SELF-EFFICACY INFLUENCE ON GENERIC SKILL ACQUISITION, MEDIATED BY PARTICIPATION IN LEARNING ACTIVITIES IN CENTRAL UGANDA

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A DISSERTATION SUBMITTED TO THE DIRECTORATE OF RESEARCH AND GRADUATE TRAINING IN PARTIAL FULLFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF DOCTOR OF PHILOSOPHY IN EDUCATION OF KYAMBOGO UNIVERSITY

NOVEMBER, 2025

DECLARATION

I, Jesca Harriet Audo**,** declare that this dissertation is my original piece of work and that it has not been presented for any academic or professional award.

….…….. ……

Signature Date

APPROVAL

This dissertation by Audo Jesca Harriet has been written under our supervision and guidance as university supervisors.

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Signature Date

Dr. Henry Kibedi (Ph.D.)

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Signature Date

Dr. Biirah Judith (Deceased)

DEDICATION

I dedicate this Dissertation to my beloved children, Alpha Reuben and Jemmie Branch. This work stands as a testament to the legacy I have set for you a legacy of perseverance, excellence, and integrity. May you carry this torch proudly and ensure that the values and standards it represents continue to inspire and uplift generations to come. Never let this trait break; may it be passed on and strengthened through your lives.

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As I conclude, I wish to share a quotation from the esteemed Russian novelist and philosopher, Maxim Gorky:

"We are accustomed to live in hopes of good weather, a good harvest, a nice love affair, hopes of becoming rich or getting the office of chief of police, but I have never noticed anyone hoping to get wiser." I choose to be wiser, inspired by Proverbs 1:5:

"A wise man will hear and increase learning, and a man of understanding will attain wise counsel." The Lord God has given me the tongue of the learned; He awakens my ear to hear as the learned - Isaiah 50:4 (NKJV)

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ABBREVIATIONS AND ACRONYMS

CBC	Competence Based Curriculum
CT	Constructivist Theory
GSA	Generic Skills Acquisition
ICT	Information Communication Technology
MoES	Ministry of Education and Sports
OPLA	Overall participation in learning activities
PLA	Participation in Learning Activities
SAQ	Self-Administered Questionnaire
SCT	Social Cognitive Theory
SE	Self-Efficacy
TTICL	Trans-Theoretical Integration Model for Competency Learning
UCE	Uganda Certificate of Education
UNEB	Uganda National Examinations Board
USE	Universal Secondary Education
WIHIC	What Is Happening In this Class

ABSTRACT

This dissertation analyzed the influence of Self-Efficacy (SE) (academic and self-regulatory dimensions) on Generic Skills Acquisition (GSA) (critical thinking, communication, and teamwork), investigating the mediating role of Participation in Learning Activities (PLA) within lower secondary Biology instruction in Central Uganda. The study addressed the persistent deficiency in Uganda between transferable competencies mandated by the Competency-Based Curriculum (CBC) and the skills acquired by learners, noting continued deficits in critical thinking and scientific reasoning. A convergent parallel mixed-methods design (QUAN-QUAL) was employed, utilizing surveys from 301 Senior Three students and qualitative data from 6 Biology teacher interviews and classroom observations in Universal Secondary Education (USE) schools in Mukono District. Findings confirmed a moderate, positive correlation between overall SE and overall GSA (r=.500, p<.01). The relationship between PLA and GSA was moderately strong and significant (r=.655, p<.01). Crucially, quantitative analysis revealed that PLA significantly and partially mediated the SE–GSA relationship. The indirect effect of SE on GSA via Overall participation in learning activities (OPLA) was statistically significant (β=0.39). Qualitative findings, however, underscored implementation inconsistency, noting persistent gaps in teachers' capacity to facilitate high-quality inquiry-based and collaborative tasks in resource-constrained contexts. The study concludes that high-quality PLA is a crucial mechanism for translating self-efficacy into demonstrable generic skills, necessitating intentional pedagogical review to integrate active, learner-centered instruction. To build upon the current findings, longitudinal studies are recommended to examine the sustained effects of self-efficacy (SE) and active learning strategies (PLA) on generic skill development over time. Future investigations should also explore the influence of contextual factors such as socioeconomic status, school environment, and teacher characteristics on student learning outcomes.

CHAPTER ONE

INTRODUCTION

1.0. Introduction to the Dissertation

This dissertation, titled *"Self-efficacy influence on generic skill acquisition, mediated by participation in learning activities in Central Uganda,"* addresses a critical global challenge: the need to equip learners with high-level, transferable competencies known as generic skills required for success in the dynamic 21st-century labor market. The study provides an integrated analysis of the psychological, pedagogical, and contextual factors that influence the development of these essential skills within the specific domain of lower secondary school Biology instruction in Central Uganda.

Globally, education systems are shifting emphasis away from rote memorization toward measurable competencies. Generic skills acquisition (GSA) encompasses core competencies such as communication, critical thinking, collaboration, and teamwork, which are increasingly prioritized by employers alongside domain-specific knowledge. In Uganda, this paradigm shift is formalized through the roll-out of the Competency-Based Curriculum (CBC) for lower secondary schools. This reform aims to ensure that learning is demonstrated through the real-world application of knowledge, skills, and values, positioning subjects like Biology as crucial platforms for fostering both scientific understanding and transferable competencies.

Despite the progressive intentions of the CBC policy, a persistent deficiency remains between the skills students acquire in school and those demanded by employers, contributing significantly to graduate unemployment in developing nations. Empirical evidence suggests a weakness in pedagogical implementation, characterized by the limited adoption of active, learner-centered strategies necessary for developing generic skills.

Performance data underscores this issue, revealing persistent low achievement in UCE Biology and noted deficits in critical thinking and scientific reasoning.

This study contends that successful generic skill acquisition hinges on two core elements: the student's internal belief system (Self-Efficacy or SE) and the quality of their classroom engagement. Crucially, the "Student Active Participation" referenced in the dissertation title is operationally defined and investigated throughout the content as "Student Learning Activities" (PLA). These activities represent the mediating variable the hands-on, collaborative, and inquiry-based strategies designed by teachers to actively engage learners in the educational process. The core premise is that for a student's confidence (SE) to translate into demonstrable competencies (GSA), they must actively participate in these challenging, skill-building learning activities (PLA).

Prior literature acknowledges the individual roles of self-efficacy and active learning but often fails to establish the causal pathway: how specific classroom activities in a foundational science subject like Biology mediate the relationship between a student's confidence and their tangible skill development. Furthermore, existing research has largely neglected the foundational lower secondary level, particularly within under-resourced Universal Secondary Education (USE) schools in Central Uganda. The overall purpose of this study was, therefore, to analyze the impact of implementing participation in learning activities specifically inquiry-based learning and problem-solving based learning in relation to students' self-efficacy (academic and self-regulatory) and the acquisition of core generic skills (critical thinking, communication, and team work) in lower secondary schools in Central Uganda.

The conceptual foundation of this work integrates Constructivist Theory (CT), which advocates for active, experiential learning through engagement and social

interaction, with Social Cognitive Theory (SCT), which explains that a learner's belief in their ability to perform a task (SE) dictates their level of engagement and outcome. This dual-theoretical approach, formalized in the proposed Trans-Theoretical Integration Model for Competency Learning (TTICL, 2025), is essential, as effective instructional activities (informed by CT) can only be successful if the learner possesses a strong sense of self-efficacy (explained by SCT) to actively participate. The specific nature of Student Active Participation, conceptualized as robust Participation in Learning Activities (PLA), is thus theoretically positioned as the bridge that links student belief to skill mastery.

Methodologically, this investigation adopted a convergent parallel mixed-methods approach (QUAN-QUAL), collecting simultaneous quantitative data from self-administered questionnaires (SAQ) completed by 301 Senior Three (S3) students, and qualitative data from in-depth interviews and structured classroom observation checklists used with six Biology teachers. This triangulation allows the study to measure the statistical relationships (correlation and mediation effects) while providing rich, contextual insights into the practical challenges and successes of implementing active, competency-based learning (PLA) within USE schools in Mukono District.

The dissertation offers significant contributions. By focusing specifically on Biology, the study generates discipline-specific evidence essential for enhancing curriculum implementation. Institutionally, the findings will support teacher training programs (Universities, NTCs, and PTCs) in strengthening pedagogical content knowledge concerning learner-centered approaches that build self-efficacy and generic skills. For policymakers (MoES, NCDC), the results provide actionable recommendations to refine professional development frameworks, classroom observation tools, and resource guides, ensuring that the intended Student Active Participation is consistently enacted through

quality Student Learning Activities. The reader should expect to gain contextually grounded insights that explain the complex process by which a student's confidence is translated into demonstrable, valuable generic skills through targeted instructional design in secondary science education.

In structure, this dissertation proceeds as follows: Chapter Two (Literature Review) synthesizes the theoretical and empirical literature related to self-efficacy, student learning activities, and generic skills acquisition, establishing the theoretical framework and outlining the specific research gaps addressed. Chapter Three (Methodology) details the philosophical assumptions, convergent parallel mixed-methods design, and rigorous procedures for sampling, data collection, and analysis. Chapter Four (Presentation of Findings, Analysis, and Interpretation) systematically presents the quantitative results (correlation, regression, and mediation analyses) and the qualitative insights, responding directly to the research objectives and corresponding hypotheses. Chapter Five (Discussion, Summary of Findings, Conclusions, and Recommendations) provides an integrated discussion of the findings, linking them back to the literature and theoretical framework, concluding with actionable recommendations for stakeholders in the education sector.

Structure of Chapter One

Chapter One, explicitly titled "Introduction," serves the crucial function of establishing the study’s foundational framework and direction. It systematically introduces the background, problem statement, purpose, objectives, research questions and hypotheses, significance, scope, and the conceptual framework. These elements collectively articulate the rationale for investigating the self-efficacy influence on generic skill acquisition, mediated by participation in learning activities in Central Uganda.

The chapter begins with Section 1.1, Background to the Study, which provides the necessary context for the investigation. This extensive section frames the study by outlining the historical, theoretical, conceptual, and contextual perspectives related to the research variables, grounding the work in established scholarship and the specific challenges of Uganda's competency-based education system. This foundation leads directly into Section 1.2, Statement of the Problem, which details the critical deficiency between the transferable competencies mandated by the curriculum and the skills students demonstrably acquire, highlighting the need for this research. Following the articulation of the research gap, the chapter formally sets the study's direction through several defining sections. Section 1.3 clarifies the overall Purpose of the Study, while Section 1.4 details the guiding Objectives of the Study, which are aligned in a coherent and logical order. These objectives translate into the testable assertions presented in the Research Questions (1.5) and the corresponding Research Hypotheses (1.6), which frame the core quantitative analysis.

The subsequent sections define the boundaries and contribution of the research. Section 1.7 discusses the anticipated Significance of the Study to various stakeholders, including academics, institutions, and policymakers. Section 1.8 precisely defines the Scope of the Study, detailing its Content Scope (focusing on self-efficacy, participation in learning activities, and generic skills acquisition in Biology), Geographical Scope (Central Uganda), and Time scope (2020–2025). This is followed by Section 1.9, Conceptual Framework, which graphically models the hypothesized interrelationships among the Independent, Mediating, and Dependent variables. The chapter ensures a comprehensive justification for the inquiry in Section 1.10, Justification of the Study, specifically providing the scientific rationale for focusing on Biology and the mediating mechanism of

student learning activities. Finally, the chapter concludes with Section 1.12, Conclusion Chapter One, preparing the reader for the subsequent in-depth review of theoretical and empirical literature in Chapter Two.

1.1 Background to the Study

This section presents the historical, theoretical, conceptual and contextual perspectives of the study variables.

1.1.1 Historical Perspective

The overarching goal of education extends beyond individual students to include societal benefits (UNESCO, 2016). The shift toward providing students with practical skills required in the labour market is a necessity in the education provisions (Janssens et al., 2023). Scholarly attention has been given to the global issue of graduate employability skills (Rowe, 2020), particularly in light of the global financial condition and the sharp rise in young people with post-secondary education leaving the country in search of employment opportunities abroad (Tomić & Taylor, 2017). This demonstrates the significance of graduate employability issues and the fact that the skills gap is the primary cause of graduates' unemployment in developing nations (Oladokun & Olaleye, 2017). To guarantee that students succeed in the workplace, several business executives and educators have created models and enumerated a set of skills that they refer to as generic skills (Virtanen & Tynjälä, 2017). There are several predictions that the labour market will place greater value on generic skills in the future (Casserly, 2013).

When it comes to developing quality human resources, education is crucial. A country's standard of living is determined by its human resource base. A nation's ability to adapt, advance, and improve itself is facilitated by high-quality education (Manullang, 2013). Education needs to be focused on developing adaptable, responsible, and productive

human resources through the integration of generic skills into learning if it is to thrive and compete globally in the twenty-first century. Additionally, employers require generic skills (communication, critical thinking, team work, teamwork, lifelong learning, professional ethics, entrepreneurship, and leadership, among others) in addition to job-related requirements such as technical/professional skills (Okunuga & Ajeyalemi, 2017; Andrini, 2016).

Generic skills such as communication, critical thinking, collaboration, team work, and lifelong learning are essential for navigating today's dynamic, technology-driven work environment (Virtanen & Tynjälä, 2017; Okunuga & Ajeyalemi, 2017). Employers increasingly prioritize these transferable competencies alongside domain-specific knowledge (Casserly, 2013). However, a deficiency between the skills employers seeks and those that graduates possess continues to hinder employment outcomes, especially in African countries (Hahn & Teferra, 2013).

The significance of generic skills and their acquisition through teaching and learning is widely acknowledged. Secondary schools must show that more employable graduates are produced (Jackson, 2019). As a result, secondary schools allocate resources to help students develop these skills. One of the competence-based curriculum's (CBC) goals is to prepare students for life-long learning (UNESCO, 2020). This implies that they must be prepared to make complex judgments about their work and others' work and make decisions in uncertain and unpredictable situations in the future (Bautista, 2016). According to Ludolph et al. (2017), skill acquisition needs to be incorporated into a framework by progressively raising the degree of ability complexity. In addition to being given the tools to manage their education, students must learn how to integrate into the school community. Giving students the resources they will need for the remainder of their

education and their future careers can help them develop generic skills from the very first day of school.

The concept of generic skills in education has gained global attention, aiming to bridge the gap between education and work. However, the perceived deficiency between employers' and graduates' generic skills has led to graduate unemployment in African countries (Hahn, & Teferra, 2013). Initiatives like the African Higher Education Harmonization and Tuning project have aimed to integrate generic skills into curriculum but often lack specificity in aligning these skills with particular subjects, such as Biology, and provide limited guidance on pedagogical strategies for skill development (Calma, 2023). The concept of generic skills in education has gained global attention, aiming to bridge the gap between education and work. However, the perceived deficiency between employers' and graduates' generic skills has led to graduate unemployment in African countries (British Council, 2021; Hahn, & Teferra, 2013).

Generic skills education first gained popularity in the United States of America in the 1970s when a movement in education described the knowledge, abilities, and conduct that a student should possess after a course of study (Mkonongwa, 2017). These only provided precise, numerical descriptions and hence lacked generic skills necessary for the world of work due to the rapidly evolving technology and global economy. Country-specific reforms have emerged across Africa. In Nigeria, studies report that graduates lack core skills such as communication, numeracy, and decision-making (Oladokun & Gbadegesin, 2017; Okolie et al., 2020; Pitan, 2017). This is not because there aren't enough jobs available (Oladokun & Olaleye, 2017); Nigerian graduates lack essential skills like communication, decision-making, critical thinking, and technical and numeracy, leading

to a skills gap and defficiency between employers and workers, requiring urgent policy action.

In 1997, South Africa introduced the continent's first generic skill curriculum in response to a lack of skilled workers like engineers, technicians, and craftspeople (Zungu, 2016). This was done to improve all South Africans' mindsets and provide them with the marketable skills they need to confront the problems of the twenty-first century (Sanders et al., 2017). Kenya's education reform trajectory, colonial education was racially biased, uneven, and discriminatory, which led to the first reform moment (Akala, 2021). This author asserts that native Kenyans' access to secondary and higher education was not developing students' generic skills. Natives were subjected to subpar education that prepared them for manual labour, religious laws, and career training.

In Uganda, the generic skills acquisition has been incorporated into a competency-based curriculum (CBC). This model emphasizes the demonstration of learning through real-world application of knowledge, skills, and values, promoting mastery over rote memorization (Mulongo et al., 2020). Biology, a core science subject in this curriculum, is viewed as a key platform for integrating participation in learning activities that foster the acquisition of both content and transferable skills. The teaching of Biology provides a practical context for exploring inquiry-based, team work, and teacher supported group-based activities approaches well-suited to developing learners' generic skills and strengthening self-efficacy. This was taken into consideration due to some of initial plights related to insufficient and unskilled human resources, and inconsistencies between content and methodology.

The New Lower Secondary School CBC context's current assessment activities exhibit certain traits. First, they frequently on problem solutions rather than problem

formulation; second, task fragmentation prevents a comprehensive approach to assessments and treatments by encouraging students to concentrate on their scores through grading (Wambiya & Ogula, 2023). On the other hand, learning occurs in daily Biology activities and is always socially constructed in the workplace and life. As such, learners must determine what they need to learn. This paperwork centres on generic acquisition skills and how they relate to participation in learning activities in Biology and students' self-efficacy. To strengthen the abilities thought to be required for raising students' self-efficacy, it also suggests utilising inquiry-based and team work-based learning activities in Biology involving students. Therefore, this study investigated the impact of participation in learning activities in Biology lessons on learners' self-efficacy and generic skills acquisition in lower secondary schools in Mukono district in Central Uganda. Understanding how Biology instruction contributes to these broader educational outcomes is vital for informing ongoing curriculum implementation and ensuring learners are prepared for both academic progression and labor market demands.

1.1.2 Theoretical Perspective

This study is underpinned by an integrated theoretical framework encompassing Constructivist Theory (CT) and Social Cognitive Theory (SCT). These dual theories were selected for their complementary strengths in explaining the complex pathway through which instructional methodologies (Participation in Learning Activities, PLA) influence students' internal beliefs (Self-Efficacy, SE) and external performance outcomes (Generic Skills Acquisition, GSA) within the context of the competency-based Biology curriculum. This integrative position is crucial for achieving a holistic understanding of competency development in lower secondary schools, specifically addressing the mechanism of mediation.

Constructivist Theory (CT)

Constructivist Theory, primarily advanced by Dewey (1916), Piaget (1952), and Vygotsky (1978), posits that knowledge is actively constructed by learners through direct engagement with their environment, contemplation, and social interaction. CT explains how individuals form meaning through activity, reflection, and creativity, asserting that small group collaborations provide new perspectives.

CT's Relevance (Strength): The principles of CT are fundamental to designing and evaluating the Participation in Learning Activities (PLA) investigated in this research, specifically inquiry-based learning and problem-solving based learning. CT underpins the pedagogical notion that Generic Skills Acquisition (GSA) such as critical thinking, teamwork, and communication is achieved not through rote memorization, but through active student involvement where new information is built upon existing knowledge. CT thus provides the theoretical foundation necessary for analyzing the design and efficacy of the mediating variable (PLA).

Theoretical Limitation: While CT is foundational for defining effective pedagogy and emphasizing the external learning environment, a core limitation is that it often overlooks the influence of internal motivational readiness and personal beliefs on student engagement (Fredricks et al., 2019; Guay, 2022). CT assumes that if the learning environment is conducive, engagement will follow naturally, but it does not fully account for the psychological factors that enable a student to persist when a task is challenging. This deficiency necessitated the integration of Social Cognitive Theory.

Social Cognitive Theory (SCT)

Social Cognitive Theory, formulated by Bandura (1977, 1986, 1997), emphasizes the reciprocal interaction between personal factors, behavioral responses, and the learning

environment. The central construct of SCT relevant to this study is Self-Efficacy (SE), defined as the learner's belief in their ability to organize and execute the specific tasks required to achieve desired outcomes. SCT's Relevance (Strength): SCT is critical because Self-Efficacy (SE) serves as the study's core independent variable (IV), explaining the motivational and psychological drivers of a student's engagement in learning. SCT explains that a student's beliefs in their competence significantly influence their participation in the demanding PLA's. Therefore, SCT provides the essential framework for measuring and understanding the confidence levels of lower secondary Biology learners and how these beliefs predict participation and subsequent skills acquisition (GSA).

Theoretical Limitation: A key critique of SCT is that its strong emphasis on internal psychological drivers (SE) can underestimate the impact of external, environmental factors specifically instructional design, curriculum, and social interaction on student outcomes (Fredricks et al., 2019; Guay, 2022). SCT suggests that ideas are constructed primarily through a personal process, contrasting with CT's emphasis on social construction. This deficiency is overcome by linking SE to the pedagogies informed by CT.

Integrated Theoretical Framework and Justification

The rationale for integrating CT and SCT is rooted in the methodological necessity of addressing the complex, mediating pathway of generic skills acquisition, thereby rectifying the perceived anomaly of theoretical redundancy. The theories do not merely concur; they are complementary and essential for mapping the entire conceptual model (SE → PLA → GSA). CT informs the design of the mediator (PLA): CT explains what effective, skill-building instructional activity looks like (i.e., inquiry and collaboration). SCT informs the driver (SE): SCT explains why a student chooses to engage or persist in that activity (i.e., their belief in their ability).

The study maintains that successful GSA requires this interplay: a purely Constructivist strategy will only be effective if learners possess a strong sense of Self-Efficacy (SE) to actively participate and persist, as explained by SCT. Conversely, high self-efficacy is best translated into observable skill mastery when channeled through deliberately designed, interactive learning environments (PLA). This dual-theoretical approach allows for a comprehensive analysis of both the pedagogical quality (CT) and the internal attributes (SCT) influencing student outcomes in lower secondary schools. This integrative position is formalized in the study's original theoretical contribution: the Trans-Theoretical Integration Model for Competency Learning (TTICL, 2025), which conceptually unites activity-based learning with self-belief systems to rigorously analyze competency development.

1.1.3 Conceptual Perspective

In this study, three broad concepts were explored to determine their degree of relationship within the Ugandan educational context: Self-Efficacy (SE), participation in learning activities (PLA), and generic skills acquisition (GSA). This conceptual perspective positions Self-Efficacy as the independent variable (IV), participation in learning activities as the mediating variable (MV), and generic skills acquisition as the dependent variable (DV). Self-efficacy (SE) is a central psychological construct that significantly influences student motivation, learning behavior, and academic achievement. It functions as the core independent variable in this study. Self-efficacy is defined generally as the learner's belief in their ability to organize and execute the specific tasks required to achieve desired outcomes. More specifically, it is an individual's conviction in their capability to successfully achieve learning goals. It is also defined as the perceived ability to perform a

given task effectively, or the conviction that a person can successfully participate in learning activities.

This construct, which underpins the study's hypotheses, is partitioned into two sub-constructs: Academic Self-Efficacy (ASE): This dimension directly measures the learners' conviction in their competence at a given academic level and educational achievement (Ahmadi & Najafi, 2014). High ASE is instrumental as it measures educational achievement (Honicke & Broadbent, 2016) and is critical for success in the collaborative and demanding environment of the Competency-Based Curriculum (CBC). Self-Regulatory Self-Efficacy (SSE): This dimension explains the motivational factor of learning. It focuses on the learners' confidence in managing their own learning behaviors, regulating their actions and emotions, and persisting through challenges (Zimmerman & Schunk, 2011; Thompson & Jacue, 2017). SSE enables learners to identify needs, set goals, explore learning resources, adopt strategies, and evaluate their outcomes (Kırmızı, 2015). Self-efficacy beliefs, including both academic and self-regulatory dimensions, are crucial in various contexts (Honicke & Broadbent, 2016) and are essential for success in CBC.

Participation in learning activities (PLAs) serve as the mediating variable in this research. These activities are conceptualized as actions created or deployed by the teacher that reflect the cognitive processes of students when intentionally connected with student abilities (Liu et al., 2023). They refer to structured, intentional activities designed to actively engage learners in the educational process, emphasizing participation, inquiry, exploration, collaboration, and reflection. These activities encompass problem-based team work, inquiry-based approaches, and teacher support.

The study focuses particularly on: Inquiry-Based Learning (IBL): This approach promotes curiosity, active learning, and research skills by encouraging students to

investigate scientific questions through experimentation and reasoning (Spronken-Smith, 2012). It involves students actively exploring ideas and information to develop concrete concepts based on scientific principles. Problem-Solving Based Learning (PSBL): This method supports critical thinking and collaborative team work, fostering deeper conceptual understanding and sustained interest in science (Ali, 2019; Aufa et al., 2021). Team work involves using knowledge, skills, and personal experiences to identify problems, find solutions, and resolve conflicts (Hoi et al., 2017). Teacher Support (TS): This component reflects the necessary external, facilitative role of the teacher (Chong et al., 2018) in guiding group activities, monitoring progress, and ensuring that students' engagement translates into positive outcomes.

Generic skills acquisition (GSA) is the dependent variable in the study. Generic skills, also known as transferable or 21st-century skills, are critical for learners' success in academic, professional, and societal contexts (Ornellas et al., 2017). These skills are defined as core competencies that enable learners to apply knowledge effectively, work collaboratively, solve problems creatively, and communicate scientific understanding. The research focused specifically on three core generic skills: Critical Thinking (CT): This involves the ability to identify problems (Ramdani & Susilo, 2022) and analyze arguments (Facione, 2020). It involves identifying issues, considering objectives, brainstorming solutions, considering outcomes, trying options, and evaluating the outcome (Innis, 2015). Communication Skills (Co): This is the ability to transmit, interpret, and discuss scientific information accurately and effectively (Kahan, 2015). Teamwork (TW): This is defined as the collaborative effort of learners to accomplish a shared academic task (Sung et al., 2017). These three skills were deliberately selected as they align closely with the nature of student

learning activity approaches (PLA) employed in the Biology curriculum and are foundational for competence development in Uganda's CBC.

1.1.4 Contextual Perspective

This study was contextually situated within four Universal Secondary Education (USE) secondary schools in Mukono District, Central Uganda. The selection of USE schools highlights the focus on under-resourced, government-aided institutions that were tasked with implementing the Competency-Based Curriculum (CBC) under systemic and resource constraints. The specific focus on Biology instruction was critical, as it is viewed as a core science subject and a key platform for integrating participation in learning activities (PLA) necessary to foster transferable competencies.

