those teaching and their learners. A learning model that gives support for learner independence and choice is central to assessment, support, and delivery in our universities and other primary learning institutions. This study seeks to establish from the available literature any model for promoting the development of a self-directed learning culture in the Kenyan CBC junior school and beyond. The study has established a gap in the existing model and seeks to propose a reliable model for developing a self-directed learning culture in Kenyan CBC junior schools and beyond.

3.0 Methodology

The study is a documentary analysis and it uses secondary data from scholars, educationalists, policymakers, and government reports to address the SDLC gap in Kenyan CBC junior school integrated science. Speculation and reflection methods are used to analyze, critique, and assess secondary documents for Kenya's CBC junior school education curriculum. Reflected on are reform reports, teaching models, curriculum design, and lesson materials in Kenyan CBC Junior schools. Speculated and reflected upon is the application of self-efficacy, open-mindedness, propensity to seek reason, inquisitiveness, self-reflection, self-monitoring, and self-control in Kenyan CBC education curriculum design for junior school integrated science learners. Also reflected and speculated upon in the documents are pedagogy, and theories employed or suggested to be employed in the Kenyan CBC junior school education curriculum to facilitate the development of a self-directed learning culture. The following documents provided data for this study: Kenya Basic Education COVID-19 emergency response plan report (2020); Kenya Institute of Curriculum Development (KICD) curriculum for junior school grades VIII and IX (2023) integrated science. The analyzed categories are used to develop theoretical premises that underpin the study analysis and assessment.

4.0 Study Findings and Analysis

The 2017 implementation of a competency-based curriculum (CBC) attempted to include artificial intelligence (AI) in teaching and learning. The purpose of CBC content is to be skill-based rather than content-based. The issue of implementing artificial intelligence (AI) has been faced with challenges of insufficient information and communication technology (ICT) devices and infrastructure, as well as slow and unreliable internet connectivity. Additionally, CBC has promoted summative evaluation after every cycle. The purpose of summative evaluation is to ascertain how a student should proceed from one cycle or level to the next.

In both public and private elementary schools, 120,000 of the 2 million pre-primary students have access to computers and iPads. Out of 120,000, only 22.4% have access to the internet. As of 2023, 82% of schools had power connectivity. These consist of mains power and solar energy. Just 49,000, or 5%, of the 914,000 students who took the KCSE 2022 exam took computer classes. The majority of secondary schools have access to a few computers. This suggests that Kenyan basic education has low levels of computer literacy. There are challenges with ICT infrastructure and digital resources for management and learning. To incorporate digital content into the departure process, many teacher educators need access to digital devices. Devices and internet infrastructure present further difficulties. As a result, educational institutions' digital infrastructure and resources are underutilised.

4.1 Addressing self-directed learning culture gap in Grade nine (IX) Kenyan CBC Junior School Integrated Science

Applying literacy, scientific knowledge, and scientific principles for suitable scientific abilities and scientific practices in daily life is the primary learning objective for a junior high school student in grade nine (IX) integrated science classes. To tackle scientific problems in daily life, learners must also apply their scientific knowledge, abilities, values, and attitudes. The following learning outcomes must be attained by a junior school integrated science student to possess critical thinking, problem-solving abilities and knowledge. Through a scientific approach to problem-solving and creativity, the students should develop their manipulation, management, conservation hygiene, sanitation, and interpretation skills. In junior school, students must also employ scientific principles, knowledge, and early-learned abilities to solve scientific problems in a variety of settings. Science knowledge, science abilities, and science principles are to be taught in integrated science curricula. Critical thinking dispositions and criticality are not addressed in the grade nine integrated science curriculum for junior school students.