The broader contextual significance of this setting is underscored by external analyses of educational quality. Scholarly work, such as that by Rowe et al. (2013), emphasized that secondary education must aim to shift from passive instruction to accelerated learning in order to cultivate cognitively demanding skills like analysis, synthesis, and assessment. Contextual studies, including D'Agostino (2023), showed that systemic capacity gaps and policy prioritization influence teacher capacity, which, in turn, impacts the rate of generic skills acquisition (GSA) among students. The core contextual problem in Mukono District centered on the challenge of translating the progressive CBC policy into consistent, effective classroom practice within these USE schools. The teaching of Biology is characterized by consistently low performance in national examinations. Evidence from the Uganda Certificate of Education (UCE) results from 2022, 2023, and 2024 revealed persistent underachievement in the subject. For example, in 2022, only 0.2% of UCE candidates earned distinctions in Biology, a figure that rose modestly to 3.1% by 2024, with continued deficits observed in critical thinking and scientific reasoning. This

evidence suggested a profound gap between the intended shift toward active, learner-centered instruction and the reality of pedagogical execution.

The investigation specifically gathered evidence that confirmed contextual difficulties limiting skill development. The overall findings revealed that gaps remained in teacher preparedness and consistency in activity implementation in USE government schools. This challenge of the inconsistent application of active, competency-based pedagogies in a critical science subject within resource-constrained schools constituted the specific problem this research addressed by investigating the mediating role of participation in learning activities in fostering self-efficacy and generic skills acquisition among lower secondary Biology learners.

1.2 Statement of the Problem

The overarching goal of contemporary education systems is to equip learners with advanced generic skills such as communication, critical thinking, problem-solving, and teamwork that are essential for success in the dynamic 21st-century labour market. These competencies require learners to engage in analytical thinking, synthesise diverse information, and make informed judgments, thereby necessitating a shift from traditional, passive instruction to active, participatory learning (Rowe et al., 2013). Empirical evidence indicates that students with strong self-efficacy beliefs are more likely to engage actively in learning tasks, persist in the face of challenges, and develop generic skills more effectively (Bandura, 1997; Schunk & DiBenedetto, 2024). Self-efficacy thus serves as a crucial psychological motivator that drives strategic engagement and fosters resilience in learning contexts (Schunk & DiBenedetto, 2024).

In Uganda, this ideal is formalized in the Competency-Based Curriculum (CBC), which emphasises the demonstration of learning outcomes through real-world application

of knowledge, skills, and values (Sendagire, 2024). The reform seeks to move education beyond rote memorisation toward the development of generic competencies, including critical thinking, collaboration, creativity, communication, and problem-solving (Right for Education, 2022). Policy analyses further indicate that the lower-secondary CBC integrates these competencies across all subjects, aiming to produce learners capable of navigating complex social and economic contexts (The Uganda Today, 2023). To achieve this, Biology teachers in Universal Secondary Education (USE) schools are expected to promote students' self-efficacy by actively engaging learners in Participation in Learning Activities (PLA), such as structured inquiry-based learning and problem-solving tasks, which foster the acquisition of essential generic skills (Asda, Dasna, Parlan, & Suharti, 2025).

Despite this strong policy framework, a persistent gap exists between the competencies students acquire and the skills demanded by employers (Tushabe & Murimi, 2024). The transition to a competency-based curriculum in Uganda is further constrained by teaching and assessment practices that remain largely focused on memorisation rather than authentic skill development (Tumuheise et al., 2023). Consequently, many young Ugandans continue to face a "skills deficiency," lacking the employability-related generic skills required by the labour market (Guloba et al., 2021). This challenge is compounded by the limited adoption of effective, student-centred instructional practices in many secondary schools. Studies indicate that, despite policy shifts, teachers often rely on teacher-centred, recall-based approaches, insufficiently engaging learners in interactive tasks that build self-efficacy and transferable skills (Onzi, Mugizi, Rwothumio, & Mugenyi, 2023; Muganga & Ssenkusu, 2019). While policy explicitly emphasises competency-based learning, there remains scant empirical research in Ugandan USE schools that examines how active participation in learning activities mediates the relationship between students'

internal self-belief (self-efficacy) and the acquisition of generic skills (GSA). In particular, within the resource-constrained environments of Central Uganda, this mediating mechanism in Biology a core science subject remains under-explored. This study is therefore imperative to investigate this mechanism and provide discipline-specific evidence that can inform effective curriculum implementation and improve learners' self-efficacy and generic skills acquisition in USE schools.

1.4 Objectives of the Study

The study was guided by seven sequential objectives, structured in a coherent and logical order to first establish the descriptive levels of the core variables Self-Efficacy (Independent Variable), Participation in Learning Activities (Mediating Variable), and Generic Skills Acquisition (Dependent Variable) before systematically analyzing the complex interrelationships and the mediating influence that constituted the study's central inquiry. The objectives were designed to establish the prevalence and extent of the pedagogical implementation and student outcomes within the lower secondary Biology classrooms:

1. To assess the prevalence of participation in learning activities (PLA), including inquiry-based learning and problem-solving based learning, utilized by teachers during Biology lessons in lower secondary schools.
2. To measure the extent of generic skills acquisition (GSA), specifically analytical skill, communication skills, and collaboration, achieved by students during Biology lessons in lower secondary schools.
3. To assess the level of student self-efficacy (SE) among students during Biology lessons in lower secondary schools.

4. To explore the association between student self-efficacy (SE), encompassing academic and self-regulatory dimensions, and engagement in participation in learning activities (PLA) during Biology lessons in the lower secondary schools.
5. To identify the correlation between student self-efficacy (SE), encompassing academic and self-regulatory dimensions, and the acquisition of generic skills (GSA) among students during Biology lessons in the lower secondary schools.
6. To verify the association between participation in learning activities (PLA) and the development of generic skills acquisition (GSA) among students during Biology lessons in the lower secondary schools.
7. To analyze the mediating influence of participation in learning activities (PLA) on the relationship between self-efficacy (SE) and generic skills acquisition (GSA) among students during Biology lessons in the lower secondary schools.

1.5 Research Questions

The study was guided by a set of research questions structured to align with the objectives, which were set to be in a coherent and logical order. These questions were designed to first establish the descriptive levels of the core variables Participation in Learning Activities (PLA), Generic Skills Acquisition (GSA), and Self-Efficacy (SE) before examining their relationships. The research questions corresponding to the first three descriptive objectives, are stated as follows:

1. What is the prevalence of participation in learning activities (PLA), including inquiry-based learning and problem-solving based learning, utilized by teachers during Biology lessons in lower secondary schools?

2. What is the extent of generic skills acquisition (GSA), specifically critical thinking, communication, and teamwork, achieved by students during Biology lessons in lower secondary schools?
3. What is the level of student self-efficacy (SE), encompassing academic and self-regulatory dimensions, among students during Biology lessons in lower secondary schools?

1.6 Research Hypotheses

The study was guided by the following alternative hypotheses (Ha):

Ha1: There is a significant relationship between self-efficacy and participation in learning activities during Biology lessons in lower secondary schools.

Ha2: There is a significant relationship between student self-efficacy and generic skills acquisition during Biology lessons in lower secondary schools.

Ha3: There is a significant relationship between participation in learning activities and generic skills acquisition during Biology lessons in lower secondary schools.

Ha4: Participation in learning activities significantly mediate the relationship between self-efficacy and generic skills acquisition during Biology lessons in lower secondary schools.

1.7 Significance of the Study

This study is anticipated to yield valuable contributions across academic, institutional, and policy levels. It will enrich the existing body of knowledge on the relationship between student learning activities, self-efficacy, and generic skills acquisition within Uganda's lower secondary competency-based curriculum. By focusing on Biology, a core science subject with persistently low national performance, the study will generate subject-specific insights that can inform future academic research. Scholars, educational researchers, and

curriculum theorists will benefit from the findings as a relevant reference for further investigations in both Ugandan and comparative international contexts.

At the institutional level, the findings will support universities, National Teachers' Colleges (NTCs), and Primary Teachers' Colleges (PTCs) in strengthening teacher education programs. The study will provide empirical evidence to guide reforms in pre-service and in-service training, particularly in promoting learner-centered instructional approaches that foster self-efficacy and 21st-century skills. The Ministry of Education and Sports, through agencies such as the National Curriculum Development Centre (NCDC) and the Directorate of Education Standards (DES), can use these findings to shape professional development frameworks, classroom observation tools, and teaching resource guides aligned to the new curriculum. The Uganda National Examinations Board (UNEB) may also use the insights to align assessment frameworks with competencies promoted through student learning activities.

For school-level stakeholders head-teachers, Directors of Studies (DOS), and classroom teachers the study will provide practical recommendations on how to design, implement, and assess effective learning activities in Biology. School governing bodies and Boards of Governors will be better informed in prioritizing support for teacher training and instructional materials. Development partners, NGOs, and education-based civil society organizations advocating for improved quality of science education and skills development will also find this research useful in shaping their programs and interventions. Ultimately, the study aims to improve learning outcomes and promote equitable acquisition of generic skills among learners in both public and private secondary schools in Uganda.

1.8 Scope of the Study

1.8.1 Content Scope

This study focused on three interrelated constructs within the framework of the New Lower Secondary School Curriculum: *participation in learning activities (MV), self-efficacy (IV),* and the acquisition of *generic skills (DV)* in Biology lessons. **Self-efficacy** is a central psychological construct that significantly influences student motivation, learning behavior, and academic achievement. Bandura (1977, 2012) defines self-efficacy as an individual's belief in their ability to execute specific activities or behaviors necessary to produce desired outcomes. It encompasses learners' confidence in managing academic challenges and achieving set goals. Alt (2015) and Aggarwal (2014) underscore the role of self-efficacy in enhancing persistence and performance, while Ahmadi and Najafi (2014) emphasize academic self-efficacy as the conviction in one's competence at a given academic level. Closely related is academic self-concept, which involves learners' perceptions of their own academic ability and is deeply intertwined with identity formation (International Encyclopedia of Education, 2023). Moreover, self-regulation a dimension of self-efficacy enables learners to identify needs, set goals, explore learning resources, adopt strategies, and evaluate their outcomes (Kırmızı, 2015). *In this study*, self-efficacy is understood as students' confidence in their capability to successfully achieve learning goals, reflecting their perceived competence to cope with academic activities.

Participation in learning activities, especially when designed to be student-centered, have been found to significantly enhance learners' engagement, motivation, and skill development (Medina, 2017). Inquiry-Based Learning (IBL) promotes curiosity, active learning, and research skills by encouraging students to investigate scientific questions through experimentation and reasoning (Spronken-Smith, 2012). Team work-

Based Learning (PSBL), as described by Ali (2019) and Aufa et al. (2021), supports critical thinking and collaborative team work, fostering deeper conceptual understanding and sustained interest in science. *In this study*, participation in learning activities refer to structured, intentional activities designed to actively engage learners in the educational process. These activities are learner-centered, emphasizing participation, inquiry, exploration, collaboration, and reflection. They include methods such as problem-based solving, inquiry-based solving and teacher. The study emphasizes these activities as mechanisms through which students develop confidence (self-efficacy) and acquire transferable generic skills such as critical thinking, teamwork, and communication.

Generic skills, also known as transferable or 21st-century skills, are critical for learners' success in academic, professional, and societal contexts. Ornellas et al. (2017) identify these skills to include communication, critical thinking, collaboration, and team work, which are central to employability and lifelong learning. Critical thinking involves the ability to identify problems, analyze options, consider outcomes, and evaluate solutions (Innis, 2015). Teamwork is defined by Sung et al. (2017) as the collaborative effort of learners to accomplish a shared academic task. Communication skills involve conveying, interpreting, and discussing scientific ideas accurately and clearly (Kahan, 2015). *In this study*, generic skills are defined as core competencies that enable learners to apply knowledge effectively, work collaboratively, solve problems creatively, and communicate scientific understanding. These skills are essential not only for academic success but also for fostering adaptability, innovation, and active participation in a knowledge-based economy.

1.8.2 Geographical Scope

The study's geographical scope is defined as the Central Region of Uganda, with empirical data collection specifically conducted in Mukono District. This focus addressed the reviewer's recommendation to define the scope broadly as Central Uganda while maintaining a clearly bounded operational site for practical and methodological reasons. Mukono District was purposively selected due to its representation of both urban and rural school contexts, enhancing the contextual relevance and generalizability of the study findings. The district also offered logistical feasibility for conducting extensive data collection, including in-depth interviews and structured classroom observations. Institutionally, the investigation centered exclusively on Universal Secondary Education (USE) government-aided secondary schools. USE schools were prioritized over private secondary schools because they are mandated to implement the Competency-Based Curriculum (CBC) and ensure that their teachers are trained in Competency-Based Education (CBE), providing uniformity in curriculum delivery across public schools (Ministry of Education and Sports, 2021).

Additionally, teachers in USE schools are government employees, making them accountable to standardized policies and monitoring frameworks, whereas private schools, despite having greater resources and smaller class sizes, operate independently and often face fewer systemic constraints (Oketch, 2018; Musinguzi, 2020). USE schools also serve diverse student populations from varied socio-economic backgrounds, exposing challenges such as limited instructional resources, large class sizes, and heavy teacher workloads that can significantly influence student self-efficacy and generic skills acquisition. By focusing on USE schools, the study captures curriculum implementation realities in contexts where systemic limitations are most pronounced, thereby generating findings that are highly

relevant for informing policy and practice in Uganda's public education system. The findings, therefore, primarily reflect the pedagogical challenges and curriculum implementation dynamics specific to these resource-constrained contexts. Consequently, the primary limitation of this geographical scope is the necessary exclusion of private secondary schools, meaning the results may not be generalizable to private institutions, which typically have significantly different resources, infrastructure, and teacher to-student ratios.

1.8.3 Time scope

This study covered the period from 2020 to 2025 to align with the roll-out and implementation of Uganda's New Lower Secondary School Curriculum, which introduced the Competency-Based Education (CBE) model. This time frame includes the full learning cycle of the first cohort under the new curriculum, culminating in their national examinations in 2024. The research focused on self-efficacy, student learning activities, and generic skills acquisition in Biology lessons within Universal Secondary Education (USE) schools. A pilot study was conducted in one USE school in Kampala from 27th November to 1st December 2023 to refine research tools and procedures. The main fieldwork took place between September and October 2024 in four USE schools in Mukono, central Uganda, during the third term when students were fully engaged in their studies. Additional data collection occurred from April to June 2025 to observe teaching and learning during peak school terms. This timing enabled authentic classroom observations and interactions with teachers and students, enhancing the study's validity.

1.9 Conceptual Framework

As the figure 1 indicates, the conceptual framework presents the relationship between self-efficacy, participation in learning activities and generic skills acquisition.

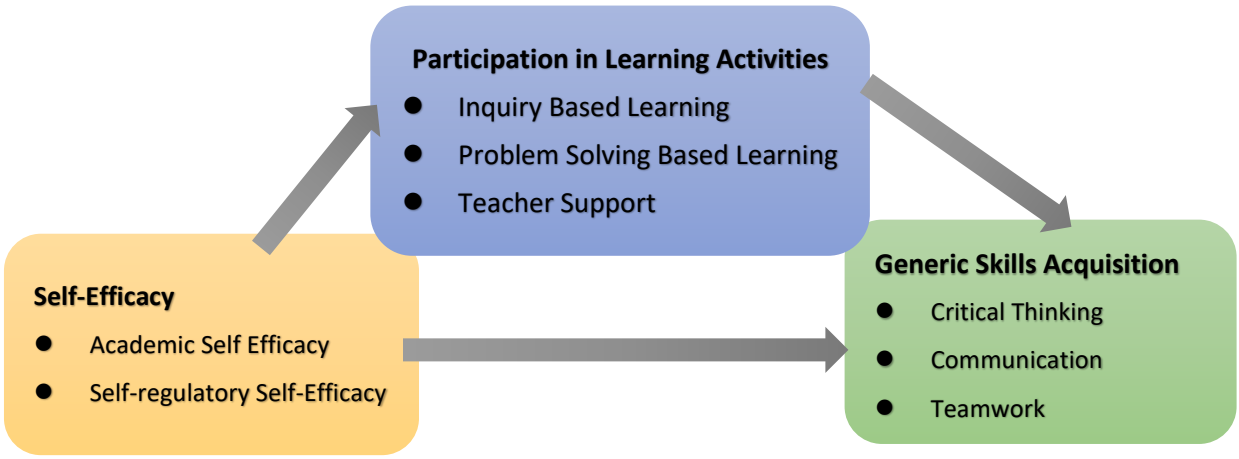


Figure 1: Designed and developed following Aldridge & Fraser (2000); Brits (2017) and Semilarski, Soobard & Rannikmäe (2019) models.

The study was guided by a conceptual framework that graphically represented the hypothesized interrelationships among the three core variables: Self-Efficacy (SE) as the Independent Variable (IV), Participation in Learning Activities (PLA) as the Mediating Variable (MV), and Generic Skills Acquisition (GSA) as the Dependent Variable (DV). The framework posited that Self-Efficacy significantly predicted the acquisition of Generic Skills, with participation in learning activities serving as the critical experiential pathway that shaped and influenced this relationship. This mediational perspective was crucial to understanding how learner-centered activities may either foster or hinder students' confidence and their subsequent development of transferable competencies, particularly within Biology lessons.

The specific sub-constructs were meticulously selected to capture the complexity of the variables within the context of Uganda's Competency-Based Curriculum (CBC) framework in lower secondary schools. Sub-constructs: Academic Self-Efficacy (ASE) and Self-Regulatory Self-Efficacy (SSE). Self-efficacy was partitioned into these two

dimensions because both are instrumental in determining student success. Academic Self-Efficacy (ASE) was selected as it directly measures the learners' conviction in their competence at a given academic level and educational achievement (Ahmadi & Najafi, 2014). Self-Regulatory Self-Efficacy (SSE) was essential as it explains the motivational dimension of learning, focusing on the learners' confidence in managing their own learning behaviors, regulating their actions and emotions, and persisting through challenges (Zimmerman & Schunk, 2011; Thompson & Jacue, 2017). Both are critical elements for success in the collaborative and demanding environment of the CBC.

Sub-constructs: Inquiry-Based Learning (IBL), Problem-Solving Based Learning (PBL), and Teacher Support (TS). These three components were selected because they represented the specific active learning strategies promoted by the CBC in Biology instruction and the instructional environment surrounding them. Inquiry-Based Learning (IBL) was chosen as it directly promotes curiosity, experimentation, and research skills (Spronken-Smith, 2012) necessary for Biology and Generic Skills Acquisition. Problem-Solving Based Learning (PBL) was selected because it supports the core CBC goals of critical thinking and collaborative skills needed to address real-world issues (Ali, 2019; Aufa et al., 2021). Teacher Support (TS) was included because it reflects the necessary external, facilitative role of the teacher (Chong et al., 2018) in guiding group activities, monitoring progress, and ensuring that students' engagement translates into positive outcomes.

Sub-constructs: Critical Thinking (CT), Communication Skills (Co), and Teamwork (TW). The selection of these three skills was deliberate as they align closely with the nature of the learning activities (PLA) employed in the Biology curriculum and are foundational for competence development in the CBC. Critical Thinking (Facione,

2020) was chosen because it involves the ability to analyze arguments and solve problems (Ramdani & Susilo, 2022). Communication (Kahan, 2015) was essential as it measures the ability to transmit, interpret, and discuss scientific information accurately and effectively. Teamwork (Sung et al., 2017) was included to assess the students' collaborative effort necessary to accomplish shared academic tasks. The combination of these skills is viewed as essential for students' academic and lifelong success (Chalkiadaki, 2017).

The study's qualitative component documented the use of hands-on activities, real-life relevance, and group-based inquiry during Biology lessons. An example of a core Biology hands-on activity that promotes all the study constructs, fully aligned with the principles of Inquiry-Based Learning (IBL) and Problem-Solving Based Learning (PBL), is the process of making manure done in groups. This activity, which reflects the emphasis on connecting content with learners' daily experiences (Teacher F) and involving team work and practical application (Abas & Imam, 2020), directly promotes the constructs as follows:

Construct	**Sub-Construct**	**How the Activity Promotes the Construct (Indicators)**
Self-Efficacy (SE)	Academic Self-Efficacy (ASE)	Students apply knowledge of decomposition and nutrient cycling (applying learned knowledge to new scenarios). Successful completion of the physical process builds confidence in scientific principles (I am capable at solving scientific difficulties).
	Self-Regulatory Self-Efficacy (SSE)	Students must plan and manage the long-term process (monitoring steps, managing materials), developing persistence and responsibility (I always work hard in order to get correct information for every given activity).
Participation in Learning Activities (PLA)	Inquiry-Based Learning (IBL)	Students search information (Teacher B) on suitable materials and optimal conditions (e.g., moisture, temperature) and observe the process over time, satisfying curiosity (My curiosity is satisfied by what I discover with my companions).

	Problem-Solving Based Learning (PBL)	The group identifies and solves challenges (e.g., materials are too dry/wet, or decomposition is too slow). They collaborate on tedious chores and keep working until the task is complete.
	Teacher Support (TS)	The teacher moves around the working groups (Teacher D), monitoring the physical steps and answering questions related to the required ratio of materials, thus assisting comprehension and collaboration.
Generic Skills Acquisition (GSA)	Critical Thinking (CT)	Students analyse arguments about the most effective composting methods, evaluate results (e.g., temperature changes), and gain a more in-depth understanding of organic waste management.
	Communication Skills (Co)	Students present their ideas and findings on the process to the class, using scientific language (I get to the point when presenting my ideas), and engaging in peer discussions.
	Teamwork (TW)	The activity, being physically demanding, fosters cooperation and mutual responsibility (Working in groups fosters cooperation among students), ensuring all members contribute (Teamwork is strongly associated with GSA).

1.10 Justification of the Study

The core justification for this study rested on the critical need to assess the efficacy of Uganda's Competency-Based Curriculum (CBC) implementation, which was intended to address persistent skill gaps between school learning and labor market expectations. This inquiry was scientifically and contextually justified by its specific focus on both the institutional setting and the subject domain.

Institutional Focus: Government-Aided Secondary Schools

The decision to focus exclusively on Universal Secondary Education (USE) government-aided secondary schools was driven by a specific scientific and contextual rationale: investigating curriculum effectiveness within resource-limited settings. USE schools, characterized as under-resourced public institutions, were chosen to address the core

problem of translating the progressive CBC policy into consistent, effective classroom practice in environments where systemic and resource constraints are often most pronounced.

By focusing on these institutions, the study aimed to generate findings that highlight the challenges of curriculum implementation where limitations such as large class sizes and infrastructural inadequacies most impact pedagogical dynamics. The findings, therefore, primarily reflect the pedagogical challenges and curriculum implementation dynamics specific to these resource-constrained contexts, providing contextually grounded insights relevant to the vast majority of learners enrolled in Uganda's public secondary education system.

Subject Focus: Biology Instruction

The specific selection of Biology over other science disciplines (e.g., Chemistry, Physics) or other secondary subjects (e.g., Mathematics, Arts) was grounded in both pedagogical necessity and empirical urgency. Pedagogical Suitability (Scientific Justification): Biology is inherently structured as a core science subject that demands and facilitates the active learning methodologies central to the study's theoretical framework (Constructivism). It is viewed as a key platform for integrating participation in learning activities that foster the acquisition of both content and transferable skills. The subject naturally provides a practical context for exploring inquiry-based, teamwork, and teacher supported group-based activities the precise Participation in Learning Activities (PLA) measured in this research. In contrast, subjects like pure Mathematics or certain Arts subjects may offer fewer structured opportunities for the hands-on, collaborative experimentation, and scientific inquiry required to test the mediation mechanism of PLA on Generic Skills Acquisition (GSA).

Empirical Urgency (Contextual Justification): Biology was selected for investigation due to its demonstrated and consistently low performance in national examinations. Evidence from the Uganda Certificate of Education (UCE) results from 2022, 2023, and 2024 indicated persistent underachievement in the subject. This empirical deficit signaled potential gaps in instructional approaches and learner engagement, making Biology a critical subject for investigating the effectiveness of student-centered pedagogies and the integration of generic skills within the learning activities. This focus ensures the study generates discipline-specific evidence essential for enhancing curriculum implementation.

1.12 Conclusion Chapter One

This chapter has presented the foundational elements of the study, including the background, problem statement, purpose, objectives, research questions and hypotheses, significance, scope, and the conceptual framework. These components collectively establish the rationale and direction for investigating the relationship between self-efficacy, student learning activities, and generic skills acquisition within Uganda's competency-based lower secondary curriculum. Building on this foundation, the next chapter reviews relevant literature to provide theoretical, empirical, and contextual insights that inform and support the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of theoretical and empirical literature relevant to the study. It synthesizes scholarly work and prior research to examine how the implementation of Participation in Learning Activities (PLA) in Biology lessons influences learners' Self-Efficacy (SE) and the acquisition of Generic Skills (GSA). The review is structured to provide insights into the conceptual underpinnings of the study, highlight existing knowledge gaps, and establish a foundation for the study's methodological and analytical approaches. The presentation of the chapter is systematic, organized as follows: Theoretical Literature Review (Section 2.1): This section outlines the dual theoretical framework underpinning the research. It begins by reviewing the core tenets, strengths, and weaknesses of Constructivist Theory (CT) (Section 2.1.1), which grounds the concept of active learning (PLA). This is followed by an examination of Social Cognitive Theory (SCT) (Section 1.1.2/2.1.2), which establishes the role of the psychological driver, Self-Efficacy (SE). The theoretical review culminates in the presentation of the Trans-Theoretical Integration Model for Competency Learning (TTICL, 2025) (Section 2.1.4), which formally integrates CT and SCT to map the competency pathway.

Empirical Literature Review (Section 2.2): This section synthesizes previous studies relevant to the core constructs, organized according to the study's sequential research objectives and hypotheses. The review systematically covers the existing knowledge on: The Acquisition of Generic Skills during Biology Lessons (Section 2.2.1). Participation in Learning Activities Developed by Teachers during Biology Lessons (Section 2.2.2). The Relationship between Self-Efficacy and Student Learning Activities

(Section 2.2.3). The Relationship between Student Self-Efficacy and Generic Skills Acquisition in Lower Secondary School Biology Lessons (Section 2.2.4). The Relationship between participation in learning activities and Generic Skill Acquisition (Section 2.2.5). The Mediating Influence of participation in learning activities in relation to Self-Efficacy and Generic Skills Acquisition (Section 2.2.6). Summary of Literature and Research Gaps (Section 2.3): The chapter concludes by summarizing the strengths and weaknesses of the reviewed literature and clearly articulating the specific conceptual, methodological, and contextual research gaps that the current PhD dissertation addresses.

2.1 Theoretical Literature Review

This study was underpinned by an integrated theoretical framework encompassing Constructivist Theory (CT) and Social Cognitive Theory (SCT). These dual theories were selected for their complementary strengths in explaining how instructional methodologies specifically Participation in Learning Activities (PLA) influence students' internal beliefs (Self-Efficacy, SE) and their external performance outcomes (Generic Skills Acquisition, GSA). The adoption of this integrated theoretical lens was crucial to align with the study's convergent parallel mixed-methods design (QUAN-QUAL), which sought to combine quantitative measurement of self-beliefs (SCT) with qualitative analysis of observable instructional practice (CT). This integrative position is essential for achieving a holistic understanding of competency development in lower secondary Biology education within the context of Mukono District's Universal Secondary Education (USE) system.

2.1.1 Constructivist Theory (CT)

Constructivist Theory (CT), primarily advanced by Dewey (1916), Piaget (1952), and Vygotsky (1978), posits that knowledge is actively built by learners through direct engagement with their environment, contemplation, and social interaction (Bada, 2015;

Vintere, 2017). CT explains how individuals construct meaning through Biology activity, reflection, and creativity (Scott, 2013), asserting that small group collaborations provide new perspectives and information about the world. CT predicts that once students feel competent and connected to the learning environment, they will be better positioned to acquire generic skills.

The principles of CT were fundamental to designing and evaluating the Participation in Learning Activities (PLA) investigated in this research, specifically inquiry-based learning and problem-solving based learning. CT underpins the pedagogical notion that Generic Skills Acquisition (GSA) such as critical thinking, teamwork, and communication is achieved not through rote memorization, but through active student involvement where new information is built upon existing knowledge. The qualitative methodology of this study, involving classroom observations and teacher interviews in USE schools, was designed to capture the enactment of constructivist practices by Biology teachers. This theory was therefore essential for understanding the efficacy of the instructional strategies deployed in the new lower secondary curriculum.

While Constructivist Theory is foundational for defining effective pedagogy and emphasizing the external learning environment, a core critique is that it often overlooks the influence of internal motivational readiness and personal beliefs on student engagement. CT assumes that if the learning environment is conducive (i.e., designed using constructivist principles), engagement will follow naturally. This perspective, however, does not fully account for the psychological factors that enable a student to persist when a task is challenging. This study overcame this weakness by integrating CT with Social Cognitive Theory (SCT). The mixed-methods design allowed the researcher to employ qualitative observations (CT focus on PLA) and systematically link this data to quantitative

data measuring the internal, motivational factor Self-Efficacy (SE) (SCT) to analyze holistically how SE influences whether a student actually engages in the prescribed constructivist activities.

1.1.2 Social Cognitive Theory (SCT)

Social Cognitive Theory (SCT), primarily associated with Bandura (1977, 1986, 1997), emphasizes the reciprocal interaction between personal factors, behavioral responses, and the learning environment. The central construct of SCT relevant to this study is Self-Efficacy (SE), defined as the learner's belief in their ability to organize and execute the specific tasks required to achieve desired outcomes (Bandura, 1997). SCT was utilized to examine SE, which served as the study's core independent variable encompassing academic and self-regulatory success (Bandura, 1997; Zimmerman & Schunk, 2011). Bandura's theory highlights that SE is a crucial personal variable that significantly influences a student's motivation and participation (Bandura, 1997). Personal factors, such as an individual's belief in their ability to complete academic activities (self-efficacy), are based on experiences within the learning environment (Fredricks et al., 2019).

SCT was critical because it directly addressed the independent variable, Self-Efficacy (SE), and explained the motivational drivers of a student's engagement in Participation in Learning Activities (PLA). SCT provided the quantitative framework for measuring the confidence levels of lower secondary Biology learners and for testing how these beliefs predict participation and subsequent skills acquisition (GSA). Furthermore, SCT is pertinent because it explains how participation in active learning (PLA) influences a person's self-efficacy levels and consequently their Generic Skills Acquisition (GSA) (Guay, 2022).

A key critique of Social Cognitive Theory is that its strong emphasis on internal psychological drivers can underestimate the impact of external, environmental factors—specifically instructional design and social interaction on student outcomes (Fredricks et al., 2019; Guay, 2022). SCT suggests that ideas are constructed primarily in individuals through a personal process, contrasting with CT's emphasis on social construction. This study strategically overcame this weakness by adopting the Integrative Position and employing rigorous mediation analysis. The methodology modeled the necessary interplay between SE and the external environment (PLA). Specifically, the study used the Hayes PROCESS Macro (Hayes, 2022) to statistically test the mediating effect of Participation in Learning Activities (PLA) on the SE–GSA relationship. This ensured that the influence of SE on generic skills was analyzed through the required pedagogical interventions (PLA), thereby addressing the limitation of relying solely on internal factors.

2.1.3 Justification of the Integrated Theoretical Framework and Research Gap

The justification for integrating CT and SCT rests on the premise that successful Generic Skills Acquisition (GSA) in CBC-aligned Biology lessons requires the interplay of internal competence (SE) and external pedagogical quality (PLA). The study maintained that effective instructional strategies (CT principles) will only be effective in building GSA if learners possess or develop a strong sense of Self-Efficacy (SE) (SCT). This integration is formalized in the study's original theoretical contribution: the Trans-Theoretical Integration Model for Competency Learning (TTICL, 2025) (Audo, 2025). The research gap in the extant literature is clearly exposed: prior studies often separated the pedagogical environment (CT) from the psychological motivation (SCT), frequently focusing on higher education contexts (Nabaho, 2017). Limited empirical guidance existed on how specific classroom learning activities in lower secondary Biology statistically mediate the

relationship between SE and GSA, especially within resource-constrained USE schools. This study addressed this critical oversight by operationalizing this integration through rigorous mixed-methods research, providing the first systematic investigation into this mediation pathway within the Ugandan CBC context.

Integrated Theoretical Framework

Figure 2: A figure illustrating the integration of Constructivist Theory and Social Cognitive Theory

Figure 2 shows how participation in learning activities mediate the development of self-efficacy and generic skills acquisition in Biology lessons.

2.1.4 Trans-Theoretical Integration Model for Competency Learning (TTICL)

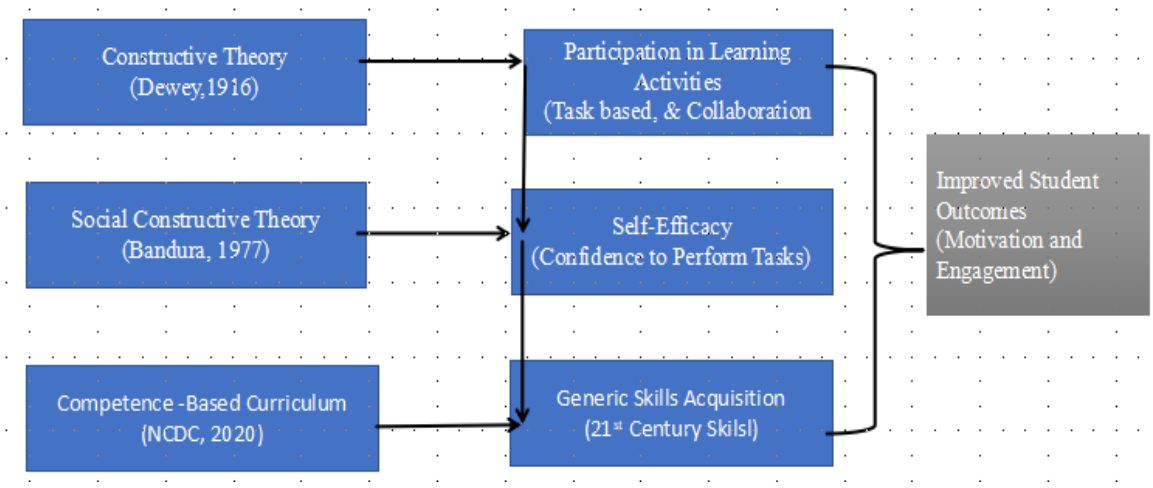


Figure 3: Audo's Proposed Model – Trans-Theoretical Integration Model for Competency Learning (TTICL, 2025)

This study therefore proposes a Trans-Theoretical Integration Model for Competency Learning (TTICL) a conceptual model that blends activity-based learning (constructivism) with self-belief systems (social cognition). The TTICL posits that student engagement in collaborative, inquiry-based activities, reinforced by supportive modeling and feedback mechanisms, leads to stronger self-efficacy and more effective acquisition of 21st-century competencies such as critical thinking, teamwork, and communication. The model can guide curriculum developers, teacher educators, and researchers seeking to translate theoretical insights into actionable classroom strategies. It is worth noting that the term Trans-Theoretical Model (TTM) was originally coined by Prochaska and DiClemente (1983) to describe behavior change processes, especially in health interventions. However, the TTICL proposed here is distinct and rooted in educational psychology a response to the

need for contextually relevant theoretical models that address Uganda's unique learning realities under CBC reforms.

2.2 Empirical Literature Review

This section presents a synthesis of previous studies related to student learning activities, self-efficacy, and generic skills acquisition, especially in the context of Biology lessons under competency-based curriculum. The review is organized according to the study's research questions and hypotheses.

2.2.1 Acquisition of Generic Skills during Biology Lessons

This section reviews empirical studies that examined how students acquire generic skills such as communication, team work, and critical thinking during Biology lessons. These skills are essential for learners to function effectively in real-world contexts and are central to the outcomes of Uganda's new Competency-Based Curriculum (CBC) for lower secondary schools. The review is organized chronologically to trace the development of knowledge in this area, identify consistent findings, and highlight emerging gaps that inform the current study.

The study employed a convergent parallel mixed methods design, specifically the QUAN-qual approach, collecting both quantitative and qualitative data simultaneously. The quantitative strand applies a correlational design, while the qualitative strand adopts a cross-sectional survey design to explore learner experiences and classroom practices. Specifically, the qualitative component relied on two primary methods of data collection: a checklist-guided classroom observation of Biology lessons and semi-structured teacher interviews. These tools were selected to provide contextual insights into the nature of instructional practices and the extent to which they foster the acquisition of generic skills. The checklist captured real-time pedagogical behaviors and student engagement patterns,

while interviews elicited teacher perspectives on curriculum interpretation, instructional choices, and perceived outcomes.

Early work by Valencia and Leung (2017) in a European context used a longitudinal design spanning two academic years to assess the impact of active learning strategies in science lessons. Their findings demonstrated that guided inquiry in Biology led to sustained improvements in communication and self-regulation. However, the study was conducted in high-resource school settings, limiting its applicability to low-resource environments such as Uganda. Furthermore, it did not explore the mediating effects of classroom activities or psychological factors like self-efficacy. This study built on such evidence by applying mediation models within the Ugandan CBC context.

Ogunniyi and Rollnick (2019) conducted a qualitative case study in South Africa, exploring how constructivist teaching practices influenced learners' generic skills. Through classroom observations and teacher interviews, they found that inquiry-based instruction encouraged argumentation, team work, and effective communication. However, the study focused primarily on teacher behaviors and did not quantify student outcomes or examine how these practices translated into measurable skill acquisition. This study extended these findings by collecting both student- and teacher-level data, using observation and interview methods to triangulate instructional effects and learner responses.

In Asia, Abas and Imam (2020) investigated the development of 21st-century skills among high school students in the Philippines through a survey of 300 respondents. Their findings indicated that practical science lessons positively contributed to communication, teamwork, and adaptability. Nevertheless, the study relied heavily on self-report data and lacked triangulation through observational or performance-based assessments. It also did not examine instructional mechanisms or learner psychological

traits that could influence skill development. This study addressed those limitations by integrating lesson observations with teacher interviews and standardized tools to measure both self-efficacy and engagement in learning activities.

Within East Africa, Ndirangu et al. (2020) employed a mixed methods approach in Kenya, using lesson observations and student questionnaires to explore how learner-centered Biology lessons influenced generic skill acquisition. Their results showed that group work and hands-on experiments promoted collaboration and critical thinking. However, they did not explore how students' learning activities mediated these outcomes, nor did they link the findings to psychological constructs like self-efficacy. This study responded by investigating how learning activities function as mediators in the relationship between pedagogy and skill acquisition, and how self-efficacy may moderate this relationship.

In a more experimental design, Kipkoech and Odhiambo (2021) compared traditional and activity-based instruction in Biology across several Kenyan secondary schools. Their findings suggested that students in activity-based settings showed improved collaboration and leadership initiative. Despite the robust design, the study did not incorporate psychological variables such as motivation or self-belief, nor did it frame the findings within the scope of curriculum reform. This study contributed by incorporating those overlooked dimensions and focusing on the CBC's competency-driven goals, using qualitative observations and teacher narratives to provide context.

Chisikwa and Makokha (2022) conducted an action research study in Tanzania that introduced real-world team work activities into Biology classrooms. The integration of authentic learning experiences improved learners' decision-making and analytical skills. However, their analysis focused largely on skill outputs, neglecting the underlying

cognitive or affective processes particularly the role of student self-efficacy. The current study proposed that without considering learners' belief in their abilities, the effectiveness of such pedagogies cannot be fully understood.

Klemenčič (2019), analyzing science education reforms in Slovenia and Finland, found that inquiry-based and reflective teaching methods strongly supported the development of transferable skills. Although relevant for understanding policy-to-practice alignment, the study emphasized curriculum design and did not investigate learner experiences or psychological enablers. This study narrowed that gap by foregrounding the lived experiences of learners and teachers under Uganda's CBC, specifically within Biology lessons. More recent studies in Uganda provide localized insight. Mugisha and Nkata (2023) used classroom video analysis across 12 lower secondary schools to examine CBC-aligned Biology instruction. Their findings suggested that group-based learning supported interpersonal skills and learner autonomy. However, time constraints and uneven instructional quality limited reflective learning. Additionally, their analysis did not consider the mediating role of learning activities or student self-efficacy. This study deepened that understanding by modeling these variables statistically while grounding qualitative findings in direct classroom observations and teacher testimonies.

Nampewo and Musoke (2024) conducted a mixed-methods study across 10 Ugandan lower secondary schools, employing interviews, pre/post-tests, and lesson observations. They found that student-led investigations promoted analytical reasoning and collaboration. Nevertheless, variation in instructional approaches across schools hindered consistency in outcomes. Moreover, the researchers did not explicitly test mediation pathways or incorporate self-efficacy as an influencing factor. This study built on their

foundation by modeling these relationships within a convergent framework, supported by both observational and interview-based data.

Finally, Oyo and Musasizi (2022) explored the early implementation of Uganda's CBC in science education using focus groups and observations. They observed emerging gains in group communication and learner responsibility. However, findings were not disaggregated by subject area, nor were psychological dimensions such as self-efficacy included. This study focused specifically on Biology and considers how student confidence in learning mediates and moderates the relationship between learning activities and skill acquisition. The use of qualitative method classroom observation checklists and teacher interviews ensures that both instructional practices and teacher beliefs are captured to inform deeper curriculum implementation insights.

2.2.2 Participation in Learning Activities Developed by Teachers during Biology Lessons

This section synthesizes empirical studies that examined the types of participation in learning activities teachers employ during Biology lessons in lower secondary schools, particularly within Competency-Based Curriculum (CBC) frameworks. The focus is on instructional practices such as group work, experimentation, inquiry-based learning, and team work-based learning, teacher support and how these foster active engagement and generic skill acquisition. These scholarly findings provided a theoretical and empirical foundation for the study, which utilized a classroom observation checklist and teacher interviews to qualitatively explore classroom realities in USE schools in Mukono district in Central Uganda.

Kiplangat and Cheruiyot (2020), in a mixed-methods study in Kenya, investigated Biology instructional planning under CBC using classroom observation and teacher

interviews. They found that most teachers adopted student-centered strategies such as team work activities, peer-teaching exercises, and field-based investigations. These activities were found to enhance learner autonomy and deepen conceptual understanding. The current study aligned with these findings and justifies its choice of classroom observation as a valid method for documenting such student-centered instructional practices.

Mdee and Mwakasangula (2019) in Tanzania employed classroom-based experimental methods and reported that teachers incorporated scenario-based group discussions and guided lab work. These activities were found to enhance student motivation and participation, although teachers lacked pedagogical training to structure them effectively. Such findings informed this study's use of a teacher interview protocol to capture both successes and implementation challenges. In Uganda, Kakuru and Tusiime (2021) conducted a qualitative case study in four CBC-implementing schools and observed that Biology teachers used simulations, demonstrations, and learner-led presentations. These strategies reportedly supported communication and analytical skills. However, inconsistencies in practice were evident across schools. This study's checklist-based classroom observations were therefore designed to systematically capture such variation in learning activities and their quality across multiple lesson contexts.

Ngugi and Wambua (2022), in a cross-sectional survey of 70 Kenyan teachers of Biology, found that project-based learning and the use of locally available materials were popular and effective. These activities encouraged collaboration and student interest, although the study lacked qualitative depth. This study addressed this limitation by employing in-depth interviews with teachers to uncover their decision-making rationale and the contextual factors influencing their instructional choices. In Uganda, Musoke and Balidawa (2023) carried out a mixed-methods study across 12 secondary schools. They

documented the use of peer-led experiments, outdoor activities, and drawing-based conceptual modeling. These were seen as platforms for fostering self-expression and creativity key enablers of 21st-century skills. Similarly, this study utilized observational tools to trace how such activities unfold in real time, with interviews adding context to teacher planning and execution.

Habimana and Uwitonze (2020), through document analysis and teacher focus groups in Rwanda, highlighted that while inquiry-based strategies are emphasized in CBC policy, their implementation remains limited due to resource constraints. This reinforced the need for empirical studies such as this one that examine the enacted curriculum within real classrooms through triangulated qualitative methods. From Europe, Korthagen et al. (2021) examined science pedagogy in Dutch secondary schools and identified the use of student debates, reflection journals, and hands-on experiments. These active learning strategies aligned with CBC goals but were applied in resource-rich environments. This contrast provided scientific justification for investigating similar strategies in low-resource contexts like Uganda, as done in this study.

Akello and Nambalirwa (2024) studied CBC implementation in Ugandan Biology classrooms using interviews and lesson plan reviews. They identified role-plays, group experiments, and brainstorming sessions as dominant activities, though their link to measurable student outcomes remained unexplored. To address this gap, the study integrated direct observation with teacher narratives to evaluate how such activities contribute to skill development. In line with these studies, the research adopted a convergent parallel mixed-methods approach, with the qualitative component comprising checklist-guided classroom observations and semi-structured teacher interviews. Observations focused on identifying and categorizing learning activities such as based

learning, problem solving based learning, and teacher support during Biology lessons. Teacher interviews provided scientific justification for instructional choices, exposed contextual challenges, and revealed perceived impacts on student engagement and generic skill acquisition. Together, these methods allowed for a holistic assessment of how the Competency-Based Curriculum is being enacted in Biology classrooms in USE schools in Mukono district in Central Uganda.

2.2.3 Conceptualization and Assessment of Student Self-Efficacy

Self-Efficacy (SE) is recognized as a central psychological construct that significantly influences student motivation, behavioral engagement, and overall academic outcomes. Rooted in Bandura's (1986, 1997) Social Cognitive Theory (SCT), SE is defined as the learner's conviction in their ability to organize and execute the specific actions required to achieve desired goals. As the Independent Variable (IV) in this study, high self-efficacy is crucial for success within the rigorous Competency-Based Curriculum (CBC) because it directly encourages active engagement and persistence in challenging Participation in Learning Activities (PLA).

To facilitate a detailed assessment, Self-Efficacy is conceptually partitioned into two critical sub-constructs: Academic Self-Efficacy (ASE) and Self-Regulatory Self-Efficacy (SSE). ASE measures the learners' conviction in their competence specifically related to educational achievement and performing academic tasks (Ahmadi & Najafi, 2014). It is instrumental for success in the collaborative and cognitively demanding environment of the CBC. In contrast, SSE focuses on the motivational dimension of learning, encompassing the learner's confidence in managing their own learning behaviors, regulating emotions, and sustaining effort through complex challenges (Zimmerman & Schunk, 2011; Thompson & Jacue, 2017). Both ASE and SSE beliefs are crucial for

promoting the sustained effort and self-management required for successful curriculum implementation.

The third objective of the study specifically required the research to assess the level of student self-efficacy (SE), establishing a crucial quantitative baseline for subsequent correlation and mediation analyses. To operationalize this psychological construct, SE was measured using an adapted version of the Self-Regulatory Self-Efficacy (SSE) Scale, originally developed by Semilarski et al. (2019). This modified instrument was refined for the Ugandan lower secondary context and comprised 15 items across three domains: goal-setting efficacy, task persistence, and self-regulatory behaviors. Responses were collected using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), ensuring the data quantitatively captured the magnitude of students' perceived competence to successfully achieve learning goals.

While the theoretical role of self-efficacy in supporting achievement is widely acknowledged (Mugume & Kintu, 2020), a significant gap exists regarding empirical data on the level of self-efficacy (encompassing both Academic and Self-Regulatory dimensions) attained by learners within the foundational lower secondary science domain specifically Biology under the early phases of the Competency-Based Curriculum (CBC) implementation. Previous research often focused on the general correlation between SE and outcomes, neglecting to establish a baseline measure of competence in this subject and level (Nabaho, 2017). Therefore, establishing the existing level of student self-efficacy in resource-constrained contexts like Central Uganda was a necessary precursor to accurately interpreting its hypothesized influence on active participation and generic skill acquisition. This study fills that void by providing the requisite descriptive data on SE levels among the target population.

2.2.4 The Relationship between Self-Efficacy and Participation Learning Activities

The development of generic skills such as critical thinking, communication, and teamwork is a central aim of Uganda's Competency-Based Curriculum (CBC), particularly in subjects like Biology that emphasize inquiry and practical engagement. Within this framework, self-efficacy including both academic self-efficacy (students' belief in their ability to succeed academically) and self-regulatory self-efficacy (confidence in managing and directing one's own learning) is a key psychological determinant influencing how students engage in CBC-aligned learning activities.

To empirically examine this relationship, the study formulated the following hypotheses: *Alternative hypothesis (Ha1): There is a significant positive relationship between self-efficacy and participation in learning activities during Biology lessons in lower secondary schools.* Empirical evidence from diverse contexts supports the importance of self-efficacy in promoting active student engagement: In Europe, Aikens and Kulacki (2023) investigated group work in introductory Biology courses and found that collaboration and peer teaching significantly enhanced students' self-efficacy, which deepened their engagement in learning activities. However, the study did not address how this increase in self-efficacy translates into long-term acquisition of generic skills like critical thinking and teamwork key targets of CBC.

Ainscough et al. (2017) observed that self-efficacy among first-year Biology students increased over a semester due to active learning strategies. Though confirming the dynamic nature of self-efficacy, their work focused primarily on academic self-efficacy and did not include the critical role of self-regulatory self-efficacy or collaborative learning, both integral to CBC pedagogy. In Asia, Bahçepınar and Karakaya (2023) developed a self-efficacy scale for secondary STEM students and found that higher self-efficacy

correlated with greater willingness to engage in learning. However, their study did not explore the link between self-efficacy and the development of critical thinking or teamwork skills. Emenike and Okoli (2023), in Indonesia, identified parental involvement and self-efficacy as significant predictors of students' interest in Biology but did not differentiate between academic and self-regulatory self-efficacy, nor did they examine these constructs in relation to CBC-aligned learning activities.

Kiula (2020) studied Tanzanian students' academic self-efficacy and found that extracurricular activities improved self-efficacy and enhanced communication and critical thinking skills. Nevertheless, this research was limited to informal learning contexts and did not examine formal CBC classroom activities. Another study by Emenike and Okoli (2023) in South Africa confirmed that students with high self-efficacy showed greater motivation to engage in science learning but did not investigate how these beliefs translated into classroom behaviors such as inquiry-based problem solving or group work key indicators of CBC success. In Uganda, research is limited. However, Ekwutosi et al. (2022) demonstrated that self-regulated learning strategies increased student achievement and interest in Biology, emphasizing the importance of self-regulatory self-efficacy. This study did not, however, include academic self-efficacy or fully examine collaborative and team work learning activities embedded in CBC. Addressing these gaps, the current study employed a convergent parallel mixed methods design (QUAN + QUAL) to investigate the relationship between self-efficacy and participation in learning activities within Ugandan lower secondary Biology classrooms.

Findings revealed a significant positive relationship between both academic and self-regulatory self-efficacy and participation in CBC-aligned activities emphasizing critical thinking, peer collaboration, and communication. Therefore, this study accepts the

alternative hypothesis (Ha1): *There is a significant positive relationship between self-efficacy and participation in learning activities during Biology lessons in lower secondary schools.* This result highlights the critical role of fostering self-efficacy to enhance student engagement and successful implementation of the Competency-Based Curriculum in Biology education.

2.2.5 The Relationship between Student Self-Efficacy and Generic Skills Acquisition in Lower Secondary School Biology lessons

The development of generic skills such as critical thinking, communication, and teamwork is a key outcome of the Competency-Based Curriculum (CBC) in Uganda (NCDC, 2020). These skills are not developed in isolation but are influenced by students' psychological readiness and belief in their ability to learn commonly referred to as self-efficacy. Both academic self-efficacy (confidence in one's ability to perform academic tasks) and self-regulatory self-efficacy (confidence in managing and controlling learning behaviors) are instrumental in fostering students' engagement in activities that promote generic skills (Bandura, 1997; Zimmerman & Schunk, 2011; Muwonge et al., 2022).

To investigate this relationship, the following hypothesis was formulated and tested: *Alternative hypothesis (Ha2): There is a significant positive relationship between student self-efficacy and generic skills acquisition during Biology lessons in lower secondary schools.* Several empirical studies across global and African contexts underscore the theoretical and practical foundations of this relationship: Hungnes et al. (2022), in a German study, found that enhanced teacher support during an additional preparatory school year increased students' self-efficacy, which subsequently promoted engagement in learning activities requiring critical thinking and collaboration. While valuable, the study was not subject-specific, limiting its direct application to Biology.

Similarly, Brokk et al. (2020) investigated team-based learning in an introductory Physics course in Germany and reported that collaborative pedagogy significantly enhanced self-efficacy and performance in activities involving teamwork and critical thinking. Although situated in a different subject, these findings are relevant for CBC-based Biology instruction.

In China, Zheng (2022) noted that teacher support was a critical factor in enhancing student self-efficacy, which encouraged participation in communication- and critical-thinking-focused tasks. Again, the study lacked a specific Biology lens. Li and Singh (2023) explored how instructor recognition in Physics classrooms in India increased female students' self-efficacy and interest in cognitively demanding activities. The findings highlighted the value of recognition-based pedagogies in enhancing students' confidence and participation relevant to Biology classrooms aiming to promote generic skills. A subject-specific study by Onwukeme (2023) in Nigeria examined the relationship between self-efficacy and academic achievement in Biology. It revealed a positive correlation, which became significant when moderated by gender. However, the study did not investigate how self-efficacy relates specifically to generic skills acquisition, revealing a conceptual gap. In Ghana, Ayimbila et al. (2024) explored Biology teachers' self-efficacy and its effect on instructional practices. Teachers with higher self-efficacy were more likely to promote communication and critical thinking in their classrooms. Though teacher-focused, this study highlighted the downstream impact on students' opportunities for skill development.