The learning objectives for integrated science include acquiring scientific knowledge, scientific abilities, and scientific concepts to preserve and manage the environment, maintain excellent personal hygiene, and establish sound scientific methods for controlling our surroundings. Junior school integrated science students should acquire the following scientific skills: manipulation, environmental management, conservation, sanitation, nutrition, and natural interpretation. The learning objectives for junior school students studying integrated science in grade nine do not include critical thinking dispositions or self-efficacious skills. The general objectives of an integrated scientific course do not include any requirement for students to develop self-monitoring, self-management, self-reflection, open-mindedness, and curiosity sub-themes and learning strategies. For an individual or learner to develop a self-directed learning culture and critical thinking this study and Roeniger (2023) note that self-monitoring, self-management, self-reflection, open-mindedness, and curiosity sub-themes and learning strategies are necessary.

Self-efficacy is discussed in passing in the strand force and energy and the research of curved mirrors. When discussing the qualities of the pictures created by curved mirrors with classmates, a ninth-grade integrated science learner will practise leadership and build self-efficacy. Self-efficacy is the term used to describe learners' confidence in themselves when confronted with difficult tasks, queries, or circumstances during the instructional process. Peer discussions are a widespread practice, but they are not the same as self-efficacy. The level of self-efficacy is assessed. Consequently, there is a deficiency in critical thinking dispositions that develop SDLC in integrated science curricula.

The integrated science curriculum design for junior school students lacks the most crucial abilities needed for a learner to develop SDLC and critical thinking, aside from scientific knowledge, principles, and skills: manipulation, environmental management, environmental conservation, sanitation, nutrition, and interpretation of nature. A portion of the essential critical thinking dispositions absent from the integrated science KICD (2024) curriculum according to the study and Elder-Paul (2019) model of assessing SDLC is role-playing, active learning, inquiry-based learning, modelling thinking, using tools to stimulate thinking, collaboration or community learning, using real-world experience, visualising and predicting, and writing. This indicates that in addition to failing to teach all critical thinking indicators, an integrated scientific curriculum for junior school students in grade nine does not impart all the abilities required for students to acquire SDLC and critical thinking. Without the other abilities required, manipulatives, environmental management, environmental conservation, sanitation, nutrition, and natural interpretation cannot help someone fully

develop an SDLC. Therefore, it is evident that there is a gap in SDLC in junior schools for learners taught integrated science.

The main inquiry topics for an integrated scientific course in the following areas are not critical thinking oriented: mixtures, elements, and compounds; living things and their surroundings; force and energy. For instance, when considering mixtures, elements, and compounds, students are urged to consider the following inquiries.

a) What significance does an atom's structure have?

Students are expected to construct models of specific elemental atoms using resources that are readily available to them locally. Since real atoms are so complicated and require such sophisticated manipulation, they can only be seen via an electronic microscope, which is only available at national science centres. Imagination is stimulated by modelling an imaginary atom. According to Bloom's taxonomy, imaginative activities are lower-order talents that cannot aid in the development of critical thinking and SDLC in learners.

For an integrated science junior school learner in grade nine, the following recommended inquiry questions are related to the strand of living things and their environment:

a) Why is hard water favoured for drinking?
b) What role does photosynthesis play in nature?
c) How does the human body break down food?

To assess the conditions for photosynthesis, a learner is expected to conduct an experiment and present the results in class. Critical thinking and creative skills include experimental or manipulative skills. It is simply crucial to inquire about the learner's comprehension of photosynthesis, regardless of whether it has been covered previously. A critical and reflective learner can proceed and check for the conditions even in the absence of this inquiry.

Students are expected to talk about what they know and understand about how humans digest food and to listen to others' opinions. Only when students are forced to recall what they have been taught or when they acquire knowledge early on may listening occur without any practical exercises. In Bloom's taxonomy, remembering is a lower-order skill. Critical thinking and SDLC cannot be developed using lower-order thinking techniques.

The following are the suggested inquiry question(s) for the force and energy strand that a student is expected to answer:

a) What are curved mirrors and how are they used in daily life?
b) How are waves used in day-to-day activities?

These and many other recommended major inquiry questions for a learner completing integrated science in grade nine are guided inquiries that typically elicit a certain answer from the student. Questions for guided

inquiry are closed. These kinds of queries can't foster the growth of an open-minded student. One of the three main dispositional components of critical thinking is open-mindedness. Since the proposed major inquiry questions lack open-mindedness, there is a deficiency in critical thinking abilities within the integrated science curriculum for Kenyan CBC junior school students.

In addition to scientific knowledge, a learner who meets or exceeds assessment criteria should possess managerial, manipulative, conservation, experimental, and nutritional abilities. While the recommended inquiry questions for grade nine integrated science students may be beneficial in helping them develop their critical thinking skills, the student's curiosity is lacking. "How" and "what" are the only starting words for the majority of the grade nine integrated science junior school proposed inquiry questions. This indicates that the recommended inquiry questions lack a significant amount of interest or inquisitiveness. Secondly, rather than coming from the topic or the person teaching them, students should propose inquiry questions out of pure curiosity. This indicates that the integrated science curriculum for grade nine students in junior schools lacks important critical thinking elements for SDLC. The integrated science and CBC curricula for junior schools thus have an SDLC gap.

The integrated scientific curriculum for junior school students in grade nine makes no mention of how self-efficacy should be built. One essential critical thinking disposition that any critical thinking learner needs to cultivate is self-efficacy, also known as self-confidence. The new CBC curriculum for grade nine integrated science learners in junior school does not cover the essential critical thinking dispositions: open-mindedness, inquisitiveness, truth-seeking, and self-efficacy. Since critical thinking dispositions are a crucial component of critical thinking indicators and SDLC, junior school-integrated scientific activities lack them. For junior school students, critical thinking and SDLC are therefore lacking in the integrated scientific curriculum. Because the curriculum lacks the essential component of critical thinking indicators, a junior high integrated science student might not be able to think critically. Even the development of critical thinking skills is only partially discussed or handled. The curriculum lacks the majority of critical thinking abilities that are essential for SDLC.

The absence of criticality stems from the fact that learners are never expected to voluntarily engage in particular study projects for their own and society's benefit. Engaging in integrated science projects and activities that facilitate learning and help society address issues like hearing loss, vision impairment, and other issues that could improve integrated science education are examples of criticality among students. For junior school students in grade nine, criticality is thus completely absent from the integrated scientific

programme. The study is one of the most important indications of critical thinking that should be covered in schools, even though it does not address criticality.

Junior school students studying integrated science in grade nine are required to create and develop a community service project(s). They must pinpoint an issue facing the community and devise a plan to attempt to resolve it. Knowledge, abilities, values, and attitudes related to community service are among the things a junior high integrated science student in grade nine will acquire. The grade nine integrated scientific learner curriculum lacks many critical thinking abilities, including writing, a community of inquiry, active learning, expert modelling, creativity, and real-world skills. This indicates that the curriculum for an integrated science learner in grade nine either ignores or assumes the critical thinking indicators' essential component. Additionally absent from the grade nine integrated science learner's community service assignment are criticality and critical thinking characteristics, such as open-mindedness, curiosity, truth-seeking, and self-efficacy. Because this learner lacks critical thinking indicators, community service programmes cannot help them improve their critical thinking abilities and develop SDLC. For Kenyan CBC junior school integrated science learners in grade nine, there is a deficiency in critical thinking dispositions and thus SDLC.

The curriculum report does not specify that a learner in grade nine integrated science must plan and carry out the community service project by themselves. This implies that any member of the learner's family or community can choose the project, complete it, or offer assistance to the learner in completing it. The learner might not accomplish the project's objective if the person who assigned it to them also taught them how to present it in class. The curriculum report does not provide a suitable means for teachers or instructors to verify the legitimacy of the community service project completed by students enrolled in integrated scientific courses. Before determining whether a learner has met, exceeded, approached, or fallen short of expectations, the assessment process for such project works should advise instructors or guides on how to demonstrate the authenticity of the finished project.