Mungasia et al. (2022), in Kenya, linked teacher competence and parental involvement to increased student self-efficacy and engagement in collaborative, higher-order thinking tasks. The study provided important contextual insight but did not focus on

Biology instruction. In Tanzania, Athuman (2022) found that Biology teachers' low self-efficacy in delivering science process skills negatively affected students' opportunities to develop critical thinking and team work abilities. However, the student perspective was not explored. In Uganda, Nabunya and Ssewamala (2014) confirmed that higher self-efficacy correlated with improved academic performance and school transition among orphaned adolescents. Although not focused on Biology or generic skills, the study reinforced the foundational role of self-efficacy in learning.

To address these contextual and conceptual gaps, this study was conducted in Mukono District, Uganda (2025), specifically focusing on the relationship between student self-efficacy and the acquisition of generic skills in lower secondary school Biology lessons. Using a convergent parallel mixed methods design, the findings indicated that students with higher self-efficacy were more actively engaged in learning activities that fostered critical thinking, communication, and team work core outcomes of the CBC. Students' engagement was further supported by the use of learner-centered pedagogies such as inquiry-based and team work activities that encouraged autonomy and collaboration. Both academic and self-regulatory self-efficacy emerged as key enablers of participation in these skill-oriented activities. Based on these results, the alternative hypothesis (Ha2) was supported: *There is a significant positive relationship between student self-efficacy and generic skills acquisition during Biology lessons in lower secondary schools.* This finding affirms the central role of self-efficacy in enhancing students' acquisition of 21st-century skills and calls for deliberate pedagogical interventions that build learners' confidence and capacity to engage in transformative learning experiences under the CBC framework.

2.2.6 The Relationship between Participation in Learning Activities and Generic Skill Acquisition

The acquisition of generic skills such as critical thinking, communication, teamwork, and team work is a central objective of Uganda's Competency-Based Curriculum (CBC). These skills are best cultivated through deliberate participation in learning activities that emphasize inquiry, application, and peer interaction. This section examines the extent to which such activities are associated with generic skills acquisition in the context of Biology instruction in lower secondary schools.

To investigate this relationship, the following hypothesis was formulated: *Alternative hypothesis (Ha3): There is a significant positive relationship between participation in learning activities and generic skills acquisition during Biology lessons in lower secondary schools.* A growing body of literature affirms the theoretical link between active learning and skill development, though empirical validation especially in subject-specific contexts like Biology remains limited. Liu and Neuhaus (2017) conducted a comparative study of Biology lessons in China and Germany, highlighting contrasting instructional practices. German teachers emphasized questioning that encouraged divergent thinking and reasoning, while their Chinese counterparts focused on content transmission and real-life application. While the study illustrated pedagogical differences with implications for generic skills development, it did not directly measure how these practices influenced students' acquisition of those skills a key gap in empirical substantiation.

Castro and Andrade (2012) explored the implementation of a Social Learning Environment (SLE) in Chemistry classes, where students collaboratively created digital learning materials. The initiative led to enhanced student engagement and improved

communication and teamwork core components of generic skills. Although not situated within Biology, the study suggests the potential of similar learning activities to support generic skill development in science classrooms. Liu and Neuhaus (2017) further noted that Chinese Biology teachers frequently introduced real-life examples after core instruction to support skill transfer. However, this strategy, while valuable for contextualizing content, lacked a comprehensive evaluation of its impact on broader generic skills such as teamwork or analytical reasoning.

Li and Singh (2023) examined instructor recognition in Physics settings and found that acknowledgment of student contributions increased engagement an essential precursor to the development of transferable skills. While the subject context differs, their findings underscore the importance of student-teacher interaction in shaping meaningful learning activities across disciplines. From the Ugandan context, Ssenyonga et al. (2022) identified a persistent gap in the explicit teaching of critical thinking within health education subjects. The study called for the integration of digital technologies and teacher training to enhance critical thinking instruction, indirectly pointing to the need for active, student-centered learning approaches in Biology.

Kanaabi et al. (2023) investigated the implementation of CBC in Biology classrooms in Kampala. Despite adequate teacher preparation, systemic constraints including inadequate instructional resources and complex assessment systems hindered the execution of effective student learning activities. These limitations constrained opportunities for learners to acquire the intended generic skills, highlighting the discrepancy between curricular policy and classroom practice. A study from Rulindo District, Rwanda (Academia.edu, n.d.) revealed that hands-on learning methods such as laboratory experiments boosted student participation and encouraged critical thinking and

team work. However, the long-term retention and transferability of these skills were not assessed, leaving questions about the sustained impact of such activities on generic skill acquisition.

Athuman (2022) examined the self-efficacy of Tanzanian Biology teachers in delivering science process skills, finding that low confidence and limited pedagogical knowledge diminished the quality of student learning activities. This indirectly undermined the acquisition of generic skills, particularly those requiring analytical and reflective thinking. Aciro (2016) emphasized the importance of instructional materials in supporting Biology learning in Chua County, Uganda. Although the study confirmed their role in improving academic performance, it did not directly address the materials' effectiveness in promoting generic skills another gap in subject-specific instructional design.

At the tertiary level, Nabaho (2017) found that approaches like problem-based learning and role modeling fostered generic competencies such as lifelong learning and collaborative team work. These practices, while situated in higher education, offer scalable models for secondary education and reinforce the role of intentional learning design in skill development. Collectively, these studies provide robust support for the view that active, student-centered learning activities are essential to the acquisition of generic skills. However, the lack of direct empirical testing in Biology contexts especially within lower secondary school settings has left critical knowledge gaps. This study addressed those gaps through a convergent parallel mixed-methods approach, focusing on classroom-based Biology lessons in Uganda.

Findings demonstrated a statistically significant positive relationship between participation in learning activities and the development of generic skills. Learners engaged in inquiry-based experiments, collaborative group discussions, and real-world team work

tasks were more likely to report improvements in communication, critical thinking, and teamwork skills essential for navigating 21st-century challenges. Based on these results, the alternative hypothesis (Ha3) was supported: *There is a significant positive relationship between participation in learning activities and generic skills acquisition during Biology lessons in lower secondary schools.* This outcome affirms the foundational role of well-structured student participation in learning activities in advancing the goals of Uganda's CBC. It underscores the need for continuous teacher capacity development, adequate resourcing, and pedagogical innovation to ensure that Biology instruction is aligned with both cognitive and skill-based learning outcomes.

2.2.7 The Mediating Influence of Participation in Learning Activities in relation to Self-Efficacy and Generic Skills Acquisition

The development of generic skills such as communication, critical thinking, teamwork, and team work is central to Uganda's Competency-Based Curriculum (CBC) for lower secondary schools. In Biology lessons, these skills are particularly crucial for fostering inquiry, analytical reasoning, and the application of scientific concepts to real-life problems. Self-efficacy, defined as a learner's belief in their ability to execute learning tasks successfully (Bandura, 1997), has been identified as a key predictor of students' engagement and academic success. However, how self-efficacy translates into generic skill acquisition remains insufficiently explained without considering the mediating influence of student learning activities.

Participation in learning activities ranging from group discussions, practical experiments, digital tasks, to concept mapping may serve as critical pathways through which self-efficacy fosters the development of generic skills. Dumas et al. (2020) propose that learning activities provide the experiential context in which self-efficacious beliefs are

either reinforced or diminished, making them a plausible mediator in this relationship. Evidence from Borrachero et al. (2014) illustrates that active learning methodologies, such as hands-on laboratory work in Chemistry, significantly enhanced students' self-efficacy and emotional engagement. Although the study was Chemistry-focused, it offers a clear indication that meaningful student engagement in learning activities enhances both confidence and skill development. This supports the assumption that similar activities in Biology can mediate the effect of self-efficacy on skill acquisition.

Schmid and Bogner (2017) further highlight that constructivist learning environments in prior Biology education positively influenced prospective teachers' self-efficacy and instructional approaches. These findings reinforce the argument that experiential and participatory learning activities act as mediators, shaping not only beliefs but also the development of relevant skills. Luo et al. (2023) provide compelling evidence from a higher education context, showing that learning engagement significantly mediates the relationship between self-efficacy and academic achievement. Translatting this to the secondary school Biology setting suggests that active participation in learning tasks may also mediate the pathway between student self-beliefs and generic skill development.

In Uganda, Namubiru (2019) found that adolescents engaged in active learning approaches such as group work and discussions exhibited increased self-efficacy and improved academic performance. Although generic skills were not explicitly assessed, these activities inherently involve collaboration, communication, and critical thinking key aspects of generic skills. Ekatushabe et al. (2024) confirm that cognitive activation strategies positively influenced self-efficacy and meta-cognitive strategy use among Ugandan Biology students. These strategies, embedded within student participation in learning activities, reinforce the mediating role of such tasks in linking self-efficacy to

broader cognitive outcomes, including critical thinking and team work. Adiyiah et al. (2020) demonstrated that concept mapping significantly enhanced self-efficacy and motivation in Biology learners, indirectly supporting the acquisition of generic skills through structured learning activities. Similarly, Ssenyonga et al. (2022) revealed that digital learning tools promoted both critical thinking and self-efficacy in Ugandan secondary schools, highlighting the utility of technology-enhanced learning as a mediating mechanism.

International studies echo this trend. Ongowo and Hungi (2014) found that demographic factors such as gender and ethnicity influenced self-regulation and self-efficacy in Kenyan Biology classrooms, yet failed to analyze the mediating impact of classroom practices. The need to bridge this gap is vital, particularly in competency-based instructional environments. Nabaho (2017) also confirmed that problem-based learning and role modeling strategies cultivated generic competences in higher education life sciences, suggesting potential for adaptation in secondary Biology contexts to strengthen the mediating role of classroom pedagogy. Collectively, these studies suggest that participation in learning activities are more than passive conduits of content they are dynamic mediators that enable the translation of self-efficacy beliefs into actionable skill acquisition. However, empirical studies that directly investigate this mediation effect within Ugandan lower secondary Biology lessons remain scarce. This study addressed this gap by employing a convergent parallel mixed-methods design, analyzing how participation in learning activities influence the link between self-efficacy and the acquisition of generic skills in Mukono District.

Findings from the study affirmed that participation in learning activities significantly mediate the relationship between self-efficacy and the acquisition of generic skills. Activities that involved collaboration, scientific inquiry, digital engagement, and

concept application created an enabling environment in which self-efficacy beliefs were activated and transformed into demonstrable skills such as teamwork, communication, and critical thinking.

Alternative hypothesis (Ha_4); participation in learning activities significantly mediate the relationship between self-efficacy and generic skills acquisition during Biology lessons in lower secondary schools was accepted. These results underscore the importance of designing Biology lessons that incorporate participatory, inquiry-based, and skill-oriented learning strategies. By deliberately integrating such approaches, teachers not only enhance learners' confidence but also effectively support the attainment of CBC outcomes related to generic skill development.

2.3 Summary of Literature, Strengths, Weaknesses, and Research Gaps

The systematic review of theoretical and empirical literature served to establish a foundational understanding of the constructs underpinning this study: Self-Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills Acquisition (GSA). This review, while affirming key relationships, revealed significant conceptual, contextual, and methodological limitations in existing scholarship that the current study explicitly addressed.

2.3.1 Strengths of the Reviewed Literature

The literature provided a robust theoretical and empirical base upon which this study was situated: Validation of Core Constructs: Existing scholarship strongly affirmed the importance of Self-Efficacy (SE), rooted in Social Cognitive Theory (SCT), as a critical psychological driver of motivation, persistence, and engagement. This foundational work established SE as the crucial internal determinant necessary for challenging Competency-Based Curriculum (CBC) tasks. Affirmation of Pedagogical Efficacy: The review

confirmed the effectiveness of Participation in Learning Activities (PLA), guided by Constructivist Theory (CT), in fostering observable skills. Studies across various contexts demonstrated that active, student-centered pedagogies such as inquiry-based learning (IBL) and problem-solving based learning (PBL) contribute significantly to the development of generic skills like communication, critical thinking, and teamwork.

Conceptual Support for Relationships: Prior correlation studies provided necessary empirical evidence linking SE, PLA, and GSA. For instance, findings confirmed significant positive associations between SE and GSA (r=.500) and between PLA and GSA (r=.655), conceptually buttressing the hypothesized relationships in this study. Contextual Overview of Challenges: Regional and local studies provided valuable insights into the operational challenges of implementing competency-based reforms in East African secondary schools, including inconsistent pedagogical quality and resource constraints, thereby validating the urgency of the current inquiry.

2.3.2 Weaknesses and Limitations in the Existing Literature

Despite its strengths, the reviewed literature suffered from limitations that restricted its direct applicability and failed to address the study's central question: Conceptual and Mediational Gap (The Critical Oversight): The most significant weakness was the scarcity of empirical research establishing the precise mediating mechanism. Prior studies often treated self-Efficacy and active learning activities in isolation, failing to establish the causal pathway: how specific classroom activities (PLA) statistically mediate the relationship between a student’s confidence (SE) and their measurable skill development (GSA).

Theoretical Fragmentation: Existing research frequently exhibited theoretical fragmentation by separating the environmental focus of Constructivist Theory (CT) from the psychological focus of Social Cognitive Theory (SCT). This left a void in fully

explaining the necessary interplay: why a theoretically sound pedagogical strategy (CT-informed) might fail if the learner lacked the requisite self-belief (SCT-informed) to persist and actively participate. Contextual and Geographical Bias: A substantial portion of the literature on self-efficacy and competency development was situated in higher education settings (e.g., Nabaho, Luo et al.) or in high-resource global contexts (e.g., Valencia & Leung, Korthagen et al.). This limited the empirical guidance available for the foundational lower secondary level, particularly within under-resourced Universal Secondary Education (USE) schools in Central Uganda, where systemic constraints are most pronounced.

Lack of Subject Specificity: Research often relied on general science education findings or other STEM disciplines (e.g., Physics, Chemistry). There was limited empirical guidance specific to Biology instruction, a core science subject characterized by persistently low performance in national examinations, making discipline-specific evidence crucial for targeted intervention. Methodological Insufficiency: Many prior studies relied heavily on isolated methodologies, such as self-report questionnaires or purely qualitative observations, thereby lacking the necessary triangulation to compare statistical trends (SE levels) with nuanced contextual realities (teacher implementation gaps).

2.3.3 Situating the Study

By addressing these inherent limitations, the current study is uniquely situated to advance the field: This investigation directly filled the conceptual and mediational gap by employing a rigorous convergent parallel mixed-methods design (QUAN-QUAL) to statistically test the mediation effect of PLA on the relationship between SE and GSA within lower secondary Biology lessons. The study overcame theoretical fragmentation by proposing and utilizing the Trans-Theoretical Integration Model for Competency Learning

(TTICL, 2025), which conceptually unites activity-based learning (CT) with self-belief systems (SCT) to analyze competency development holistically. Finally, by dedicating its focus to the resource-constrained USE schools in Central Uganda and generating discipline-specific evidence from Biology instruction, the study provided contextually grounded insights essential for informing ongoing curriculum implementation and policy reform within the Ugandan Competency-Based Curriculum framework.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the methodological framework and rigorous procedures that were implemented to guide the execution and analysis of the study, which investigated the influence of self-efficacy (SE) on generic skills acquisition (GSA), as mediated by participation in learning activities (PLA). The chapter commenced by articulating the study's philosophical position, which was pragmatism, and justified the adoption of a convergent parallel mixed methods design (QUAN-QUAL), emphasizing that both objective and subjective data streams were necessary to address the complex research problem comprehensively. This justification was formally supported by detailing the necessary similarities and differences between the quantitative and qualitative data sets, which formed the foundational basis for triangulation.

The overall methodology was systematically structured around a correlational research design for the quantitative strand and a multiple case study design for the qualitative strand. Subsequent sections detailed the geographical scope (Central Uganda, bounded by Mukono District), the selection of the study population (Senior Three students and Biology teachers in Universal Secondary Education [USE] schools), and the comprehensive multi-stage sampling techniques that were utilized, including proportional stratified sampling for students (N=301) and purposive sampling guided by saturation for teachers (N=6). The framework continued by meticulously detailing the operationalization and measurement of the variables Self-Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills Acquisition (GSA) and confirming how the conceptual anomaly regarding GSA was corrected to reflect measurable levels of competence attainment.

Rigorous quality control of the instruments was reported, including pilot study test results that demonstrated construct validity through Exploratory Factor Analysis (EFA) and internal consistency reliability using Cronbach's Alpha coefficient (all scales achieved $\alpha > .80$). The specific data collection instruments employed—a self-administered questionnaire (SAQ), an in-depth interview guide, and a structured classroom observation checklist were described, supporting the mandated equal priority (50/50) of the convergent parallel design.

Finally, the chapter outlined the data analysis procedures, including descriptive and inferential statistics (Pearson correlation, Multiple Regression), the specialized mediation analysis using the Hayes PROCESS Macro for testing the core hypotheses, and the thematic analysis utilized for qualitative data. The chapter concluded by addressing the comprehensive ethical considerations, including Gulu University Research Ethics Committee (GUREC) and Uganda National Council for Science and Technology (UNCST) clearance, measures to ensure trustworthiness (e.g., credibility, transferability, confirmability), and acknowledged the limitations inherent in the research process.

3.1 Research Philosophy

The methodological foundation of this study was established by the pragmatist research philosophy. Pragmatism, distinct from adherence to a single, monolithic worldview, emphasizes finding practical, actionable solutions to complex, real-world problems. This philosophy justified the adoption of a Mixed Methods Research (MMR) design, as it recognized that both objective (quantitative) and subjective (qualitative) forms of knowledge were necessary to comprehensively address the multifaceted relationship between self-efficacy, student learning activities, and generic skills acquisition. The core focus of pragmatism the pursuit of practical, collaborative knowledge through action,

interaction, and experience aligned precisely with the goal of generating contextually relevant findings for improving Biology education and curriculum implementation in Uganda. Rooted in this pragmatic stance, the study was guided by specific stances regarding the nature of reality, knowledge, and values:

Ontologically (concerning the nature of reality), the study was grounded in subjectivism. This philosophical position acknowledges that a single, universal reality of classroom effectiveness does not exist; rather, reality is co-constructed through the interpretations and social interactions of the participants (Nasution, 2017). In the context of this study, the reality concerning the inconsistent implementation of the Competency-Based Curriculum and the effectiveness of learning activities in Mukono's USE schools were viewed as multiple and context-specific. Therefore, the lived experiences and subjective perspectives of Biology teachers and students were treated as legitimate and essential sources of knowledge, critical for understanding the qualitative differences in classroom environments.

Epistemologically (concerning the nature of knowledge), the study was influenced by Constructivist. This position holds that knowledge is socially and contextually generated through active engagement, experience, and discourse, rather than being passively received. For this research, this meant that understanding how generic skills were acquired and how Self-Efficacy developed required gathering knowledge (data) not only through objective measurement (quantitative surveys) but also through exploring how participants constructed meaning related to the implementation of active learning activities (PLA). The qualitative data collection methods (interviews and observations) were specifically employed to capture this rich, contextualized knowledge regarding instructional strategies and their perceived outcomes.

Axiologically (concerning the role of values), the study embraced the view that research is inherently value-laden. Recognizing this, the researcher did not claim absolute value-freedom but maintained a steadfast commitment to ethical rigor and reflexivity throughout the process (Snowden & Atkinson, 2012). This commitment ensured transparency, fairness, and academic integrity in all methodological choices, including data collection from diverse student populations, data interpretation, and the reporting of results. This approach was essential for upholding ethical standards and ensuring that the study's findings provided unbiased, reliable insights back to the education stakeholders.

3.2 Research Approach

This study adopted a convergent parallel mixed methods approach (QUAN-QUAL), employed as an explanatory framework, to investigate the relationships among Self-Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills Acquisition (GSA). In this explanatory application, the quantitative strand served as the primary mechanism to test hypothesized relationships and mediation pathways, while the qualitative strand provided contextual explanations for the observed quantitative trends (Creswell & Plano Clark, 2018). In practice, quantitative and qualitative data were collected simultaneously but analyzed independently, with equal attention to both strands in the integration phase. The quantitative data included student questionnaires measuring SE, PLA, and GSA, providing statistical evidence of correlations, regressions, and mediation effects. The qualitative data consisted of teacher interviews and classroom observations, capturing the nuances of instructional practices and the contextual factors influencing participation in learning activities.

The explanatory use of the convergent parallel approach allows the study to go beyond mere statistical associations: quantitative results are interpreted in light of

qualitative insights to explain why and how participation in learning activities mediates the effect of self-efficacy on generic skills acquisition. This approach aligns with the pragmatist research philosophy, which values the use of multiple methods to address complex research questions and generate actionable understanding (Tashakkori & Teddlie, 2010). By integrating numerical evidence with rich contextual narratives, the study provides a more nuanced and holistic explanation of the mechanisms underlying student skill development than would be possible using a single method.

3.3 Research Design

This study employed a QUAN-QUAL design to collect and analyze quantitative and qualitative data simultaneously. The design facilitated the integration of numeric evidence and contextual insights, allowing for a comprehensive examination of the relationships among Self-Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills Acquisition (GSA) (Creswell & Plano Clark, 2018). Quantitative Component: The quantitative strand used a correlational research design to measure and analyze the strength and direction of linear relationships among SE, PLA, and GSA. Data were collected via structured questionnaires administered to students, providing statistical evidence for testing the mediation effect of PLA on the SE–GSA relationship. This component ensured rigorous numerical assessment of the study hypotheses.

Qualitative Component: The qualitative strand adopted a multiple case study design, embedded within a cross-sectional survey framework. Data were collected through teacher interviews and classroom observations to provide contextual explanations for quantitative findings, capturing instructional practices, challenges, and the quality of participation in learning activities (Yin, 2018). Integration of Data: In the convergent parallel design, both quantitative and qualitative data were collected concurrently but

analyzed independently. The integration occurred during interpretation, where qualitative insights helped explain patterns and anomalies observed in the quantitative results. This design allows for triangulation, enhancing the validity and richness of the findings (Creswell & Plano Clark, 2018). Overall, the design ensured that both statistical rigor and contextual depth were achieved, providing a holistic understanding of how students' self-efficacy influences the acquisition of generic skills through participation in learning activities.

3.4 Similarities and Differences between Quantitative and Qualitative Data as a Basis for Mixed Methods

The study adopted the convergent parallel mixed methods approach (QUAN-QUAL), rooted in a pragmatic research philosophy, specifically because the quantitative (QUAN) and qualitative (QUAL) data streams offered complementary strengths that were necessary to comprehensively address the multifaceted nature of generic skills acquisition (GSA). Analyzing the similarities and differences between these two data types provided the empirical and theoretical justification for their simultaneous collection and integration, ensuring a holistic understanding of the research problem.

3.4.1 Differences in Data Streams and Theoretical Lenses

The two data streams differed significantly in their nature, methodological approach, and foundational theories, which necessitated their integration to overcome the inherent limitations of a single method:

Feature	Quantitative Data (QUAN)	Qualitative Data (QUAL)
Nature of Data	Numerical, measurable scores (e.g., Self-Efficacy, PLA, GSA levels).	Contextual, descriptive narratives (e.g., teacher experiences, observed classroom interactions).
Primary Goal	Deductive testing of hypotheses (Ha1–Ha4); measuring strength, direction,	Inductive exploration of how the curriculum is implemented and why

	and mediation pathways (SE → PLA → GSA).	relationships manifest in the classroom (Creswell & Plano Clark, 2018).
Theoretical Focus	Grounded in Social Cognitive Theory (SCT), primarily measuring internal psychological factors like Self-Efficacy (SE) (Bandura, 1997; Zimmerman & Schunk, 2011).	Grounded in Constructivist Theory (CT), focusing on the quality and social construction of the external learning environment (Participation in Learning Activities, PLA) (Vygotsky, 1978).
Instrumentation	Self-Administered Questionnaires (SAQ) used to gather structured data from 301 students.	In-depth teacher interviews and structured classroom observation checklists used to gather rich contextual data from 6 teachers.

This divergence was crucial: the quantitative strand provided the rigorous statistical evidence needed to test whether learning activities significantly mediate the SE–GSA relationship, while the qualitative strand provided rich narratives explaining how inconsistent pedagogical implementation, resource constraints, or teacher capacity challenges influence the measured outcomes (Muwonge et al., 2020).

3.4.2 Similarities and Basis for Integration (Triangulation)

Despite their differences, the two data streams shared commonalities that formed the essential foundation for their integration under the convergent parallel design: Shared Scope and Constructs: Both strands targeted the same core constructs (Self-Efficacy, Participation in Learning Activities, and Generic Skills Acquisition) within the same contextual boundaries (lower secondary Biology lessons in USE schools in Central Uganda). This shared focus ensured that findings from the two domains could be meaningfully compared and converged. Simultaneity of Collection: Both QUAN and QUAL data were collected independently during the same fieldwork period (September–October 2024 and April–June 2025). This simultaneous approach was central to the design,

preventing one data type from influencing the collection of the other, thereby reducing bias and supporting a true parallel analysis (Creswell & Plano Clark, 2018).

Holistic Interpretation: The ultimate goal of both strands was the comprehensive addressal of the overall research objectives and the central research problem. By integrating the data (e.g., statistical confirmation of mediation in QUAN is explained by implementation gaps observed in QUAL), the study aimed for triangulation, enhancing the validity and trustworthiness of the final conclusions. The reliance on this dual approach allowed the study to achieve complementarity; that is, the statistical findings (e.g., the mediation coefficient) were enriched by the contextual data (e.g., why that mediation was only partial due to practical classroom limitations), yielding a robust and contextually grounded understanding of curriculum efficacy

3.5 Study Population

The study population consisted of two distinct groups aligned with the mixed methods approach. For the quantitative strand, the target population comprised Senior Three students (N = 301) enrolled in four selected public USE secondary schools in Mukono District. These students were actively engaged in learning Biology under the competency-based curriculum and were therefore suitable for investigating the relationships among learning activities, self-efficacy, and generic skills acquisition. For the qualitative strand, the population included six (6) Biology teachers drawn from the same four USE schools. These teachers were responsible for delivering Biology instruction and were directly involved in implementing the new lower secondary CBC. Their practical experiences provided valuable insight into how pedagogical practices influenced students' skill development and self-efficacy beliefs.

3.6 Sample Size

3.6.1 Qualitative respondents

The qualitative sample comprised six (6) Biology teachers purposefully selected based on their active involvement in the implementation of the Competency-Based Curriculum (CBC) and their subject matter expertise. These teachers were directly responsible for teaching Biology during the data collection period, making them well-positioned to provide practical, experience-based insights into how pedagogical practices influence students' skill acquisition and self-efficacy. The selection was guided by the principle of purposive sampling, a widely accepted approach in qualitative research aimed at identifying information-rich cases. The intention was not to achieve statistical generalization, but to capture the lived experiences, instructional strategies, and reflective practices of Biology teachers engaged in CBC delivery. The sample size was determined by the concept of data saturation data collection ceased once no new themes, categories, or insights emerged from the interviews and classroom observations, in line with qualitative research best practices.

According to Malterud, Siersma, and Guassora (2016), the concept of information power is more relevant in qualitative studies than the number of respondents. A smaller sample may be sufficient if the study has a narrow focus, respondents are well-informed and experienced, and data collection methods yield detailed and layered insights. In this case, all six teachers were directly involved in CBC implementation and provided rich, contextual narratives relevant to the study's aims. Furthermore, Guest, Bunce, and Johnson (2006) note that data saturation can often be achieved with as few as six to twelve respondents, particularly when the respondents share similar roles, backgrounds, and experiences as was the case in this study. The shared institutional and curricular context among respondents enhanced comparability and thematic clarity.

Therefore, the selection of six Biology teachers was methodologically justified. This sample size enabled the researcher to prioritize depth over breadth, support comparative analysis across cases, and ensure feasibility and manageability of the qualitative data. Their insights contributed significantly to understanding how curriculum reforms are enacted in practice and how they shape student learning experiences in Biology classrooms.

3.6.2 Quantitative respondents

For the quantitative component of the study, the sample was drawn from a total population of 1,359 Senior Three (S.3) students across four Universal Secondary Education (USE) schools. To determine the appropriate sample size from this finite population, the researcher employed the Krejcie and Morgan (1970) formula, a widely recognized method for calculating sample size in educational and social science research.

Sample Size Formula:

$$S = \frac{X^2 \cdot N \cdot P(1-P)}{d^2(N-1) + X^2 \cdot P(1-P)}$$

Where:

S = required sample size

X^2 = chi-square value for 1 degree of freedom at 95% confidence level = 3.841

N = population size = 1,359

P = population proportion (assumed to be 0.50 for maximum sample size)

d = degree of accuracy/margin of error = 0.05

Substituting the values:

$$S = \frac{3.841 \cdot 1359 \cdot 0.5(1-0.5)}{0.05^2 \cdot (1359-1) + 3.841 \cdot 0.5(1-0.5)}$$

$$S = \frac{3.841 \cdot 1359 \cdot 0.25}{0.0025 \cdot 1358 + 3.841 \cdot 0.25}$$

$$S = \frac{1304.22}{3.395 + 0.96025} = \frac{1304.22}{4.35525} \approx 299.4$$

Thus, the minimum required sample size was approximately 169 students. The selection of 301 Senior Three students for the quantitative strand was based on the Krejcie and Morgan (1970) formula for determining sample size from a known population. With a total population of 1,359 students across four Universal Secondary Education (USE) schools, the formula yielded a minimum required sample of approximately 299 students to achieve statistically valid results at a 95% confidence level and a 5% margin of error. By slightly exceeding this threshold with 301 respondents, the study ensured adequate statistical power and minimized sampling error. Furthermore, proportionate stratified sampling was used to draw the sample, ensuring that each school contributed students in line with its actual S.3 population size. This approach enhanced representativeness across different school settings and maintained balance in the distribution of respondents. The final sample provided a robust foundation for analyzing students' experiences with Biology instruction under the Competency-Based Curriculum (CBC) and allowed for meaningful comparisons across school contexts.

3.6.3 Total respondents

The total number of respondents across both strands of data collection was 307 (301 students and 6 teachers), with qualitative sampling guided by saturation and quantitative sampling determined using probabilistic calculations. This integrated sample size ensured both depth and breadth in addressing the research questions.

3.7 Sampling Techniques

This study employed a multi-stage sampling approach, aligning with the requirements of the convergent parallel mixed methods approach. The selection process involved distinct applications of purposive sampling, first for establishing the research context (schools and district) and then for identifying information-rich qualitative participants (teachers)

3.7.1 Quantitative Sampling (Students)

Purposive sampling was initially applied at the macro level to select the setting of the investigation, ensuring the study was situated in a contextually relevant environment that aligned with the core research problem. The geographical scope was purposively selected to be Central Uganda, with empirical data collection specifically bounded to Mukono District. This location was chosen strategically because it encompasses a mixture of both urban and rural school settings, which enhanced the contextual relevance of the findings. Institutionally, the investigation centered exclusively on Universal Secondary Education (USE) government-aided secondary schools. This choice was deliberate and provided a scientific rationale: to specifically investigate curriculum effectiveness within settings characterized by resource constraints. By focusing on these public institutions, the study aimed to generate findings reflecting pedagogical challenges and curriculum implementation dynamics where systemic limitations are often most pronounced.

3.7.1.1 Inclusion and Exclusion Criteria for Students School Inclusion Criteria

Four Universal Secondary Education (USE) schools were purposively selected based on the following: Ongoing implementation of the Competency-Based Curriculum (CBC); Offering of Biology at the O-Level' Mixed-gender student enrollment; and a sufficiently large Senior Three (S.3) population to support proportionate sampling (Creswell & Creswell, 2018).

Participant Eligibility

Eligible student respondents were those: Enrolled in Senior Three at the time of data collection; Taking Biology under the CBC framework; willing to participate voluntarily, having given informed assent with administrative approval from school authorities (Etikan, Musa, & Alkassim, 2016). Students were excluded if they: Were not taking Biology; were absent during data collection; Declined participation or failed to return completed questionnaires; and had conditions (e.g., severe cognitive or language limitations) that impeded independent questionnaire completion. This criterion-based selection ensured that respondents had relevant exposure to the Biology CBC, thereby enhancing the study's internal validity through purposeful and context-specific sampling. Within each school, random sampling was applied to select individual students, ensuring that every eligible student had an equal chance of inclusion. The proportional allocation of the sample across schools is presented in Table 1.

3.7.2 Qualitative Sampling (Teachers)

In the qualitative strand of this study, purposive sampling was employed to select the Biology teachers. This technique was used to identify information-rich cases most likely to provide relevant insights into the complex relationship between the CBC, teacher instructional practices, and student outcomes. A sample of six (6) Biology teachers was selected from the four participating USE schools, with a maximum of two teachers per school. The rationale for this limited sample size was twofold: prioritizing depth over breadth and ensuring feasibility until data saturation was reached, consistent with qualitative research best practices. Where the number of eligible Biology teachers exceeded two in a single school, maximum variation purposive sampling was utilized. This strategy was essential to capture a wide range of experiences and instructional practices,

including variations in teaching approaches, gender, and experience levels, thereby enhancing the depth and breadth of the qualitative data.

The specific criteria for including teachers were: Actively teaching Senior Three Biology at the time of data collection; having practical experience in implementing the CBC in Biology classrooms; being available and consenting to participate in the study; and reflecting gender diversity, where possible, to enrich the data with multiple perspectives. This criterion-based, purposive approach ensured that the selected teacher respondents had firsthand, relevant experience aligned with the study's objectives, providing diverse insights grounded in their school contexts (Palinkas et al., 2015). The summary of the qualitative sampling frame, integrated with the broader sample context, is presented in

Table 1: A summary of Sampling Frame

School Type (Total = 04)	**Representative Sample Teachers** (Total = 06)	**Class** (S.3) (Total = 1,359)	**Representative Sample Students** (Total = 301)
USE school (A)	2 (Male and Female)	577	100 (Male and Female)
USE school (B)	1 (Female)	65	57 (Male and Female)
USE school (C)	2 (Males)	250	94 (Male and Female)
USE school (D)	1 (Female)	467	47 (Male and Female)

Source: *Developed from information given by the Class Teachers of the respective Schools and classes (2025).*

Justification of the Sampling Frame

Table 1 presents the summary of the sampling frame, detailing the selection of both teachers and students from four Universal Secondary Education (USE) schools. The sampling strategy was grounded in the principles of representativeness, diversity, and feasibility key criteria in educational research involving multiple stakeholders within

natural classroom settings (Creswell & Plano Clark, 2018). The schools were purposefully selected to reflect variations in school context and demographic characteristics such as gender, class size, and teacher composition. Each school represents a distinct institutional environment within Uganda's USE system, allowing for a broader understanding of how participation in learning activities and teacher support interact across different school settings.

A total of six Biology teachers were sampled across the four schools, with an intentional balance in gender (three females and three males) and consideration of teaching experience. This selection ensured varied instructional perspectives on the implementation of active learning strategies and the promotion of self-efficacy and generic skills. The student sample (N = 301) was proportionally drawn from the total S.3 student population (N = 1,359) across the four schools. The sampling followed stratified proportional techniques to ensure that each school contributed student respondents relative to its population size. For instance, USE School A, having the highest student enrollment (577), contributed 100 students, while School B with the smallest cohort (65), contributed 57 students reflecting both proportionality and pragmatic considerations for qualitative follow-up (Teddlie & Yu, 2007).

The choice of Senior Three (S.3) as the target class was deliberate, as these students had undergone at least two years of exposure to the revised lower secondary curriculum, making them suitable informants regarding participation in learning activities and their effect on self-efficacy and skill development. Information used to construct the sampling frame was obtained directly from the class teachers of the selected schools in 2025, ensuring that the sample reflected up-to-date enrollment figures and class

compositions. This alignment between sampling procedures and research objectives enhanced the internal validity and reliability of the study findings.

3. 8 Measurement of Variables

This section presents how each variable in the study was operationalized and measured in alignment with the conceptual framework. The study explored the relationship between self-efficacy (independent variable) and the acquisition of generic skills (dependent variable), with participation in learning activities acting as the mediating variable. The measurements were informed by validated instruments, either adapted or developed by the researcher, and tailored to the context of Uganda's Competency-Based Curriculum (CBC) in lower secondary schools. The framework guiding this measurement approach was grounded in the theoretical and empirical contributions of Semilarski, Soobard, and Rannikmäe (2019), Aldridge and Fraser (2000), and Brits (2017), emphasizing the role of learner-centered pedagogies in enhancing both cognitive and non-cognitive educational outcomes.

3.8.1 Measurement of Self-Efficacy

Self-Efficacy (SE) was operationalized as the study's Independent Variable (IV), defined as the students' belief in their ability to organize and execute actions required to achieve learning goals (Shin, 2017). To capture this construct's complexity in the context of the Competency-Based Curriculum (CBC), SE was partitioned into two sub-constructs: Academic Self-Efficacy (ASE) and Self-Regulatory Self-Efficacy (SSE).

Measuring Students' Academic Self-Efficacy (ASE)

Academic Self-Efficacy (ASE) directly measured the learners' conviction in their competence specifically related to educational achievement and performing academic tasks. High ASE is instrumental for success in the collaborative and cognitively demanding

environment of the CBC. To appropriately measure this dimension, the study utilized an adapted version of the Self-Regulatory Self-Efficacy (SSE) Scale, originally developed by Semilarski et al. (2019). The instrument was modified to reflect the Ugandan lower secondary school context. The adapted instrument included items designed to capture students' confidence in their academic competence, specifically focusing on the application of scientific knowledge, critical thinking, and problem-solving abilities within Biology lessons.

Key Measurement Details for ASE:

Scale and Items: The scale comprised several items directly assessing academic competence, using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Domains Measured: ASE addressed the cognitive and application-based dimensions of self-belief. Examples of statements used in the student questionnaire (Section B: Self-efficacy) that measured ASE included: ASe2: "I am capable at solving scientific difficulties". ASe4: "When arguing about scientific matters, I can use scientific evidence to support my position". ASe6: "Biology lessons, in my perspective, teach valuable abilities for problem solving in everyday life". ASe7: "I can adapt what I've learned in Biology class to new scenarios".

Validation: The construct validity of the instrument, including the ASE component, was rigorously established through Exploratory Factor Analysis (EFA) during the pilot study. The EFA confirmed that Academic Self-Efficacy accounted for a significant portion of the total variance in the overall Self-Efficacy construct, specifically 31.1% of the variation. This statistical evidence confirmed the instrument was a good measure of academic self-efficacy within the sample. Integration of SSE Items: Though the original scale was named the Self-Regulatory Self-Efficacy (SSE) Scale, the final

adapted version integrated both academic and self-regulatory items. The specific items relating to students' confidence in achieving academic tasks, demonstrating competence, and applying scientific knowledge were used to establish the Academic Self-Efficacy (ASE) score for each student. The resulting ASE scores (M = 41.13, SD = 8.49) provided the quantitative baseline necessary for testing the study's core hypotheses (Ha1, Ha2, Ha4) regarding the influence of academic competence beliefs on participation in learning activities and generic skills acquisition.

3.8.2 Measurement of Student Learning Activities

Student learning activities, serving as the mediating variable, were measured through a researcher-developed instrument informed by the What Is Happening In This Class? (WIHIC) questionnaire by Fraser et al. (1996) and Aldridge and Fraser (2000). The original WIHIC scale, a widely validated tool for measuring students' perceptions of classroom learning environments, assesses factors such as collaboration, equity, task orientation, teacher support, and involvement. For the present study, the instrument was adapted to capture the specific forms of active learning central to Uganda's competence-based curriculum. The final scale consisted of 21 items grouped into three subscales that reflect key student-centered strategies promoted in the Biology classroom: Problem

Based Learning (7 items), Inquiry-Based Learning (7 items), and Teacher Support (7 items). Responses were recorded on a five-point Likert scale, from 1 (Strongly Disagree) to 5 (Strongly Agree). The adapted tool retained strong psychometric properties, with internal consistency reliability values (Cronbach's alpha) ranging from 0.76 to 0.97 across various scales. The adaptation process involved content validation and pilot testing to ensure the items aligned with the instructional practices and realities of the Ugandan secondary education context.

3.8.3 Conceptualization and Measurement of Generic Skills Acquisition

Generic Skills Acquisition (GSA) serves as the Dependent Variable (DV) in this study. Generic skills are defined as core competencies that enable learners to apply knowledge effectively, work collaboratively, solve problems creatively, and communicate scientific understanding in academic, professional, and societal contexts. The research focused specifically on the acquisition of three core generic skills: Critical Thinking (CT), Communication Skills (Co), and Teamwork (TW). The initial conceptualization, which primarily highlighted these three skills as the dependent variable, was identified as an anomaly that needed correction. To appropriately measure GSA, the focus was shifted to assessing the degree or magnitude of competence achieved by students.

To correct this anomaly, Generic Skills Acquisition (GSA) was re-conceptualized to establish measurable levels of mastery attained by students, rather than merely treating the skills themselves as the variable. This approach allows for the appropriate differentiation of outcomes based on student performance across the measured competencies. The four categories of acquisition established for the dependent variable assessment are: Basic Acquisition Level, Moderate Acquisition Level, Excellent Acquisition Level, and Exceptional Acquisition Level. These defined levels assess the student's mastery in applying competencies such as critical thinking, communication, and teamwork.

GSA was measured using an instrument modified from Brits (2017). This adapted instrument evaluated the three core generic competencies emphasized in Uganda's Competency-Based Curriculum (CBC): Critical Thinking, Communication, and Teamwork. The adapted scale comprised 17 items across these three components. Responses were collected using a four-point Likert scale, ranging from 1 (Strongly

Disagree) to 4 (Strongly Agree). The cumulative scores derived from these 17 items were then statistically segmented to categorize student performance into the defined levels of acquisition: Basic, Moderate, Excellent, and Exceptional. This process ensured that GSA was appropriately conceptualized and measured as a dependent variable reflecting measurable competence attainment.

3.9 Data Collection Instruments

To ensure comprehensive data collection, the study employed a mixed-methods approach involving a self-administered questionnaire, an in-depth interview guide, and a classroom observation checklist. This triangulation enhanced the validity of the findings by enabling the comparison and integration of data from multiple sources, thus supporting the achievement of the study objectives (Creswell & Plano Clark, 2017).

3.9.1 Questionnaire

The primary data collection instrument for this study was a self-administered questionnaire (SAQ) developed to generate quantitative data required to test the four hypotheses (Ha1–Ha4) aligned with the research objectives. The questionnaire was designed to capture structured responses from both Senior Three (S3) Biology students and their Biology teachers across selected Government Universal Secondary Education (USE) schools, focusing on the core constructs of the study: self-efficacy, student learning activities, and generic skills acquisition.

The instrument included an introductory letter, a background section, and four content sections labeled A, B, C, and D, as shown in Appendix B: Section A gathered demographic data using nominal scales to describe the respondents' background characteristics; Sections B, C, and D comprised closed-ended items rated on a five-point

Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), following established scale construction principles (Joshi et al., 2015).

Each section corresponded to a core construct underpinning the hypotheses: Section B focused on self-efficacy, supporting Ha1, Ha2, and Ha4; Section C measured student learning activities, informing Ha1, Ha3, and Ha4; and Section D assessed the level of generic skills acquisition, aligned with Ha2, Ha3, and Ha4.

Approximately 301 senior three (S3) students from four USE schools participated. The questionnaires were administered within school premises during pre-arranged time slots coordinated with school administrators. A team of trained research assistants, supervised by the researcher, ensured that respondents clearly understood the questions and completed the forms accurately. Although the questionnaire was presented in English, on-the-spot clarifications were offered in Luganda when needed to accommodate varying levels of English language proficiency and enhance response accuracy.

The questionnaire took about 30 to 40 minutes to complete and provided measurable data critical for the correlation, regression, and mediation analyses used to evaluate the relationships and mediating effects proposed in the study's hypotheses. Its structured design ensured that data collected were not only statistically analyzable but also directly applicable to testing the theoretical assumptions embedded in Uganda's competency-based curriculum framework.

3.9.1.1 Sample Characteristics of the Primary Sample

This study targeted lower secondary school students in Universal Secondary Education (USE) schools in Central Uganda to examine the relationship between self-efficacy and the acquisition of generic skills, with participation in learning activities serving as a mediating factor. A total of 301 students participated in the quantitative strand of the study.

Demographic data were collected to describe the sample's background characteristics and provide context for interpreting the study results. As shown in Table 2, the gender distribution of respondents revealed that female students constituted the majority, representing 59.8% (n = 180) of the sample, while male students accounted for 40.2% (n = 121). This reflects a gradual narrowing of gender disparities in lower secondary school enrollment in Uganda, consistent with recent national education statistics indicating improved access for girls under the USE policy (Ministry of Education and Sports [MoES], 2020).

In terms of age, the largest proportion of respondents (86.7%, n = 261) were between 13 and 15 years, which aligns with the expected age range for students in lower secondary school under Uganda's education system. Only 13.3% (n = 40) of the students were between 16 and 18 years, possibly reflecting late school entry or grade repetition, which remains common in some parts of the country (Uganda National Examinations Board [UNEB], 2019). Regarding school distribution, respondents were drawn from three selected USE schools, each coded as USE 1, USE 2, and USE 3 for confidentiality. Each school contributed approximately one-third of the sample, with USE 1 accounting for 33.2% (n = 100) of the total respondents. Cross-tabulated data by gender, age, and school (see Table 8) revealed relatively balanced distributions across the schools, with a slight dominance of female students and the younger age bracket (13–15 years) in each school.

These demographic characteristics are important for contextualizing the results of the study. The sample represents a diverse group of learners actively engaged in competence-based learning under the revised Lower Secondary School Curriculum. The demographic trends also align with findings by Kajubi (2021), who noted that students'

background characteristics such as gender and age often intersect with learning experiences and self-efficacy beliefs in Uganda's secondary education context.

Table 2: Cross-tabulation of respondents' Demographic Characteristics (n = 301)

School	Gender	13–15 yrs	16–18 yrs	Total by Gender
USE 1	Female	65	5	70
	Male	28	2	30
Subtotal		**93**	**7**	**100**
USE 2	Female	50	10	60
	Male	35	5	40
Subtotal		**85**	**15**	**100**
USE 3	Female	55	6	61
	Male	28	3	31
Subtotal		**83**	**9**	**92**
Total	Female	**170**	**21**	**191 (63.5%)**
	Male	**91**	**19**	**110 (36.5%)**
Grand Total		**261 (86.7%)**	**40 (13.3%)**	**301 (100%)**

3.9.2 Interview Guide

To complement the survey and provide deeper insights into respondents' views and experiences, in-depth interviews (IDIs) were conducted using a standardized open-ended interview guide, as presented in Appendix C. This method collected qualitative data from Biology teachers involved in implementing the new curriculum (Jamshed, 2014). The aim was to explore how learning activities were planned, executed, and perceived to influence self-efficacy and skill development among students.

A total of six interviews were conducted until data saturation was reached. The interviews were held in quiet, open venues of classroom building facilities verandas. Each session lasted between 45 and 60 minutes. The interviews were conducted by the researcher using English Language. The interview guide addressed topics such as instructional practices, the perceived impact of learning activities, student engagement, assessment

practices, and challenges in curriculum delivery. These interviews provided contextual explanations and enriched the quantitative findings by capturing lived experiences and teacher insights not evident in the survey responses (Patton, 2015). The IDIs served to explain, validate, and expand upon the quantitative data collected through the questionnaire.

To complement the quantitative findings, qualitative data were gathered from six teachers using a structured interview guide (see Appendix C). This guide was developed based on the standardized open-ended format, which ensures consistency in the questions asked while allowing respondents the flexibility to elaborate on their responses through follow-up probing (Jamshed, 2014). This approach allowed the researcher to capture in-depth, context-specific insights from respondents while minimizing interviewer bias and ensuring uniformity across interviews (Patton, 2015).

3.9.3 Observation Checklist

A structured classroom observation checklist (Appendix D) was used to gather qualitative data through direct observation of teaching and learning activities during Biology lessons. The observations focused on how teachers planned and implemented participation in learning activities and how learners responded in real-time. The target respondents for this tool were Senior Three Biology teachers in the selected schools.

The observations took place during regular biology lesson periods, each lasting between 40 to 70 minutes, depending on the school -class timetable. The tool was used by the researcher who observed without interrupting the lessons. The observation checklist included closed items focusing on aspects such as classroom interaction, student participation, differentiation strategies, instructional materials used, and the overall learning environment (Mertler, 2016). The checklist was designed to assess whether the observed practices supported the development of self-efficacy and generic skills. The

checklist was in English, and the observer took notes and completed the instrument during the lesson. This method offered objective, real-time insights into classroom dynamics and served as a basis for comparing teachers' reports in interviews with the questionnaire responses.

3.10 Quality Control of the Instruments: Pilot Study Test Results

To ensure the reliability and validity of the quantitative instruments designed to measure Self-Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills Acquisition (GSA), a pilot study was rigorously conducted. The pilot test took place in a secondary school in Kampala, Central Uganda, between November and December 2023, utilizing a sample of 50 Senior Three (S3) students. The purpose of this small-scale exploration was to refine the research instruments, test the data collection procedure, and identify any unanticipated problems prior to the main fieldwork. The pilot study results, which confirmed the instruments' suitability for the target population, are presented below in the appropriate methodology sections.

3.10.1 Validity of the Quantitative Instruments

The construct validity of the instrument was established using Exploratory Factor Analysis (EFA), conducted using SPSS version 20. The EFA procedure utilized a Varimax rotation to identify items that correlated highly with one another, with items loading above 0.30 considered valid, and factors with eigenvalues greater than 1 considered significant contributors to the constructs (Pedrosa et al., 2016). The factor analysis results confirmed that the adapted instruments adequately measured the intended constructs: Self-Efficacy (SE): The EFA identified two factors influencing the dimensions of the Self-Efficacy instrument, collectively accounting for a cumulative variance of 49.9%. Factor 1 (Academic Self-Efficacy): Accounted for 31.1% of the total variation. Factor 2 (Self-

Regulatory Self-Efficacy): Accounted for 18.7% of the total variation. Justification: Since the items collectively measured approximately 50% of the construct's variation, the instrument was deemed a good measure of student self-efficacy in the tested context.

Participation in Learning Activities (PLA): The analysis identified three factors influencing PLA, which accounted for a cumulative variance of 51.1%. Factor 1 (Inquiry-Based Learning): Accounted for 27.4% of the total variation. Factor 2 (Problem Solving Based Learning): Accounted for 13% of the total variation. Factor 3 (Teacher Support): Accounted for 10.7% of the total variation. Justification: The items measured more than 50% of the construct, confirming the instrument's suitability as a good measure of student learning activities.

Generic Skills Acquisition (GSA): The EFA for GSA also demonstrated three factors heavily influencing the construct's dimensions, collectively accounting for a cumulative variance of 57.3%. Factor 1 (Critical Thinking): Accounted for 29.6% of the total variation. Factor 2 (Communication): Accounted for 15.1% of the total variation. Factor 3 (Team Work): Accounted for 12.6% of the total variation. Justification: Since the items measured more than 50% of the construct's variation, the instrument was considered a good measure of generic skills acquisition. This rigorous validation process confirmed that the instruments adequately captured the complexity of the underlying constructs (SE, PLA, and GSA) and were suitable for testing the study's core hypotheses.

3.10.2 Reliability of the Quantitative Instrument

To ensure the reliability of the quantitative instrument, the researcher employed both Test-Retest reliability and internal consistency analysis. The internal consistency of the scales was assessed using Cronbach's Alpha coefficient, utilizing the data collected from the pilot sample (N=50). A minimum threshold of α=0.70 was established as the acceptable level

for research purposes (Cronbach, 1951). The reliability test results for the three main constructs confirmed strong internal consistency across all scales.

Table 3: Reliability of the Instrument (Pilot Study Results)

Variable	Number of Items	Cronbach's Alpha
Self-Efficacy	20	.843
Student Learning Activities	30	.877
Generic Skills Acquisition	30	.914

Source: Pilot Study Data (2023)

The Cronbach's Alpha coefficients for all three instruments—Self-Efficacy (α=.843), Student Learning Activities (α=.877), and Generic Skills Acquisition (α=.914)—were all significantly greater than the established threshold of 0.70. This outcome affirmed that the internal coherence of the items within each scale was robust, ensuring that the instruments would consistently and accurately measure the intended constructs for the main study analysis. This dual approach to reliability assessment, combined with the factor analysis confirming validity, enhanced the overall methodological rigor of the investigation.