4.2 Addressing the self-directed learning culture gap in Kenyan CBC Junior school integrated science education Curriculum using Reflective Self-Directed Instructional Model (RSIM)

To critically assess all the documents analyzed, the study has employed a self-directed teaching-learning framework/model: the Reflective Self-directed Instructional Model (RSIM) also known as the multiliteracies self-directed learning model advanced by Mentz, Laubscher & Olivier

(2021) in their work; Self-directed learning: An imperative for education in a complex society. Mentz, Laubscher & Olivier (2021) analyzed all existing self-directed teaching-learning models before them and designed RSIM after identifying gaps in the previous models of self-directed learning. Reflective self-directed instructional Model (RSIM) has themes, sub-themes, and elements that a self-directed learning curriculum and learners should possess to control, manage, and monitor their learning autonomously.

The self-directed learner's learning strategy according to Mentz, Laubscher & Olivier's (2021) RSIM framework is summarized in Table 1 below.

Table 1: Reflective SDLC for a self-directed learner (Mentz, Laubscher & Olivier; 2021)

Common themes	**Common Sub-themes**	**Learning strategy (The role of the SDL learner)**
Learner's competency and commitment (Content level)	Self-motivation Self-monitoring Self-control Self-reflection	• Learners to choose a specific topic for discussion • Include open-ended activities and assignments to allow learners to select and reflect on what they learn, how they can complete given tasks, and /or what they can create to demonstrate their learning competency. • Learners generate their own research or inquiry-based questions for exploration of a given problem of study • Learners to examine diverse sources of information on the problem stated
Develop the value of conviction in self-directed learning	Critical thinking skills Critical reflection Self-sufficiency	• Allow learners to select materials or tools they want to use to complete a task • Provide learners with opportunities to work alone or with others, and either online or offline • Work in collaborative communities of inquiry or set up peer-response groups to provide learners with feedback on their work. Learners in collaborative communities of inquiry can: i. Split tasks deemed as complex into parts and step ii. Plan and manage time iii. Explore, discuss, explain, elaborate, and explain iv. Give and receive learning performance outcomes v. Give a challenge to assumptions vi. Provide stronger communicability. • Ask learners to complete a proposal describing their plan at the start of a complex assignment or project. • Include time for student self-assessment, self-reflection, self-monitoring, and goal setting
Desired Outcome for Learners	Modelling, real-life experiences/issues, problem-solving, collaboration and community study, logical reasoning, and self-management	• Learners to demonstrate their competency through finished projects, reports, and portfolios. • Learners select the medium to communicate their competency (for example, writing, speaking, visual, multimedia, reports, and projects). • Learners identify the criteria for success associated with the task given. • Digital literacy • Learners to develop their inquiry-based questions • Questions of a hypothetical nature for learners should take the format: What if that did not occur? What if it happened? What happens if that is not true? • What if I cannot do something?

Mentz, Laubscher & Olivier's (2021) Reflective Self-directed Instructional Model (RSIM) is used in this study as a standard model to assess Self-Directed Learning Culture (SDLC) in junior school education curricula, especially for integrated science curricula. Competency-based curriculum Junior school integrated science documents analyzed by the RSIM include the reform reports on CBC, integrated science junior school education curriculum and emergency response plan report to education during the COVID-19 crisis. Analyzed in the documents using the standard model are common themes and learning strategies that promote the development of a self-directed teaching-learning culture as stated in Table 1.

These shared sub-themes and learning strategies of a self-directed learning culture have been modelled in this study using Kenyan CBC junior school integrated science curricula in Kenya. The majority of these sub-themes are absent or inadequately described in the Kenyan CBC junior school's Grade IX curricula as analyzed earlier. Some of the appropriate learning strategies for a self-directed learning culture for example digital literacy, goal setting, learners generating their inquiry questions, real-life experience/issues, and collaboration and community study are missing. Others for example modelling, role-playing, competency through finished projects and portfolios, open-mindedness, self-monitoring, and real-life experience are not well developed at the Kenyan CBC junior school integrated science curriculum design.