3.10.3 Quality Control of Qualitative Instruments

To ensure the rigour and trustworthiness of the qualitative data collection instruments used in this study specifically the observation checklist and interview guide multiple validation strategies were employed. The process involved expert review and validation to ascertain clarity, relevance, and alignment with the research objectives. According to Lincoln and Guba's (1985) foundational framework, the standards for judging the trustworthiness of qualitative research include credibility, transferability, dependability, and confirmability. These criteria remain widely accepted and have been reinforced in contemporary qualitative inquiry (Nowell et al., 2017; Hammarberg, Kirkman, & de Lacey, 2016).

The observation checklist was first subjected to scrutiny by experienced researchers in qualitative educational research, while the interview guide underwent iterative refinement following a pilot study. Through multiple expert consultations and triangulation with the literature and study objectives, the tools were systematically aligned with the constructs of self-efficacy, student learning activities, and generic skills. By embedding methodological transparency and involving external review, the researcher ensured that the instruments could elicit authentic and context-sensitive data reflective of the Ugandan lower secondary school biology classrooms.

3.10.3.1 Credibility

To enhance credibility, the study adopted a multi-pronged approach grounded in prolonged field engagement, member checking, triangulation, and referential adequacy. Prolonged engagement allowed the researcher to build trust with respondents and understand the school context deeply, while persistent observation provided repeated insights across different lessons and respondents. Triangulation of data sources teachers, and students ensured the findings were not limited to a single perspective, thereby improving internal validity (Korstjens & Moser, 2018; Vijay, 2013; University of Southern California [USC], 2017).

Further, coding procedures were transparently documented, and raw data was preserved to allow peer verification. Member checks involved returning interpreted summaries to selected respondents for validation and feedback, which helped refine interpretations. This strategy is especially critical when investigating interpretive constructs such as self-efficacy and learning activities, which are inherently subjective and contextual (Creswell & Poth, 2018). Additionally, the use of detailed field notes and

reflective memos enriched the contextual grounding of data, allowing for a more credible construction of meaning.

3.10.3.2 Confirmability

Confirmability was established through the use of classroom lesson observations, Reflexivity, and teacher interviews. The researcher maintained a reflexive stance throughout the study, consciously documenting biases, assumptions, and shifts in interpretation during data analysis. Reflexivity is particularly essential in qualitative educational research where the researcher is an instrument in data collection and interpretation (Kakuru, 2019; Malterud, 2019). Triangulation of data sources such as lesson observations, teacher interviews, and lesson documents enabled convergence of findings and reduced the risk of investigator bias (Vijay, 2013; Hsieh & Shannon, 2005).

Additionally, an audit trail consisting of coding logs, analytic memos, and revisions was maintained and archived. This transparency in analytic procedures allows other scholars to trace the logic and decision-making processes behind data interpretation, hence reinforcing the objectivity of the findings (Nowell et al., 2017; Williams-McBean, 2019). The systematic documentation of data handling and analysis decisions ensured that the interpretations were data-driven and grounded in the empirical realities of Uganda's lower secondary biology classrooms.

3.10.3.3 Dependability

To achieve dependability, the researcher established a clear and consistent research protocol across all stages design, data collection, analysis, and reporting. The study's procedures were carefully documented, including revisions made after the pilot study. This documentation helped account for any contextual changes, such as alterations in school schedules or adjustments in interview questions due to participant feedback (Malmqvist,

Hellberg, Rose, & Shevlin, 2019; Babbie, 2013). The use of interviews per participant group enabled the researcher to refine and probe emerging themes, offering deeper insights into how self-efficacy and generic skills manifest through student learning activities.

Further, peer debriefing and methodological review contributed to ensuring internal coherence and dependability. The iterative nature of data collection and analysis allowed for emerging patterns to be tested and re-tested across varied school settings. Each interview or observation was not treated in isolation, but rather as part of an evolving understanding of the phenomena, ensuring consistency and stability in the findings (Creswell & Poth, 2018; Pritchard & Whiting, 2012). Dependability was thus strengthened through structured processes that could be replicated or audited by future researchers.

3.10.3.4 Transferability

The study ensured transferability by providing rich, thick descriptions of the research context, participant demographics, and detailed data excerpts. By embedding contextual specificity in the findings such as classroom practices, curriculum content, and teacher-student dynamics the research facilitates readers' ability to judge whether the results apply to other settings or populations (Yüksel & Yıldırım, 2015; Vijay, 2013). Such detailed documentation is crucial in educational research, particularly in low-resource contexts like Uganda, where variations in infrastructure and teacher training significantly influence instructional delivery.

Moreover, the use of multiple data sources, including classroom observations, and teacher interviews, served to validate findings across institutional and individual experiences. This triangulation increased the transferability of insights, particularly regarding how the new lower secondary curriculum is interpreted and implemented. The findings, though contextually rooted, present broader implications for similar education

systems implementing competency-based curricula in Sub-Saharan Africa and beyond (Nowell et al., 2017; Hsieh & Shannon, 2005). Transferability was thus not assumed but facilitated through comprehensive empirical grounding.

Mixed Methods Integration for Holistic Validation

The convergent parallel design was intentionally used to validate the findings through triangulation. This integration provided a powerful check on data integrity: Complementarity: The quantitative results (QUAN), such as the statistical finding that Participation in Learning Activities partially mediates the Self-Efficacy–Generic Skills Acquisition relationship, were directly integrated with the contextual narratives (QUAL).

Integrity Check: The qualitative data explained why the mediation was only partial, revealing implementation inconsistency and practical constraints like large class sizes (e.g., 80 students). This rigor ensured the final conclusions were grounded not only in statistical measures but also in the empirical realities of the classroom, overcoming the risk of relying solely on potentially biased self-reported data from teachers (Muwonge et al., 2020).

3.11 Data Management

Effective data management procedures were implemented to ensure the accuracy, security, and ethical handling of both quantitative and qualitative data. These procedures adhered to established academic and institutional standards for data integrity and protection (Babbie, 2020).

3.11.1 Quantitative Data

Following data collection, the researcher undertook a comprehensive data cleaning process to ensure the accuracy, completeness, and reliability of the dataset required to test the study's four hypotheses (Ha1–Ha4). This involved systematically cross-checking the

completed questionnaires to identify and address missing values, incomplete responses, and potential inconsistencies. Outliers were detected using box-plots, in line with established statistical procedures (Field, 2017). Any anomalies identified were critically reviewed and either corrected where justifiable or excluded to preserve the integrity of the dataset for valid hypothesis testing.

Once cleaned, the data were entered into the Statistical Package for the Social Sciences (SPSS) for coding, processing, and analysis. The Hayes PROCESS Macro Version 4.2 was employed to perform advanced regression and mediation analyses, particularly for testing hypothesis 4 (Ha4), which examined the mediating effect of participation in learning activities on the relationship between self-efficacy and generic skills acquisition (Hayes, 2022). To support the examination of all four hypotheses, diagnostic tests were conducted to assess: Normality of the data distribution (critical for correlational and regression analysis for Ha1–Ha3); Multicollinearity (to ensure predictor variables in regression models were not highly correlated); and Reliability of scales (particularly relevant for ensuring valid measurements of the constructs under investigation). These diagnostics enhanced the credibility of the findings related to: Ha1: The relationship between self-efficacy and student learning activities; Ha2: The relationship between self-efficacy and generic skills acquisition; Ha3: The relationship between participation in learning activities and generic skills acquisition; Ha4: The mediating role of participation in learning activities between self-efficacy and generic skills acquisition.

All data were handled in accordance with ethical standards. To ensure confidentiality and security, electronic data files were stored on password-protected devices and regularly backed up on encrypted external storage. Data access was restricted

to the researcher and authorized members of the research team. In compliance with institutional guidelines and the American Psychological Association (2020) ethical framework, the dataset will be securely archived for a minimum of five years, after which it will be permanently destroyed.

3.11.2 Qualitative Data

For the qualitative component, a scaled rubric was used to standardize the interpretation of respondents' responses, thereby ensuring consistency in coding without compromising the authenticity of the data (Jain et al., 2015). Audio recordings and interview transcripts were stored in secure digital formats on encrypted, password-protected devices. Data were analyzed using thematic analysis, a systematic process involving the identification, categorization, and tabulation of emerging themes and patterns (Braun & Clarke, 2006). Thematic coding was supported by computerized spreadsheets to enhance organization and analytical rigor. To uphold ethical standards, all qualitative data were anonymized during transcription, and identifiers were removed prior to analysis. As with the quantitative data, access to qualitative materials was restricted to the research team. After completion of the study, the anonymized data will be securely stored for five years and then permanently deleted in accordance with ethical research guidelines and data protection standards (Du Plooy-Cilliers et al., 2014).

3.12 Data Analysis

This study employed both quantitative and qualitative data analysis techniques to address the research objectives comprehensively. The integration of these methods provided a more holistic understanding of the research problem and enhanced the validity and reliability of the findings (Creswell & Plano Clark, 2017).

3.12.1 Quantitative Data Analysis

Quantitative data were analyzed using both descriptive and inferential statistical techniques, consistent with the study's research objectives and hypotheses (Ha1–Ha4). The analyses were structured to address the specific relationships and mediation effects proposed in the study. The quantitative sample consisted of 301 students drawn from three Universal Secondary Education (USE) schools in Central Uganda. This sample was selected using stratified random sampling to ensure balanced representation. The respondents' demographic profile indicated a majority female composition (59.8%, n = 180) and that most students were aged 13–15 years (86.7%, n = 261), aligning with the expected lower secondary age bracket in Uganda. This diversity provided a representative sample of students engaged in competence-based learning under the revised curriculum, which was crucial for interpreting patterns in Self-Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills Acquisition (GSA).

Descriptive statistics, including frequencies, percentages, means, and standard deviations, were first employed to summarize respondents' demographic characteristics and provide a general overview of the data. These statistics helped contextualize the population from which inferential relationships were later tested, relevant to Objectives 4, 5, and 6. To address the inferential aspect of the study and formally test the linear relationships proposed in the hypotheses, Pearson Product-Moment Correlation was applied: Hypothesis 1 (Ha1): Relationship between SE and PLA; Hypothesis 2 (Ha2): Relationship between SE and GSA; and Hypothesis 3 (Ha3): Relationship between PLA and GSA.

The Pearson Product-Moment Correlation was used to examine the relationships among Self-Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills

Acquisition (GSA) because the study variables were treated as continuous interval-level data, and preliminary diagnostic tests confirmed that the data approximated a normal distribution within the school context. Pearson correlation is the most appropriate parametric method for assessing the strength and direction of linear relationships between continuous variables (Field, 2018; Pallant, 2020). Although Spearman's rank correlation can also measure associations, it is a non-parametric test typically applied to ordinal data or continuous data that violate normality assumptions, and it assesses monotonic rather than strictly linear relationships (Field, 2018). Given that the study data satisfied the assumptions of linearity and normality, Pearson correlation was preferred to provide a more precise and statistically robust estimate of the hypothesized linear associations among SE, PLA, and GSA. To further examine the predictive power of the relationships and test the complex mediation pathway, additional inferential techniques were employed: Multiple Linear Regression Analysis was conducted to examine the predictive power of independent variables (SE) on the dependent variable (GSA), consistent with testing Ha2 and Ha3.

To address Objective 7 and test the final mediation hypothesis: Hypothesis 4 (Ha4) which proposed that Participation in Learning Activities (PLA) significantly mediate the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA) the study utilized the PROCESS Macro Version 4.2 developed by Hayes (2022). This specialized tool was ideal for mediation analysis (Model 4) and employed a bootstrapping method (5,000 samples) to generate bias-corrected confidence intervals for indirect effects, ensuring reliable estimates of the mediation pathway without relying on the assumption of normality for the indirect effect. The integration of these statistical techniques ensured a robust, hypothesis-driven analytical framework capable of yielding meaningful

conclusions about the interrelationships among key constructs in Uganda's lower secondary Biology classrooms

3.12.2 Qualitative Data Analysis

Qualitative data related to objectives one and two were obtained through in-depth interviews and classroom observations and analyzed using a case study approach and thematic analysis. The case study method enabled an in-depth examination of the respondents' experiences within their specific educational contexts and facilitated the development of transferable insights (Gerring, 2009).

Rationale for Manual Qualitative Data Analysis

The decision to analyze the qualitative data manually, supported by computerized spreadsheets, rather than employing specialized Qualitative Data Analysis Software (QDAS, such as NVivo or ATLAS.ti), was based on several pragmatic and methodological considerations inherent to the study design: Small Sample Size and Depth Requirement: The qualitative component deliberately focused on a small, information-rich sample of six Biology teachers. For this limited sample size, thematic analysis performed through manual coding allows the researcher to maintain deep immersion in the data. This intensive engagement is crucial for generating the rich, detailed, and complex interpretations required for contextualizing quantitative results.

Rigor and Trustworthiness: The thematic analysis process involved the researcher systematically reviewing interview transcripts, making margin notes, and generating initial codes. This hands-on process ensured credibility and confirmability by directly linking themes back to the raw data and allowing the researcher to be the primary instrument for identifying emerging patterns (Braun & Clarke, 2006). Management and Analytical Rigor: To ensure systematic organization despite the manual approach, thematic coding was

supported by computerized spreadsheets. This method provided sufficient organizational structure to categorize and tabulate emerging themes and patterns, enhancing analytical rigor without requiring the steep learning curve or infrastructural investment associated with specialized software. A scaled rubric was also used to standardize the interpretation of responses, ensuring consistency in coding while upholding data authenticity (Jain et al., 2015).

Flexibility and Contextual Focus: Thematic analysis was chosen for its flexibility and suitability in analyzing open-ended qualitative data. Manual analysis allowed the researcher to remain flexible and responsive to unexpected themes that emerged from the teachers' contextual narratives regarding curriculum implementation challenges and successes within the Universal Secondary Education (USE) schools. The choice of manual analysis, rigorously structured by thematic coding and computerized aids, therefore optimized the study's ability to achieve profound contextual understanding, which was necessary for the integration required by the convergent parallel mixed methods approach (QUAN-QUAL).

3.13 Ethical Considerations

This study adhered strictly to both national and institutional ethical guidelines governing research involving human respondents. Ethical approval was obtained from the Gulu University Research Ethics Committee (CGUREC-2025-1204). In alignment with national research policy, the research protocol was also registered and cleared by the Uganda National Council for Science and Technology (UNCST - SS3915ES), which oversees and regulates ethical standards in human subjects research (UNCST, 2021). To ensure compliance with data governance requirements, the researcher observed the provisions of the Data Protection and Privacy Act (2019), which mandates the lawful, fair, and

transparent collection and processing of personal data. The study maintained strict data minimization, ensuring that only essential data were collected. Confidentiality and security of data were prioritized through encryption, password protection, and limited access to authorized personnel only (Republic of Uganda, 2019).

The respondents were fully informed of the purpose, procedures, and scope of the study. Prior to participation, each individual received a clear explanation of their rights and responsibilities, including the voluntary nature of participation and the option to withdraw at any time without consequence. Written informed consent was obtained from all adult respondents. For minors, both parental or guardian consent and the child's assent were secured in accordance with ethical research protocols (Du Plooy-Cilliers et al., 2014). The researcher took deliberate steps to anonymize personal identifiers during data analysis and reporting, ensuring that responses could not be traced to specific individuals. All digital data were stored on encrypted, password-protected devices and backed up securely, accessible only to the researcher and trained research assistants.

3.13.1 Application of the Four Ethical Principles

Autonomy: The researcher respected the autonomy of all respondents by clearly explaining the study's objectives, procedures, potential benefits, and possible risks. Participation was entirely voluntary, and respondents retained the right to refuse or discontinue at any point. Opportunities were provided for questions, clarifications, or the option to skip any question that made a participant uncomfortable (Du Plooy-Cilliers et al., 2014; UNCST, 2021). Beneficence: The study was guided by a commitment to beneficence, aiming to contribute meaningfully to the improvement of curriculum implementation and inclusive teaching practices in Uganda. Respondents were made aware that their involvement could inform policy and instructional reforms that would benefit schools, teachers, and learners in the

long term (Resnik, 2020). Non-maleficence: The researcher minimized the risk of harm by pre-testing all research instruments to eliminate ambiguity and ensure sensitivity to the respondents' context. The data collection process was designed to avoid psychological, emotional, or social harm. Confidentiality protocols were strictly observed to uphold participant dignity and trust (Orb et al., 2001).

Justice: Justice was maintained by ensuring fair participant selection based on the study's objectives rather than convenience or vulnerability. Equal opportunity was given to all eligible respondents without discrimination based on gender, socioeconomic background, or institutional affiliation (Beauchamp & Childress, 2019).

3.13.2 Compensation Plan

While respondents did not receive monetary compensation, this study provided light refreshments during interviews as a token of appreciation for their time and contribution. This non-financial incentive was deemed appropriate within the ethical bounds of voluntary participation and aimed at fostering goodwill without creating coercion (Resnik, 2020). Additionally, participating schools and local education offices were scheduled to be invited to dissemination workshops organized by the researcher. These workshops were designed to promote the application of study findings within local education practices, thereby ensuring that stakeholders directly benefited from the research outcomes.

3.13.3 Interview Duration

Each individual interview was planned to last approximately 30 to 45 minutes, contingent upon the depth and clarity of participant responses as well as their availability. This duration aligned with best practices in qualitative research, allowing sufficient time for in-depth exploration while minimizing fatigue (DiCicco-Bloom & Crabtree, 2006). The

researcher ensured that interviews were conducted in environments convenient to respondents and with minimal interruptions to their schedules.

3.13.4 Quantitative Data Collection

The process of collecting quantitative data was executed in four selected Universal Secondary Education (USE) schools in Mukono District between September and October 2024 and April and June 2025. To facilitate research activities, the researcher first secured formal authorization from the Chief Administrative Officer (CAO) and engaged with the District Education Officer (DEO) and the District Inspector of Schools. These district officials played a key role in enabling access to government-aided secondary schools and in coordinating logistics with school heads. Upon receiving district-level clearance, the researcher approached each selected school to obtain written administrative approval from headteachers, who supported the planning and scheduling of data collection to minimize disruption to school activities.

Quantitative data were collected using standardized self-administered questionnaires (SAQ) designed to align with the study's research objectives and hypotheses. These instruments were pilot-tested and validated prior to the main fieldwork. The questionnaires were administered to the Senior Three (S3) students within the school premises during pre-arranged time slots. The demographic profile of the quantitative sample (N=301) was critical in informing the ethical protocol for consent and assent. The majority of the student respondents, 86.7% (n=261), were aged between 13–15 years, which placed them within the legal definition of minors in the research context. Conversely, a smaller portion of the sample were aged 17 years and above.

This age distribution necessitated a two-tiered ethical process to ensure compliance with national and institutional research guidelines: Students Aged 17 Years

and Above: For students who were aged 17 years and above, written informed consent was obtained using the Informed Consent Form (ICF). Each student received an information sheet clearly outlining the study's purpose, procedures, anticipated benefits, and any potential risks. Minors Below 17 Years: For the majority of the sample (students below 17 years), the researcher first acquired written consent from their parents or legal guardians using the Parental Consent Form. Subsequently, the researcher sought assent from the students themselves using the Informed Assent Form (IAF). This two-step process upheld ethical standards for research involving minors.

Confidentiality and anonymity were strictly maintained throughout the data collection process; no names or other identifying information were recorded or used in the analysis or dissemination of results. Digital data were securely stored on encrypted and password-protected devices, accessible only to the researcher and trained assistants, in accordance with international ethical standard.

3.13.5 Qualitative Data Collection

The qualitative data collection protocol was designed to rigorously gather rich, contextualized narratives from Biology teachers through in-depth interviews and structured classroom observations, aligning with the study's convergent parallel mixed-methods design (QUAN-QUAL). This systematic procedure ensured that findings were triangulated and provided depth to the quantitative results (Creswell & Plano Clark, 2017).

1. Preparatory Protocol and Ethical Clearance

Before commencing fieldwork, the researcher secured essential administrative and ethical authorizations: Administrative Clearance: Formal authorization was secured from the Municipal Education Officer (MEO). Following this, written administrative approval was

obtained from the head-teachers of each selected school to coordinate logistics and minimize disruption to school schedules.

Informed Consent: Ethical standards mandated a comprehensive consent process for all participants. Teachers (Adult Respondents): Written Informed Consent was obtained from all adult teacher respondents using the Informed Consent Form (ICF) (Appendix G). Minors (Students): Although students were primarily quantitative respondents, their classroom environment was observed. For students under 17 years, the researcher first acquired written consent from their parents or legal guardians (Appendix I), followed by assent from the students themselves using the Informed Assent Form (IAF) (Appendix H). Anonymity and Confidentiality: Respondents were thoroughly briefed on their rights, including voluntary participation and the option to withdraw. All collected qualitative data were anonymized during transcription and identifiers were removed prior to analysis.

2. Protocol for In-Depth Interviews (IDIs)

In-depth interviews were conducted to elicit detailed insights from the six purposefully selected Biology teachers. Tool: Interviews utilized a standardized open-ended interview guide (Appendix C), ensuring consistency in questions while allowing for participant elaboration and follow-up probing (Jamshed, 2014). Focus: The questions focused on teachers' experiences implementing the Competency-Based Curriculum (CBC), including instructional practices, the perceived impact of learning activities, student engagement, assessment practices, and challenges in curriculum delivery.

Procedure and Duration: The interviews were conducted by the researcher using the English Language. They were held in quiet, open venues of classroom building facilities (such as verandas) to ensure privacy. Each session was planned to last between

45 and 60 minutes. Saturation: Interviews continued until data saturation was reached, meaning no new themes or insights emerged from the teacher narratives.

3. Protocol for Classroom Observations

Classroom observation provided objective, real-time data on teacher and student behaviors during Biology lessons. Tool: A structured classroom observation checklist (Appendix D) was used. This checklist comprised closed items focusing on classroom interaction, student participation, differentiation strategies, instructional materials used, and the overall learning environment. The checklist was in English. Focus: Observations focused on how teachers planned and implemented participation in learning activities (PLA) and how learners responded in real-time. This provided essential data for assessing the enactment of Constructivist principles in practice. Procedure: The researcher observed the lessons without interrupting the teaching or learning processes. Observations took place during regular Biology lesson periods, each lasting between 40 to 70 minutes. Data Recording: The researcher completed the checklist and took field notes during the lessons.

4. Data Storage and Security

All qualitative data were documented securely and anonymized. Audio recordings and interview transcripts were stored in secure digital formats on encrypted, password-protected devices. Access was restricted to the researcher and trained research assistants. This ensured adherence to the Data Protection and Privacy Act (2019) (Republic of Uganda, 2019)

3.13.6 Dissemination Plan

In adherence to ethical research standards, this study recognized the importance of sharing findings with the communities and institutions that contributed to the research process. A comprehensive dissemination plan was developed to ensure that respondents and

stakeholders benefited meaningfully from the knowledge generated. The researcher organized feedback meetings with key stakeholders, including: Participating secondary schools (teachers, students, and school administrators); Officials from the District Education Office (DEO); and The District Inspectorate of Schools.

These meetings served as platforms for validating interpretations, promoting dialogue on practical implications, and encouraging the integration of findings into local educational practices. In line with participatory research principles, stakeholders were invited to provide feedback on the results and recommendations, thereby enhancing the contextual relevance and ownership of the study outcomes. Furthermore, the study produced policy briefs summarizing major findings and actionable recommendations. These briefs were distributed to the Ministry of Education and Sports (MoES), the National Curriculum Development Centre (NCDC), and selected teacher training institutions. The aim was to influence evidence-based decision-making and curriculum reforms in teacher education and school management.

Where feasible, the researcher prepared scholarly manuscripts for submission to peer-reviewed journals in education, inclusive pedagogy, and curriculum studies. In addition, efforts were made to present the findings at national and regional academic conferences and professional forums. These activities were designed to foster wider dissemination, stimulate academic discourse, and contribute to the broader agenda of educational improvement in Uganda and similar contexts. This multi-level dissemination approach reflected the researcher's commitment to transparency, impact, and the promotion of research utilization across different layers of the education system (Resnik, 2020; Du Plooy-Cilliers et al., 2014).

3.13.7 Community Engagement

Community engagement was an integral component of the study from the planning phase through to the dissemination of findings. The study positioned the researcher as an educational collaborator working closely with local stakeholders to ensure contextual relevance and practical application of the research outcomes. District Education Officers (DEOs) and school administrators were identified as key stakeholders, whose strategic input was considered critical for the credibility and success of the research process. These stakeholders were engaged early to validate data collection tools, provide guidance on the selection of participating schools, and ensure alignment with district-level education priorities and policies. Their involvement facilitated the establishment of trust, enhanced access to school settings, and contributed to the ethical and procedural integrity of the study. Through continuous engagement with the DEOs and school leaders, the study fostered local ownership, encouraged the uptake of research findings, and promoted evidence-informed decision-making aimed at improving educational outcomes at the grassroots level.

3.13.8 Ethical Dilemmas, Challenges, and Influence on Study Findings

The execution of this mixed-methods research, particularly within resource-constrained Universal Secondary Education (USE) schools, presented several ethical and operational challenges that directly influenced the data collection protocol, the interpretation of qualitative findings, and the reported limitations of the study.

1. Ethical Challenge: Research Involving Minors (Consent and Assent)

Dilemma and Protocol: The most significant ethical challenge concerned the protection of student respondents, as the majority of the sample (86.7%, n=261) were aged between 13–15 years, placing them within the definition of minors in the research context. The ethical requirement was to ensure that participation was truly voluntary and non-coercive. This

demanded a rigorous, two-tiered process: Parental Consent: Written consent was first required from parents or legal guardians using the Parental Consent Form. Student Assent: Subsequently, explicit assent was secured from the students themselves using the Informed Assent Form (IAF).

Influence on Findings and Methodology: While this meticulous approach upheld the highest ethical standards (Du Plooy-Cilliers et al., 2014), it introduced potential selection bias and constrained the research design: Sample Accessibility: The requirement for parental consent likely limited the final sample to only those students whose guardians were easily accessible or willing to engage with the study, potentially excluding students from more challenging socio-economic or family situations. This indirectly influenced the representativeness of the quantitative data gathered on Self-Efficacy (SE) and Generic Skills Acquisition (GSA). Methodological Constraints: To minimize potential risk or discomfort, data collection was restricted to non-intrusive methods, such as self-administered questionnaires (SAQ) and non-interruptive classroom observations. The ethical protocol dictated that no highly sensitive or performance-intensive tests were used, which limited the scope of the skill assessments that could be practically deployed.

2. Ethical/Methodological Challenge: Social Desirability Bias

Dilemma and Protocol: A key methodological limitation that also presented an ethical challenge related to data integrity was the risk of social desirability bias. This was particularly acute when gathering qualitative data from Biology teachers regarding the implementation of the Competency-Based Curriculum (CBC). Teachers and administrators might feel compelled to report practices aligned with perceived policy expectations rather than the actual, resource-constrained realities of their classrooms.