Prior research has also revealed that students in Kenyan CBC junior schools are struggling with speaking, writing, and communication. From the analysis early in this paper, the study has observed that digital devices and digital infrastructures are limited and poorly distributed across the country, schools, and families. The goal to be achieved by learners is already set for them, hence learners lack self-control of the problem or project given. Key inquiry question is already set for the learners and learners have no room to suggest their questions or improve on the one already stated. Here, learners' curiosity and open-mindedness in question selection and how to respond is limited. There is no proof from the curriculum design that learners are engaged in real-life experiences or issues. In the strands to be covered in grade IX: mixtures, elements and compounds; living things and their surroundings; and force and energy, learners are not exposed to real-life experiences mostly dealing with elements, compounds, force and energy. Mixtures, living things and their surroundings are partly tackled because learners are exposed to part of real mixtures and living things starting with them and their surroundings. Learners cannot visualize real elements, compounds, force and energy. A few elements for example iron, sodium, chlorine, mercury, lead, copper, calcium, magnesium etc. are stated and learners are required to master their symbols and atomic numbers all of

which cannot be visualized. Mastering or remembering cannot develop curiosity or a self-directed learner.

Modelling especially self-control, self-reflection, and self-monitoring by instructors is missing. This compromises the competency of finished projects because learners lack self-reflection, self-monitoring, and self-control of their projects. From the analysis, the study has shown that the authenticity of the work done by learners cannot be verified. Due to bad language and dialectic, learners who struggle to write and communicate are not curious. Because they overlook important dispositional aspects of critical thinking, learners who lack curiosity are less likely to be self-directed during the instructional process.

It is necessary to cultivate and impart curiosity in students. Applying Socratic questioning within small collaborative communities of inquiry with a range of perspectives and presumptions helps foster curiosity in learners. A good curiosity should enable teachers to go beyond what is commonly understood. It is only feasible to go beyond what is commonly known when educators define what is already understood and foster new concepts and understandings through creative learning. It is recommended that guides and educators prioritise curiosity and an inquiry-based approach in the planning and execution of their lessons. This method works well for coming up with fresh concepts and stimulating or reflective thought. When students are organised into small, cooperative communities of inquiry, presumptions made about a particular assignment are scrutinised and assessed. Inquirers can find a welcoming atmosphere in small groups where self-efficacy is promoted. Students' creativity and sense of self-efficacy will soar in small collaborative groups where they can expand their ideas and converse with others who have different opinions.

4.3 Effective Self-directed Learning Culture Strategies.

Learner-centred, non-formal online learning is the key effective self-directed learning strategy discussed. These learning strategies are assessed and discussed in the next segment.

a) Learner-Centered, and Non-Formal Online Learning

Self-regulated instructional models should be permitted instead of teacher-directed learning in the post-COVID-19 curriculum. The capacity of learners to create their own distinct and well-thought-out learning pathways is the source of true self-motivated and self-regulated learning, which can support the growth of a self-directed learning culture. In other words, learners can acquire knowledge that aligns with their interests and capabilities. To achieve this, the curriculum must not only include key critical thinking dispositions in the teaching-learning process but also allow students to develop their knowledge and learning pathways without being

unduly restricted or controlled by the curriculum's predetermined content or by their teachers' or instructors' instructions.

Giving students ownership over the curriculum not only helps them stand out but also allows them to express their rights as independent persons and foster a culture of self-directed learning. With the help of a curriculum like this, students can propose new and improved course material, make educated decisions on their own, and be prepared to face the repercussions of their decisions. Additionally, it assists students in taking ownership of the curriculum by allowing them to take control of the subject matter, the issue being studied, potential solutions, and the development of lifelong learning habits and abilities.

Students can access a variety of free, multi-source, and site-specific educational materials in their field of study via the Internet, virtual laboratories, and classroom settings. These students now have access to devices like video cameras, AI-enabled smartphones, tablets, and PCs that allow them to access virtual information and data that can be modified and customized for use in class assignments. To help students find the best learning resources and apply, analyze, and evaluate those resources or information that relate to a particular domain of knowledge, instructors should stop transmitting and selecting content in large information chunks, blocks of chapters, or in a single textbook. The teacher and students negotiate the contents' validity and applicability.

As a result, it is imperative that students everywhere, but especially in Kenya's CBC junior schools integrated science, be permitted to bring portable internet-enabled devices into class, including smartphones and video cameras, but only after receiving instruction and training in self-directed learning. Self-directed learners can select resources that are helpful yet difficult for social media to distribute. Independent, self-aware, and self-reliant are characteristics of self-regulated learners. Following the study analysis, most people agree that these gadgets are an easy way to accomplish pattern prediction, repetition, memorization, or any other skill related to gathering, storing, and retrieving information. Since this is a component of lower-order thinking skills that cannot support the growth of self-directed learning, it does not require demanding class activities.

Individual critical thinking, human values, and humanity will be the most important commodities that set humans apart from those lacking them in a world of artificial intelligence. Because of this, it's critical to foster in students a culture of self-directed learning from an early age in basic education settings (primary and secondary schools). Since the future is unpredictable, unclear, and ever-changing, it is crucial to foster traits like curiosity and self-efficacy. Learners will become critical thinkers if more time is allotted for more engaging activities that can foster the growth of a

self-directed learning culture in them rather than just having them recollect and retrieve knowledge that can be done quickly by AI gadgets. In Kenyan CBC junior schools, curiosity and open-mindedness that foster self-directed persons should be promoted.

This study analysis and Roeniger's (2023) study on 'cultivating learning throughout life' have observed that Massive Open Online Courses (MOOCs) and Online Education tools (OER) are two recent innovations in the field of education that provide learners with tools to enable and promote their independence during non-formal learning. Peer discussions, automated testing, and grading will give those students feedback and encouragement on their subject of study. This is also feasible if instructors have inspired students to consider ideas that are pertinent to their field of study. These chances for independent, non-formal online learning are anticipated to address any learning gaps that may have arisen during, particularly in the wake of, the COVID-19 pandemic and its aftermath. When we implement remote or online learning in our junior school and senior school going forward, we need also to instil a strong self-regulated learning culture in those students so they can make informed material choices.

4.5 Discussion and summary of study findings

The thesis that there is a gap in SDLC revealed by the introduction of COVID-19 is strengthened by this study. To encourage the development of the SDLC, it implies that educators and students require support as well as a phrasing paradigm that makes use of important critical thinking dispositions as a unifying theme. The degree to which SDLC had been promoted during instructional delivery by Kenyan educators in schools, how key critical thinking dispositions (CTD) in the current instructional model in Kenya's CBC junior school integrated science curriculum design, and the suitable instructional model that promotes SDLC in junior schools are addressed.

The majority of common themes found in self-directed learning cultures, such as important dispositional aspects of critical thinking, competency and commitment, the development of conviction as a value, and the desire to foster such a culture, are either absent from the Kenyan CBC junior grade IX education curricula or are discussed in a way that is too general to foster the growth of a self-directed learning culture. The curriculum modifications examined also lack the majority of common sub-themes, such as truth-seeking, curiosity, open-mindedness, self-motivation, self-management, self-control, and small collaborative communities of inquiry. The examined categories also lack self-directed learning techniques like digital literacy, speaking, writing, and communicating, as well as experiences from real life, role-playing, modelling, active learning, community study or collaboration, and Socratic questioning. As a result, the

current teaching-learning paradigm for the grade IX junior school integrated science curriculum has a self-directed learning culture gap.