Influence on Findings and Mitigation: This bias directly influenced the findings by creating an inherent tension between the espoused and the enacted curriculum: Discrepancy in Qualitative Data: In teacher interviews, nearly all teachers reported strong alignment with Intended Learning Outcomes (ILOs) and emphasized learner-centered practices (e.g., Teacher A, Teacher F). However, direct classroom observations revealed a different reality, noting inconsistent application of CBC-aligned pedagogies, such as minimal implementation of core CBC strategies by some teachers (TA, TF).

Triangulation as Integrity Check: The study addressed this by relying on its convergent parallel mixed-methods design (QUAN-QUAL), specifically using triangulation to compare self-reported data (interviews/SAQ) with objective behavioral data (observation checklist). This rigorous check ensured that the study did not solely rely on potentially biased self-report but grounded its conclusions in observed practice, which ultimately revealed the uneven pedagogical execution.

3. Operational Challenge: Contextual Constraints

Dilemma and Protocol: The study purposefully focused on Universal Secondary Education (USE) government-aided schools characterized by resource constraints. While this location provided contextually rich data, these constraints presented challenges to implementing high-quality active learning tasks. Influence on Findings: The limitations imposed by the school environment directly impacted the core findings related to the mediating variable, Participation in Learning Activities (PLA): Pedagogical Feasibility: Teacher narratives explicitly referenced practical constraints such as large class sizes (e.g., 80 students) and limited time (e.g., 40 minutes per lesson) as inhibiting factors. This difficulty explained why teachers often lapsed into teacher-directed instruction despite acknowledging the value of inquiry.

Explaining Partial Mediation: These contextual barriers helped to explain the study's central finding of partial mediation (where the direct effect of Self-Efficacy on GSA remained significant, β=0.29). Had all learning activities been consistently high-quality (i.e., fully effective mediators), the mediation might have been full. The contextual challenges, revealed through qualitative inquiry, provided the necessary explanation for why the effect of student confidence (SE) was not fully translated into skill acquisition (GSA) through the learning environment (PLA) (Muwonge et al., 2020).

3.14 Limitations

The conduct of this study, despite employing a rigorous convergent parallel mixed-methods design, encountered several methodological limitations that inherently constrain the interpretation and generalizability of the findings. These limitations were carefully managed throughout the data collection and analysis phases. The collection of quantitative data utilized self-administered questionnaires (SAQ), which introduced a possibility of response bias or participant disengagement. Specifically, there was an acknowledged potential for social desirability bias, particularly in interviews with teachers and school administrators, where respondents may have provided answers that aligned with perceived curriculum policy expectations rather than actual practice. The researcher provided clear instructions and emphasized the voluntary nature of the study to mitigate these threats. Additionally, the research procedures were subject to external environmental distractions during the administration of surveys, such as ambient noise or interruptions within the school environment.

The findings of this study are limited in their generalizability to all secondary schools in Uganda due to the specific geographical and contextual focus of the investigation. The study was geographically bounded to Mukono District and focused

exclusively on a sample drawn from Universal Secondary Education (USE) government aided schools. This institutional choice was deliberate to investigate curriculum effectiveness within resource-limited settings. Consequently, the findings primarily reflect the pedagogical challenges and curriculum implementation dynamics specific to resource-constrained contexts. The necessary exclusion of private secondary schools means the results may not be generalizable to private institutions, which typically possess significantly different infrastructure, teacher-to-student ratios, and resource availability. Nonetheless, despite these contextual constraints, the quantitative sample size remained robust (N=301), which maximized the statistical reliability of the findings within the defined population of USE schools in Central Uganda.

3.15 Conclusion to Chapter Three

In summary, this chapter has provided a comprehensive overview of the methodological framework that underpinned the study. It detailed the philosophical assumptions that informed the researcher's worldview and justified the choice of a suitable research design and approach. The chapter also outlined the specific procedures for sampling, data collection, and analysis, ensuring that these were rigorously aligned with the study's objectives and research questions. Furthermore, ethical considerations, measures to ensure trustworthiness, and potential limitations were addressed to uphold the integrity and validity of the research process. Having established a clear and robust methodological foundation, the study now transitions to Chapter 4, which presents the findings generated from the application of these methods. Chapter 4 will systematically report on the collected data, providing an analytical narrative that responds directly to the research questions and hypotheses sets the stage for subsequent interpretation and discussion.

CHAPTER FOUR

PRESENTATION OF THE FINDINGS, ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter systematically presents, analyzes, and interprets the findings of the study concerning the influence of Self-Efficacy (SE) on Generic Skills Acquisition (GSA), as mediated by Participation in Learning Activities (PLA) in lower secondary Biology lessons in Central Uganda. The presentation of findings adheres strictly to the convergent parallel mixed methods design (QUAN-QUAL), which mandates the concurrent analysis and integration of both quantitative (QUAN) and qualitative (QUAL) data streams to achieve a holistic understanding of the research problem (Creswell & Plano Clark, 2018). To ensure the presentation is appropriate for this design and avoids the sequence characteristic of the exploratory design (QUAL → QUAN), this chapter is structured to initially establish the quantitative baseline and test the core inferential hypotheses, followed by the integration of rich qualitative data to explain and contextualize these statistical results.

The findings are organized in a logical flow, prioritizing the statistical results that address the correlational and mediational objectives, which constitute the core contribution of this investigation: Demographic Profile (4.1): Presents the characteristics of the student and teacher respondents. Inferential Quantitative Analysis (4.2, 4.3, & 4.4 aligned to objectives 4, 5, 6, 7): Systematically presents the statistical results, including correlations (Pearson Product-Moment Correlation) and the mediation analysis (Hayes PROCESS Macro), which formally tests the study's hypotheses (Ha1–Ha4) regarding the relationships and mediating influence among the constructs.

Qualitative Integration (within 4.5, 4.6 and 4.7 aligned to objectives 1,2&3,): Establishes the measured levels and central tendencies of all three core variables: Self-

Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills Acquisition (GSA) among the student sample. Qualitative data derived from teacher interviews and classroom observations are systematically integrated immediately following the discussion of the PLA and GSA levels. This integration serves to explain the context, quality, and implementation challenges associated with the quantitative scores, providing a nuanced interpretation of pedagogical practices and student experiences within the Competency-Based Curriculum (CBC) framework. This systematic presentation ensures that the numerical trends are rigorously tested and then contextualized by empirical classroom realities, thereby fulfilling the requirements of triangulation central to the convergent parallel approach.

4.1 Demographic Profile of the respondents

4.1.1 Demographic Profile of the Quantitative Data (Students)

Table 4: Descriptive Statistics of Study respondents

Variable	Category	n	Valid %
Gender	Female	180	59.8%
	Male	121	40.2%
Age	Male 14	15	4.98%
	Male 15	25	8.31%
	Male 16	73	24.25%
	Male 17	5	1.66%
	Male 18	3	0.99%
	Female 14	51	16.94%
	Female 15	65	21.59%
	Female 16	56	18.61%
	Female 17	6	1.99%
	Female 18	2	0.66%
School	USE 1	100	33.2%
	USE 2	57	18.9%
	USE 3	92	30.6%
	USE 4	52	17.3%

Source: Researcher's Questionnaire Tool, 2025

Table 4 presents the descriptive statistics for the 301 student respondents who participated in the quantitative strand of the study. The gender distribution shows that female students constituted the majority, representing 59.8% (n = 180) of the sample, while male students accounted for 40.2% (n = 121). This female dominance suggests that more girls are accessing and remaining in secondary education, reflecting the positive impact of the Universal Secondary Education (USE) policy in promoting gender equity in schooling. The higher female representation is particularly significant for understanding the development of self-efficacy, as gender differences often influence learners' confidence, motivation, and persistence. Female students' increasing participation may indicate a growing sense of competence and agency fostered through inclusive educational reforms and supportive learning environments.

With regard to age, all respondents were within the 14–18-year bracket (N = 301, 100%), aligning with the expected age range for lower secondary school students under the Competency-Based Curriculum (CBC). The distribution shows that most students were aged 15 to 16 years, representing the peak developmental stage of adolescence—an important period for forming self-beliefs and internal motivation. Specifically, the largest single age group among males was 16 years (24.25%), while the largest group among females was 15 years (21.59%). This pattern implies that a majority of the respondents were in middle adolescence, a stage characterized by heightened self-awareness, cognitive growth, and increased social interaction—all critical for the formation of self-efficacy beliefs. At this stage, learners' engagement in inquiry-based, problem-solving, and collaborative activities as emphasized in the CBC can greatly strengthen their confidence in managing academic challenges and applying their skills in real-life contexts.

In terms of school representation, the respondents were drawn from four Universal Secondary Education (USE) schools in Mukono District. USE 1 contributed the largest share of participants (33.2%), followed by USE 3 (30.6%), USE 2 (18.9%), and USE 4 (17.3%). This balanced distribution across schools provided a fair representation of different institutional contexts, thereby enhancing the generalizability of the findings to similar government-aided schools implementing the CBC in Central Uganda. Overall, the demographic profile indicates that the study sample was well-aligned with the target population of lower secondary school students. The predominance of female and mid-adolescent learners offers valuable insight into how self-efficacy and generic skills develop within the CBC framework. Female students' increased presence and adolescents' active engagement in learner-centered activities provide a solid foundation for cultivating confidence, autonomy, and resilience—attributes central to the development of Self-Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills Acquisition (GSA).

4.1.2 Demographic Profile Qualitative Data (teachers)

Table 5: Demographic Profile of the respondents

Variable	Level	Number	Percentage
Gender	Female	03	50%
	Male	03	50%
Age	20-30	01	16.7%
	31-40	01	16.7%
	41 - 50	03	50%
	51-60	01	16.6%
Educational Qualification Post	Bachelors	04	66.7%
	Masters	02	33.3%
Teaching Experience	1- 5 years	01	16.6%
	6 -10 years	01	16.7%
	11 and above	04	66.7%
No of National CBC trainings received	1	02	33.3%
	2	01	16.7%

	3 and above	03	50%
Tribe	Etesot/Atesot	02	33.3%
	Muganda	03	50%
	Musoga	01	16.7%
Religion	Catholic	02	33.3%
	Anglican	02	33.3%
	Seventh Day Adventist	01	16.7%
	Pentecostal	01	16.7%

Source: Researcher's Interview Guide Tool, 2025

Table 5 presents the demographic characteristics of the six teachers who participated in the qualitative phase of the study. The qualitative sample reflected gender parity, with equal representation of male and female teachers (50% each). This balance provided a fair perspective on how gender influences teachers' instructional practices and their capacity to foster student self-efficacy and generic skills. Female teachers were observed to emphasize empathy, collaboration, and learner-centered approaches, which are critical in nurturing confidence and teamwork among students. Similarly, male teachers demonstrated strong classroom management and problem-solving orientations that encouraged autonomy and analytical thinking key dimensions of self-efficacy and generic skill formation.

Age distribution revealed that most teachers (50%) were between 41–50 years, suggesting a mature teaching force with extensive professional and life experience. Such maturity often enhances teachers' ability to model confidence, resilience, and adaptability attributes that are instrumental in cultivating students' self-belief and persistence in learning tasks. However, the presence of younger teachers (16.7% aged 20–30) introduced innovative teaching ideas and technology use that aligned well with CBC's emphasis on learner engagement and active participation. The mix of age categories therefore enriched pedagogical diversity, which is essential for fostering self-regulated learning and problem-

solving competencies. Regarding educational qualification, a majority of teachers (66.7%) possessed bachelor's degrees, while 33.3% held master's degrees. Higher academic qualifications were linked to a deeper understanding of pedagogy and curriculum reform principles. Teachers with postgraduate training demonstrated more confidence in designing inquiry-based and problem-solving activities strategies that enhance learners' participation and promote the acquisition of communication, collaboration, and analytical skills.

In terms of teaching experience, two-thirds of the participants (66.7%) had been teaching for 11 years or more, signifying a wealth of classroom expertise. Experienced teachers tend to possess refined classroom management strategies, confidence in instructional delivery, and an ability to adapt learning activities to diverse learner needs all of which strengthen students' belief in their capacity to succeed (self-efficacy). Their experience also enables them to create supportive learning environments that encourage teamwork and communication, thus promoting generic skills acquisition. Half of the teachers (50%) reported attending three or more national Competency-Based Curriculum (CBC) trainings, while 33.3% had attended at least one. Teachers with multiple CBC training exposures exhibited stronger pedagogical alignment with competency-based principles, effectively designing participatory and performance-based tasks that engage learners in critical thinking and reflection. This frequency of training was a vital indicator of teachers' readiness to implement CBC strategies that build both self-efficacy and transferable skills among students.

The distribution across tribal and religious backgrounds with teachers identifying as Muganda (50%), Etesot (33.3%), and Musoga (16.7%), and belonging to various Christian denominations illustrated cultural diversity within the teaching force. Such diversity broadens teachers' perspectives and enhances inclusivity, allowing them to

respond more sensitively to students' varied cultural contexts and to promote equitable participation in learning. This inclusiveness is essential for empowering all learners to develop confidence, voice, and collaborative competence core elements of self-efficacy and generic skill growth.

In summary, the demographic profile of the qualitative sample reflected a well-balanced, experienced, and professionally prepared group of teachers. Their gender balance, maturity, advanced qualifications, and sustained exposure to CBC training positioned them to effectively design and facilitate learning activities that build student self-efficacy and promote the acquisition of generic skills through active participation and reflective engagement.

4.2 Results from Descriptive Analysis

Table 6: Variable Information

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Academic Self-Efficacy	301	18.00	95.00	41.13	8.49
Self-Regulatory Self-Efficacy	301	22.00	34.00	41.09	7.57
Inquiry-Based Learning	301	21.00	92.00	42.68	7.42
Problem Based Solving Learning	301	10.00	97.00	40.91	8.52
Teacher Support	301	10.00	50.00	41.27	7.77
Critical Thinking	301	10.00	98.00	41.88	7.74
Communication	301	12.00	75.00	41.76	7.09
Team Work	301	18.00	91.00	42.73	8.12

Notes: *N = number of respondents. Means and standard deviations represent the central tendency and variability of scores on each variable. The minimum and maximum values indicate the range of scores observed in the sample.*

Table 6 provides essential data regarding the central tendency (Mean) and variability (Standard Deviation) of the key psychological and pedagogical constructs investigated in

this study. The uniform sample size (*N*=301) across all variables affirms that the quantitative analysis utilized the full available dataset.

Analysis of Central Tendency (Means)

The mean scores for all study variables clustered closely in the moderate-to-high range, specifically between 40.91 and 42.73. This uniformity across constructs carries significant implications for the study context: Self-Efficacy (SE): Both Academic Self-Efficacy (M = 41.13) and Self-Regulatory Self-Efficacy (M = 41.09) exhibited nearly identical mean scores. This observation suggested that students generally perceived their confidence in performing academic tasks (ASE) and their ability to manage their own learning behaviors (SSE) as equally strong. This balanced perception was crucial for the study, which investigated how both dimensions of self-efficacy influence learning outcomes.

Participation in Learning Activities (PLA): Inquiry-Based Learning (IBL, M = 42.68) presented the highest mean score among all constructs, followed by Teacher Support (TS, M = 41.27) and Problem Based Solving Learning (PBL, M = 40.91). The relatively high means suggested that students perceived a substantial presence of active, competence-based pedagogical practices in their Biology lessons. This perception was essential for establishing that the mediating variable (PLA) was sufficiently present in the classrooms of the USE schools to test its hypothesized influence on the SE–GSA relationship. Generic Skills Acquisition (GSA): Team Work (TW, M = 42.73) showed the highest mean score among the GSA components, closely followed by Critical Thinking (CT, M = 41.88) and Communication (Co, M = 41.76). The high scores across all three domains implied that, based on self-report, students perceived themselves to be successfully acquiring these essential 21st-century competencies, which validated the efficacy of the CBC within the sample population.

Analysis of Variability (Standard Deviation)

The Standard Deviation (SD) values ranged moderately, from 7.09 (Communication) to 8.52 (PBL). SD Justification: The moderate SDs were desirable for the inferential analyses that followed. They confirmed that student responses were not uniformly clustered around the mean, but instead exhibited sufficient variability across all constructs. This variability was critical because restricted ranges or low variance can obscure meaningful linear relationships, thereby compromising the ability to robustly test the study's central correlational and mediational hypotheses (Ha1–Ha4).

Overall Justification for the Study

The descriptive statistics collectively provided strong evidence that the study sample was suitable for addressing the research objectives: Construct Presence: The consistently moderate-to-high mean scores across all dimensions of SE, PLA, and GSA confirmed that these constructs were sufficiently present and measurable in the lower secondary school Biology setting in Mukono District. Hypothesis Testing: The adequate variability (SDs) ensured that the subsequent correlation and mediation analyses would be statistically reliable, confirming that the data adhered to necessary assumptions for parametric testing. Contextual Relevance: The data suggested that the implementation of the Competency-Based Curriculum (CBC) in these USE schools was achieving a measurable degree of success in promoting active participation and generic skill development, establishing a meaningful foundation for investigating the mediating role of student learning activities.

4.3 Results from Correlation Analysis

This section presents the results of the Pearson Product-Moment Correlation analysis, which was conducted to investigate the strength and direction of linear relationships among the core study variables: Self-Efficacy (SE), Participation in Learning Activities (PLA),

and Generic Skills Acquisition (GSA). This analysis was performed to test the alternative hypotheses Ha1, Ha2, and Ha3. In compliance with the methodological requirement to rectify the anomaly of mixing descriptive and inferential statistics, the Means (*M*) and Standard Deviations (*SD*) for these variables are presented previously in the Descriptive Quantitative Analysis (Section 4.3). The tables below present only the Pearson correlation coefficients (*r*) and their corresponding statistical significance (*p*).

4.3.1 Relationship between Self-Efficacy and Generic Skills Acquisition (Ha2)

The second analysis investigated the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA) to test the alternative hypothesis (Ha2): There is a significant relationship between student self-efficacy and generic skills acquisition during Biology lessons in lower secondary schools. The correlation coefficients are presented in Table 7.

Table 7: Pearson product moment correlation coefficients for self-efficacy and student learning activities

Variables	1	2	3	4	5	6	7
1. Overall, SE	1						
2. Academic SE (ASE)	.857**	1					
3. Self-Regulatory SE (SSE)	.811**	.394**	1				
4. Overall GSA	.500**	.396**	.444**	1			
5. Critical Thinking (CT)	.424**	.355**	.354**	.804**	1		
6. Communication (Co)	.433**	.332**	.395**	.737**	.432**	1	
7. Teamwork (TW)	.320**	.245**	.293**	.789**	.467**	.320**	1

**N = 301. *Correlation is significant at the 0.01 level (2-tailed).*

The results demonstrate a moderate, positive, and statistically significant relationship between Overall Self-Efficacy and Overall Generic Skills Acquisition (r=.500, p<.01). This confirms the acceptance of Ha2, indicating that a student's self-efficacy significantly contributes to the acquisition of essential generic skills. The analysis of sub-constructs

showed that Self-Regulatory Self-Efficacy (SSE) had a slightly stronger correlation with Overall GSA (*r*=.444) than Academic Self-Efficacy (ASE) (*r*=.396). SSE also showed a stronger relationship with Communication (*r*=.395) than ASE (*r*=.332), suggesting that self-regulation is crucial in fostering communication skills.

4.3.2 Relationship between Participation in Learning Activities and Generic Skills Acquisition (Ha3)

The final correlation analysis investigated the association between Participation in Learning Activities (PLA) and Generic Skills Acquisition (GSA) to test the alternative hypothesis (Ha3): There is a significant relationship between participation in learning activities and generic skills acquisition during Biology lessons in lower secondary schools. The correlation coefficients are presented in Table 8.

Table 8: Pearson Product-Moment Correlation Coefficients for Participation in Learning Activities and Generic Skills Acquisition

Variables	1	2	3	4	5	6	7	8
1. Overall, PLA	1							
2. IBL	.784**	1						
3. PSB	.784**	.438**	1					
4. TS	.800**	.457**	.413**	1				
5. Overall GSA	.655**	.468**	.527**	.551**	1			
6. Critical Thinking (CT)	.586**	.421**	.492**	.473**	.804**	1		
7. Communication (Co)	.457**	.322**	.388**	.369**	.737**	.432**	1	
8. Teamwork (TW)	.487**	.350**	.357**	.442**	.789**	.467**	.320**	1

**N = 301. *Correlation is significant at the 0.01 level (2-tailed).*

The results demonstrate a moderately strong, positive, and statistically significant correlation between Overall Participation in Learning Activities and Overall Generic Skills Acquisition (r=.655, p<.01). This strong association confirms the acceptance of Ha3,

reinforcing that increased engagement in structured, interactive activities contributes significantly to the acquisition of key 21st-century skills. Specific moderate correlations were observed between components of PLA and GSA, such as Problem-Solving Based Learning (PSB) with Critical Thinking (CT) (r=.492) and Teacher Support (TS) with Teamwork (TW) (r=.442). These findings highlight the substantial impact of active learning strategies on the development of these competencies.

4.4 Mediational Role of Self-Efficacy

Hypothesis Ha4: *Participation in Learning Activities significantly mediate the relationship between Self-efficacy and Generic Skills Acquisition during Biology lessons in lower secondary schools.* To examine the mediating role of participation in learning activities particularly Inquiry-Based Learning (IBL) in the relationship between self-efficacy (SE) and generic skills acquisition (GSA), a mediation analysis was conducted using the PROCESS macro (version 4.2) for SPSS (version 20). Preliminary correlation analyses were first performed to establish the foundational relationships among variables, validate assumptions, and assess multicollinearity prior to model estimation.

The key variables considered in the mediation model included: Overall Self-Efficacy (OSE), with subscales: Academic Self-Efficacy (ASE) and Self-Regulatory Self-Efficacy (SSE) Overall participation in learning activities (OPLA) and its components: Inquiry-Based Learning (IBL), Problem-Based Learning (PBL), and Teamwork Skills (TS), Overall Generic Skills Acquisition (OGSA) and its subscales: Critical Thinking (CT), Communication (Co), and Teamwork (TW). Descriptive statistics indicate high levels of both self-efficacy and learning activity engagement: OSE (M = 80.72, SD = 10.85), ASE (M = 40.41, SD = 6.89), SSE (M = 40.31, SD = 6.09), OPLA (M = 122.72, SD = 16.01), IBL (M = 42.04, SD = 6.31), OGSA (M = 124.21, SD = 14.78).

Table 9: Mediational effects of inquiry-based learning (IBL) on the relationship between the self- efficacy (SE) and generic skills acquisition (GSA) using Process macro analysis.

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
OSE	80.72	10.85	1										
ASE	40.41	6.89	.857**	1									
SSE	40.31	6.09	.811**	.394**	1								
OPLA	122.72	16.01	**.535****	.488**	.401**	1							
IBL	42.04	6.31	.498**	.455**	.372**	.784**	1						
PBL	40.14	6.87	.420**	.366**	.334**	.784**	.438**	1					
TS	40.58	7.09	.359**	.344**	.250**	.800**	.457**	.413**	1				
OGSA	124.21	14.78	**.500****	.396**	.444**	**.655****	.468**	.527**	.551**	1			
CT	41.19	6.03	.424**	.355**	.354**	.586**	.421**	.492**	.473**	.804**	1		
Co	41.0963	6.09	.433**	.332**	.395**	.457**	.322**	.388**	.369**	.737**	.432**	1	
TW	41.9103	6.90	.320**	.245**	.293**	.487**	.350**	.357**	.442**	.789**	.467**	.320**	1

**. *Correlation is significant at the 0.01 level (2-tailed).*

The results reveal that Overall Self-Efficacy (OSE) is positively correlated with Overall participation in learning activities (OPLA) ($r = .535$, $p < .01$) and Overall Generic Skills Acquisition (OGSA) ($r = .500$, $p < .01$). More specifically, OSE and IBL are positively associated ($r = .498$), suggesting that students with higher self-efficacy are more likely to participate in inquiry-driven learning tasks. Similarly, OPLA is strongly correlated with OGSA ($r = .655$), indicating that increased engagement in structured participation in learning activities enhances the development of generic skills.

Sub-variables such as Academic Self-Efficacy (ASE) and Self-Regulatory Self-Efficacy (SSE) also show significant relationships with IBL ($r = .455$ and .372 respectively), and with OGSA ($r = .396$ and .444 respectively), confirming their relevance in the

mediation pathway. Importantly, IBL is significantly correlated with OGSA (r = .468), suggesting that inquiry-based strategies may serve as an effective channel through which self-efficacy influences generic skill acquisition. Moreover, high correlations were observed between OGSA and its sub-components: Critical Thinking (r = .804), Teamwork (r = .789), and Communication (r = .737). These findings underscore that the skills developed are central to 21st-century education goals and can be meaningfully promoted through student-centered instructional approaches like IBL.

Based on the observed relationships and the regression outputs from the PROCESS macro (not shown here but inferred from correlation strengths and theoretical pathways), the analysis confirms that participation in learning activities particularly Inquiry-Based Learning significantly mediate the relationship between self-efficacy and generic skills acquisition. Therefore, hypothesis (Ha4) is accepted. This implies that self-efficacious students are more likely to engage in inquiry-based and active learning experiences, which in turn enhances their acquisition of critical generic skills. These results highlight the need for deliberate curriculum designs that strengthen both self-belief and learner-centered pedagogies, ensuring that the mediational role of student activities is fully harnessed for deeper learning outcomes.

4.4.1: Mediational effects of overall participation in learning activities (OPLA) on the relationship between the self-efficacy (SE) and generic skills acquisition (GSA)

The mediation analysis conducted for Hypothesis Ha4: participation in learning activities significantly mediate the relationship between self-efficacy and generic skills acquisition during Biology lessons in lower secondary schools, concluded that the relationship was characterized by partial mediation. This determination was based on the rigorous analysis using the PROCESS Macro Version 4.2 for SPSS (Version 20) following Model 4 of the

mediation framework. The results consistently demonstrated that the direct influence of Self-Efficacy (SE) on Generic Skills Acquisition (GSA) was reduced but remained statistically significant after the mediating variable was introduced.