The Kenyan CBC junior school grade IX curriculum does not yet include the problem-based learning (PBL) approach. Many elements must be in place for problem-based learning to occur, including students' self-determination, skillfully built teams or communities of inquiry, knowledgeable tutors, well-structured problems, activation of past knowledge, and group dynamics. The majority of these elements are absent from the Kenyan CBC junior school curriculum reports examined. A portion of the existing components have also not been implemented in the process of curriculum instruction delivery.

It is necessary to clarify how a self-directed learning culture and essential critical thinking dispositions are to be developed in Kenyan schools for students enrolled in the CBC junior school integrated science education curriculum, as well as other curriculum reform reports. To foster a culture of self-directed learning throughout all school curricula, the Kenyan curriculum needs to be changed to incorporate common themes, sub-themes, and learning strategies that are covered early on. For instance, individual learning can be done when learners are placed in small learning communities of inquirers with a welcoming environment, instructions, and tasks that are somewhat challenging to solve on their own utilizing an inquiry-based strategy, using constructivism as a learner-centred epistemological approach.

According to the logical analysis, a school's culture of SDLC is established by its teachers' competence, commitment to advancing the development of SDLC, integration of SDLC into all programs, and school-wide practice. The qualities of educators who can support the development of SDLC in a school include being competent in key critical thinking dispositions (CTD) and having a commitment to creating SDLC. School-wide SDLC practice development and the advancement of SDLC in the majority of school programs are related to the creation of a school-wide practice of SDLC. Therefore, Kenyan CBC junior schools must create a school climate that values critical thinking abilities as well as self-monitoring, self-reflection, and self-motivation. All stakeholders in the school must participate in programs that foster a culture of self-monitoring, self-reflection, self-motivation, and critical thinking.

All students should be guided through thought-provoking activities that let their minds roam and grow so they may more easily deal with the challenges they encounter. This calls for a paradigm that makes use of essential dispositional elements of critical thinking to help students reflect on what they have learned and exercise self-control over how they study, explore, and deal with obstacles in life. To assist learners become self-directed, it is vital to foster an environment that supports and encourages

self-motivation, self-reflection, self-monitoring, self-efficacy, open-mindedness, truth-seeking, and curiosity. An individual's critical thinking dispositions, knowledge, competency, and commitments, as well as their intended results and convictions, can all be used to establish a self-directed learning culture (SDLC). Additionally, this study's research reveals that teachers who are keen to promote a culture of self-directed learning should be curious, open-minded, truth-seeking, and self-assured. Content that stimulates readers' curiosity may aid them in becoming more independent learners throughout the teaching-learning process.

Several challenges might arise when attempting to establish a self-directed learning culture (SDLC) for students in Kenyan schools, particularly regarding classroom layout, scheduling, location, and even tenure for those tasked with fostering this kind of learning. To create a culture of self-directed learning throughout the school, time is needed to personalize the sessions and obtain pertinent materials. The responses, competency, and dedication of the learners should determine the direction of the discussions. It might take a bit longer to generate competent, self-directed, critical-thinking students who are also devoted, but only if the educational system is less exam-focused.

Conclusion

Kenya’s CBC junior school curriculum has not specified how to encourage the growth of a self-directed learning culture. The examined curriculum reports should include common themes, sub-themes, and learning practices that lead to the development of a self-directed learning culture in schools. According to the study analysis, the competency and commitment of all school stakeholders to SDLC, the formation of SDLC belief, the desired goals of SDLC learners, and important critical thinking dispositions are essential common themes to self-directed learning. Self-monitoring, self-reflection, self-motivation, self-control, self-regulation, and self-management are sub-themes that lead to competency and commitment. Curiosity, open-mindedness, self-efficacy, and truth-seeking are sub-themes to critical thinking dispositions that are underdeveloped in basic learning institutions, where the junior school is shelved. The Kenyan curriculum's current instructional approach includes a clear road map for fostering the creation of SDLC in classrooms. A new model is needed to guide this process.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research.

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