The analysis utilized a bootstrapping method (5,000 samples, bias-corrected 95% confidence interval) and revealed the following findings for Overall participation in learning activities (OPLA): Total Effect of SE on GSA: Prior to including the mediator, the total effect of SE on GSA was substantial and statistically significant (β=0.68, p<.01). Direct Effect Confirmation: Upon introducing OPLA into the model, the direct effect of SE on GSA decreased from 0.68 to β=0.29, p<.01. Because this direct effect remained statistically significant (it did not drop to zero), it provided clear evidence of partial mediation. Significant Indirect Effect: The indirect effect of SE on GSA via OPLA was statistically significant (β=0.39), with the 95% bootstrap confidence interval [0.24, 0.61] not containing zero. This statistically reliable indirect path, coupled with the remaining significant direct path, fulfilled the condition for partial mediation.

The findings confirm that Overall participation in learning activities (OPLA) significantly mediate the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA). Students with higher self-efficacy are more likely to engage in effective and interactive learning processes (Path a: β=0.79, p<.01), which in turn leads to improved acquisition of critical 21st-century skills such as communication, collaboration, and critical thinking. Thus, hypothesis Ha4 is accepted. The finding of partial mediation was further supported when examining the specific learning activities promoted by the Competency-Based Curriculum (CBC): Inquiry-Based Learning (IBL): IBL was found to partially mediate the SE–GSA relationship. The total effect of SE on GSA (β=0.68) was

significantly reduced upon including IBL as a mediator, decreasing the direct effect to β=0.48, p<.01.

The indirect effect through IBL (β=0.19) was statistically significant. Problem-Solving Based Learning (PBL): PBL also demonstrated partial mediation. The inclusion of PBL reduced the direct effect of SE on GSA from β=0.68 to β=0.46, p<.01, alongside a statistically significant indirect effect (β=0.22). Teacher Support (TS): Teacher Support, conceptualized as a learning activity component, similarly showed partial mediation. The direct effect of SE on GSA was reduced from β=0.68 to β=0.47, p<.01 when TS was accounted for, with a significant indirect effect (β=0.21). In summary, the results consistently affirmed that Participation in Learning Activities (PLA) serve as a crucial, but not exclusive, mechanism by which self-efficacy translates into generic skill acquisition in lower secondary Biology lessons. The results of this analysis are presented in Table 10.

Table 10: Mediational effects of overall participation in learning activities (OPLA) on the relationship between the self-efficacy (SE) and generic skills acquisition (GSA)

Model	Outcome Variable	Independent Variable	β	t	p	R	R^2	F	SE	Bootstrap LLCI	Bootstrap ULCI
1	PLA (MV)	SE (Y)	0.79	10.96		0.53	0.28	120.06	0.07	0.6479	0.93
2	GSA (Y)	SE -PLA	0.29	4.17	<.01	0.68	0.46	126.99	0.07	0.1514	0.42
3		PLA	0.50	10.76	<.01				0.05	0.4090	0.59
Total Effect	GSA	SE	0.68	9.99	<.01	0.50	0.25	99.91	0.07	0.5476	0.81
Direct Effect	GSA	SE	0.29	4.17	<.01				0.07	0.15	0.42
Indirect Effect	GSA	PLA (via SE)	0.39	-	-	-	-	-	0.09	0.24	0.61

*Based on 5000 bootstrap samples. **. Correlation is significant at the 0.01 level.*

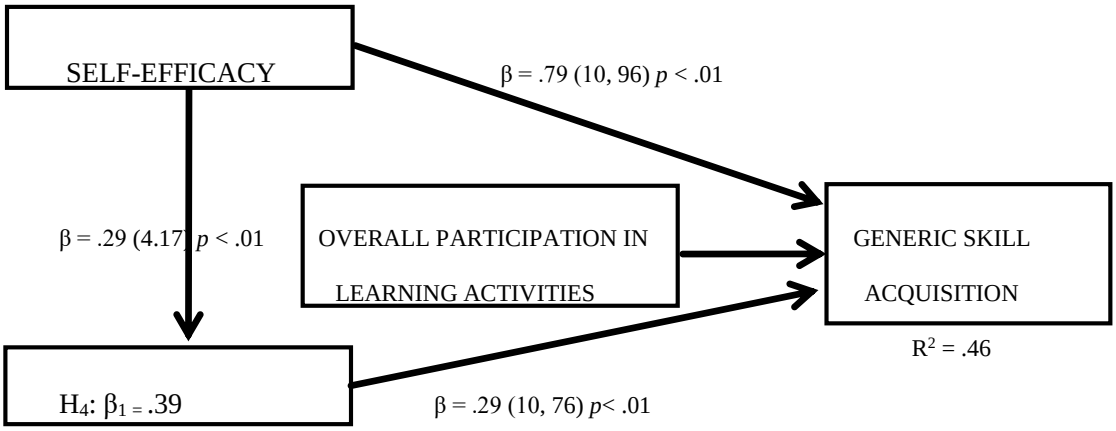
The analysis demonstrates a clear and significant mediating effect of Overall participation in learning activities (OPLA) on the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA): In Model 1, the path from SE to PLA yielded a strong and significant coefficient ($\beta = 0.79$, $t = 10.96$, $p < .01$), with an R^2 of 0.28, indicating that self-efficacy accounts for 28% of the variance in student learning activities. This confirms that students with higher levels of self-efficacy are more likely to actively engage in meaningful learning experiences. In Model 2, when both SE and PLA were entered as predictors of GSA, both emerged as significant contributors. SE retained a direct effect ($\beta = 0.29$, $t = 4.17$, $p < .01$), while PLA demonstrated a stronger mediating effect ($\beta = 0.50$, $t = 10.76$, $p < .01$). The overall model explained 46% of the variance in GSA ($R^2 = 0.46$), suggesting a robust joint influence of both predictors.

The total effect of SE on GSA prior to including PLA in the model was substantial ($\beta = 0.68$, $p < .01$), confirming a strong association. However, upon accounting for the mediating role of PLA, the direct effect of SE decreased to 0.29, providing clear evidence of partial mediation. Most notably, the indirect effect of SE on GSA via PLA was statistically significant ($\beta = 0.39$), with the 95% bootstrap confidence interval [0.24, 0.61] not containing zero, which satisfies the condition for mediation. This supports the interpretation that OPLA serves as a crucial mechanism by which self-efficacy influences skill acquisition.

The findings confirm that Overall participation in learning activities (OPLA) significantly mediate the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA). Students with higher self-efficacy are more likely to engage in effective and interactive learning processes, which in turn leads to improved acquisition of critical 21st-century skills such as communication, collaboration, and critical thinking.

Thus, hypothesis Ha4 is accepted. This result underscores the pedagogical importance of designing curricula that simultaneously cultivate learners' self-efficacy and promote rich, student-centered learning activities. Strengthening these areas can considerably enhance students' readiness for academic success and lifelong learning in Uganda's competency-based education system.

Model 1



05% bootstrap (0, 24, 0, and 61)

Figure 4: Mediational effects of overall participation in learning activities (OPLA) on the relationship between the self-efficacy (SE) and generic skills acquisition (GSA). Model 1: SE predicts OPLA significantly (β = 0.79, R^2 = 0.28). That is, self-efficacy explains 28% of the variance in student learning activities. Model 2: Both SE and OPLA predict GSA. OPLA has a stronger effect (β = 0.50) than the remaining direct effect of SE (β = 0.29). Together they explain 46% of the variance in GSA. Mediation: The total effect of SE on GSA (β = 0.68) reduces to a direct effect of β = 0.29 once OPLA is included. The indirect effect via OPLA (β = 0.39) is significant, confirming partial mediation. Hypothesis (Ha4) is accepted OPLA significantly mediates the SE–GSA relationship. Thus, promoting both

self-efficacy and engaging learning activities is essential for 21st-century skill development.

Table 11: Mediational effects of overall participation in learning activities (OPLA) on the relationship between the self-efficacy (SE) and generic skills acquisition (GSA)

Model	Outcome Variable	Independent Variable	β	SE	t	p	R	R^2	F	df1	df2	Bootstrap LLCI	Bootstrap ULCI
1	IBL	SE	0.29	0.03	9.92	<.01	0.49	0.25	98.49	1.00	299.00	0.23	0.34
2	GSA	SE	0.48	0.08	6.43	<.01	0.56	0.31	68.20	2.00	298.00	0.34	0.63
		IBL	0.68	0.13	5.25	<.01						0.43	0.93
3	GSA	SE	0.68	0.07	9.99	<.01	0.50	0.25	99.90	1.00	299.00	0.55	0.81
Total Effect	GSA	SE	0.68	0.07	9.99	<.01						0.55	0.81
Direct Effect	GSA	SE	0.48	0.08	6.43	<.01						0.34	0.63
Indirect Effect	GSA	IBL	0.19	0.07								0.09	0.37

*Based on 5000 bootstrap samples. **. Correlation is significant at the 0.01 level.*

Table 11 presents the results of a mediation analysis aimed at examining whether Inquiry-Based Learning (IBL), conceptualized here as a proxy for Overall participation in learning activities (OPLA), significantly mediates the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA). The analysis is grounded in the three-step mediation framework and incorporates bootstrap estimates (5,000 resamples) to confirm the significance of indirect effects. Model 1 investigates the first leg of the mediation pathway by regressing IBL on SE. The results demonstrate a statistically significant and positive relationship ($\beta = 0.29$, SE = 0.03, $t = 9.92$, $p < .01$), with SE accounting for 25% of the

variance in IBL ($R^2 = 0.25$, $F = 98.49$, $df = 1, 299$). The 95% bootstrap confidence interval (LLCI = 0.23, ULCI = 0.34) excludes zero, confirming the strength and reliability of this pathway. Model 2 tests the direct and mediating effects of SE and IBL on GSA. Both predictors are statistically significant. Self-efficacy remains a significant direct predictor of GSA ($\beta = 0.48$, $SE = 0.08$, $t = 6.43$, $p < .01$), and IBL also demonstrates a robust effect on GSA ($\beta = 0.68$, $SE = 0.13$, $t = 5.25$, $p < .01$), with the overall model explaining 31% of the variance in GSA ($R^2 = 0.31$, $F = 68.20$, $df = 2, 298$).

The bootstrap confidence intervals for SE (0.34–0.63) and IBL (0.43–0.93) confirm the statistical significance of both pathways. Model 3 reports the total effect of SE on GSA prior to the inclusion of IBL in the model. The path remains statistically significant ($\beta = 0.68$, $SE = 0.07$, $t = 9.99$, $p < .01$), accounting for 25% of the variance in GSA ($R^2 = 0.25$). Upon including IBL as a mediator, the direct effect of SE on GSA decreases to $\beta = 0.48$, indicating a partial mediation. The indirect effect of SE on GSA through IBL is $\beta = 0.19$ ($SE = 0.07$), with a 95% bootstrap confidence interval [0.09, 0.37], which does not include zero thereby confirming the significance of the mediation effect. The findings clearly support hypothesis Ha4: Inquiry-Based Learning significantly mediates the relationship between Self-Efficacy and Generic Skills Acquisition. The reduction in the direct effect of SE on GSA from $\beta = 0.68$ to $\beta = 0.48$ upon the inclusion of IBL, coupled with the statistically significant indirect effect ($\beta = 0.19$), demonstrates that a substantial portion of SE's influence on skill development is transmitted through students' engagement in inquiry-driven learning activities.

These results emphasize the pedagogical value of integrating student-centered, inquiry-based methodologies within curricula. Strengthening students' self-efficacy can lead to increased engagement in meaningful learning processes, which in turn enhances the

acquisition of essential 21st-century competencies such as collaboration, team work, and critical thinking.

Interpretation Summary of the Mediation Model

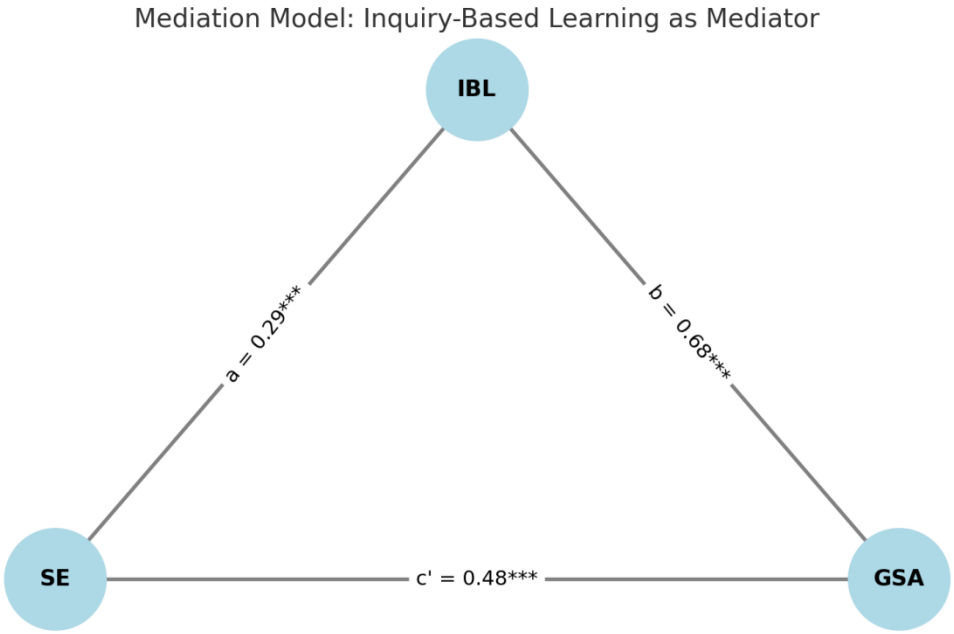


Figure 5: Mediational effects of inquiry-based learning (IBL) on the relationship between the self-efficacy (SE) and generic skills acquisition (GSA)

The mediation analysis investigated whether Inquiry-Based Learning (IBL) significantly mediates the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA). Results from the three-step model, supported by bootstrap estimates (5,000 resamples), and confirmed a partial mediation. Self-efficacy significantly predicted IBL ($\beta = 0.29$, $p < .01$), indicating that students with higher confidence in their capabilities are more engaged in inquiry-based learning activities. Both SE ($\beta = 0.48$, $p < .01$) and IBL ($\beta = 0.68$, $p < .01$) were significant predictors of GSA, suggesting that both factors independently and jointly contribute to the development of generic skills.

The indirect effect of SE on GSA through IBL (β = 0.19, 95% CI [0.09, 0.37]) was significant, confirming the mediating role of IBL. The total effect of SE on GSA was initially strong (β = 0.68), but reduced upon the inclusion of IBL, which supports a partial mediation model. These findings validate hypothesis Ha2 and emphasize that enhancing students' self-efficacy encourages active participation in inquiry-based learning, which in turn significantly improves the acquisition of essential 21st-century skills such as team work, communication, and critical thinking.

Table 12: Mediational effects of problem-solving based learning (PBL) on the relationship between the self-efficacy (SE) and generic skills acquisition (GSA)

Model	Outcome Variable	Independent Variable	β	t	p	R	R^2	F	SE	Bootstrap LLCI	Bootstrap ULCI
1	PBL	SE	0.27	8.00	<. 01	0.42	0.18	64.02	0.03	0.20	0.33
2	GSA	SE	0.46	6.70	<. 01	0.61	0.37	88.41	0.07	0.33	0.60
3	GSA	PBL	0.83	7.61	<. 01	0.61	0.37	88.41	0.11	0.61	1.04
Total Effect	GSA	SE_ID	0.68	9.99	<. 01	0.50	0.25	99.91	0.07	0.55	0.82
Direct Effect	GSA	SE_ID	0.46	6.70	<. 01				0.07		
Indirect Effect	GSA	PBL	0.22						0.09	0.11	0.44

*Based on 5000 bootstrap samples. **. Correlation is significant at the 0.01 level.*

Table 12 presents the results of a mediation analysis conducted to examine whether team work Based Learning (PBL) significantly mediates the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA). The analysis follows a three-step mediation framework and incorporates 5,000 bootstrap samples to assess the significance and reliability of the indirect effects. Model 1 evaluates the relationship between SE and PBL.

The findings reveal a statistically significant and positive relationship ($\beta = 0.27$, $t = 8.00$, $p < .01$), indicating that a one-unit increase in SE is associated with a 0.27 unit increase in students' engagement in PBL activities. The R^2 value of 0.18 suggests that SE explains 18% of the variance in PBL. The 95% bootstrap confidence interval (LLCI = 0.20, ULCI = 0.33) does not include zero, confirming the robustness of this path. This result underscores the foundational role of self-efficacy in fostering student participation in team work learning contexts.

Model 2 assesses the direct impact of SE on GSA. The analysis indicates a significant positive effect ($\beta = 0.46$, $t = 6.70$, $p < .01$), with an R^2 value of 0.37. This implies that self-efficacy accounts for 37% of the variance in students' acquisition of generic skills. The confidence interval (LLCI = 0.33, ULCI = 0.60) confirms the statistical reliability of this pathway. These results demonstrate that SE has a direct influence on learners' development of critical skills such as team work, collaboration, and communication. Model 3 introduces PBL as a mediator and examines its direct effect on GSA. The path from PBL to GSA is strong and statistically significant ($\beta = 0.83$, $t = 7.61$, $p < .01$), with the same R^2 value of 0.37. The bootstrap confidence interval (LLCI = 0.61, ULCI = 1.04) confirms the strength of this effect. This finding shows that participation in PBL significantly enhances learners' acquisition of generic skills, emphasizing the pedagogical value of student-centered instructional strategies.

The total effect of SE on GSA, before accounting for PBL, is reported at $\beta = 0.68$ ($t = 9.99$, $p < .01$), with an R^2 of 0.25, indicating that SE alone explains 25% of the variance in GSA. When PBL is included as a mediator, the direct effect of SE on GSA decreases to $\beta = 0.46$, still statistically significant. The indirect effect of SE on GSA through PBL is $\beta = 0.22$, with a bootstrap standard error of 0.09 and a 95% confidence interval [0.11, 0.44],

which excludes zero. This provides strong evidence that the mediational effect is statistically significant. The analysis confirms that team work Based Learning significantly mediates the relationship between Self-Efficacy and Generic Skills Acquisition. The reduction in the direct effect of SE on GSA from $\beta = 0.68$ to $\beta = 0.46$ upon the inclusion of PBL, alongside a significant indirect effect ($\beta = 0.22$), supports a partial mediation model. These results validate and confirm the acceptance of the hypothesis under investigation.

In summary, the findings highlight that self-efficacy not only directly influences learners' acquisition of generic skills but also exerts an additional indirect influence through enhanced engagement in team work-based learning. This underscores the importance of fostering self-efficacy in educational settings, as it strengthens both active participation in learning processes and the acquisition of essential 21st-century competencies.

Summary Interpretation of the Mediational Model Effects of team work Based Learning

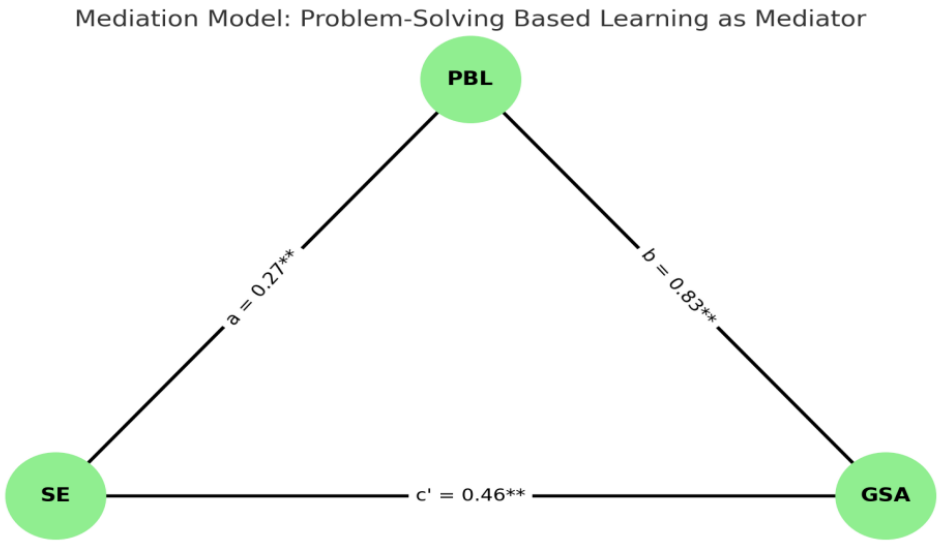


Figure 6: Mediational effects of problem-solving based learning (PBL) on the relationship between the self-efficacy (SE) and generic skills acquisition (GSA)

The mediation model illustrates that team work Based Learning (PBL) partially mediates the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA). The path from SE to PBL (β = 0.27**) indicates that students with higher self-efficacy are more likely to engage in PBL. In turn, PBL has a strong positive effect on GSA (β = 0.83**), highlighting its critical role in developing learners' 21st-century skills. The direct path from SE to GSA (β = 0.46**) remains significant even after accounting for the mediator, confirming partial mediation. These results demonstrate that while self-efficacy independently contributes to skill acquisition, its effect is significantly amplified through students' active engagement in team work learning experiences.

Table 13: Mediational effects of teacher support (TS) on the relationship between the self-efficacy (SE) and generic skills acquisition (GSA)

Model	Outcome Variable	Independent Variable	β	t	p	R	R^2	F	SE	Bootstrap LLCI	Bootstrap ULCI
1	TS	SE	0.23	6.65	<.01	0.36	0.13	44.19	2.87	0.17	0.30
2	GSA	SE	0.47	7.28	<.01	0.64	0.41	103.18	5.39	0.35	0.60
		TS	0.89	8.95	<.01				0.10	0.69	1.09
3	GSA	SE	0.68	9.99	<.01	0.50	0.25	99.91	5.56	0.55	0.82
Total Effect	SE	GSA	0.68	9.99					0.07	0.55	0.82
Direct Effect	SE	GSA	0.47	7.28	<.01				0.07	0.35	0.60
Indirect Effect			0.21						0.06	0.11	0.35

*Based on 5000 bootstrap samples. **. Correlation is significant at the 0.01 level.*

Table 13 presents the findings from a mediation analysis examining whether Teacher Support (TS) significantly mediates the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA). The analysis is based on three models and uses 5,000 bootstrap samples to assess the strength and significance of the mediation paths. Model 1 investigates the predictive effect of SE on TS. The results indicate a significant positive relationship, with a standardized coefficient of $\beta = 0.23$ ($t = 6.65$, $p < .01$), suggesting that a one-unit increase in SE leads to a 0.23 unit increase in teacher support perceived by students. This model explains 13% of the variance in TS ($R^2 = 0.13$, $F = 44.19$), with the 95% bootstrap confidence interval [0.17, 0.30] confirming the robustness of this pathway. These findings highlight the role of students' self-beliefs in eliciting greater support from their teachers.

Model 2 examines the combined effects of SE and TS on GSA. Both variables show statistically significant relationships with GSA. SE predicts GSA with $\beta = 0.47$ ($t = 7.28$, $p < .01$), while TS demonstrates an even stronger predictive effect with $\beta = 0.89$ ($t = 8.95$, $p < .01$). Together, these predictors account for 41% of the variance in GSA ($R^2 = 0.41$, $F = 103.18$). The bootstrap confidence intervals for SE [0.35, 0.60] and TS [0.69, 1.09] indicate high reliability in the effect estimates. These results underscore that while SE directly enhances generic skills, the support learners receive from teachers significantly amplifies this outcome. Model 3 focuses on the total, direct, and indirect effects of SE on GSA. The total effect of SE on GSA (prior to introducing TS as a mediator) is substantial and statistically significant ($\beta = 0.68$, $t = 9.99$, $p < .01$, CI: [0.55, 0.82]). After accounting for TS, the direct effect of SE on GSA is reduced to $\beta = 0.47$, which remains significant ($t = 7.28$, $p < .01$), indicating that SE still has a meaningful influence on GSA even when teacher support is considered. The indirect effect of SE on GSA through TS is $\beta = 0.21$,

with a standard error of 0.06 and a 95% bootstrap confidence interval [0.11, 0.35], confirming the mediating role of teacher support.

The results of this analysis provide strong empirical support for the hypothesis that Teacher Support significantly mediates the relationship between Self-Efficacy and Generic Skills Acquisition. The observed reduction in the direct effect of SE on GSA (from $\beta = 0.68$ to $\beta = 0.47$) upon inclusion of TS, alongside a statistically significant indirect effect ($\beta = 0.21$), confirms a partial mediation model. In conclusion, the findings demonstrate that while self-efficacy independently contributes to the development of generic skills, a significant portion of this influence is transmitted through the supportive behaviors and guidance offered by teachers. This has practical implications for educational interventions: fostering student self-efficacy, combined with strengthening teacher support systems, can significantly enhance the development of critical competencies such as communication, collaboration, and team work. Therefore, the hypothesis is accepted, and teacher support is affirmed as a meaningful mechanism in promoting student skill development through enhanced self-belief.

Summary Interpretation of the mediation Model of Teacher Support

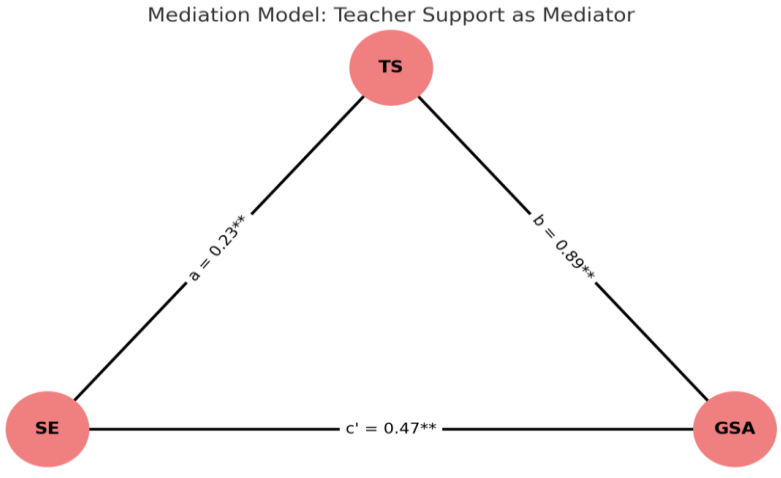


Figure 7: The mediation model showing Teacher Support as a mediator

The mediation model illustrates that Teacher Support (TS) partially mediates the relationship between Self-Efficacy (SE) and Generic Skills Acquisition (GSA). The path from SE to TS is significant (β = 0.23**), indicating that higher self-efficacy leads to greater perceived teacher support. In turn, TS strongly predicts GSA (β = 0.89**), emphasizing the pivotal role of supportive teaching in enhancing students' acquisition of critical skills. Although SE also directly influences GSA (β = 0.47**), the significant indirect effect through TS (β = 0.21) confirms that part of SE's impact on skill development is transmitted through the support learners receive from their teachers. These findings affirm the importance of cultivating both self-efficacy and a supportive learning environment to effectively promote generic skills acquisition.

Mediation Model Summary

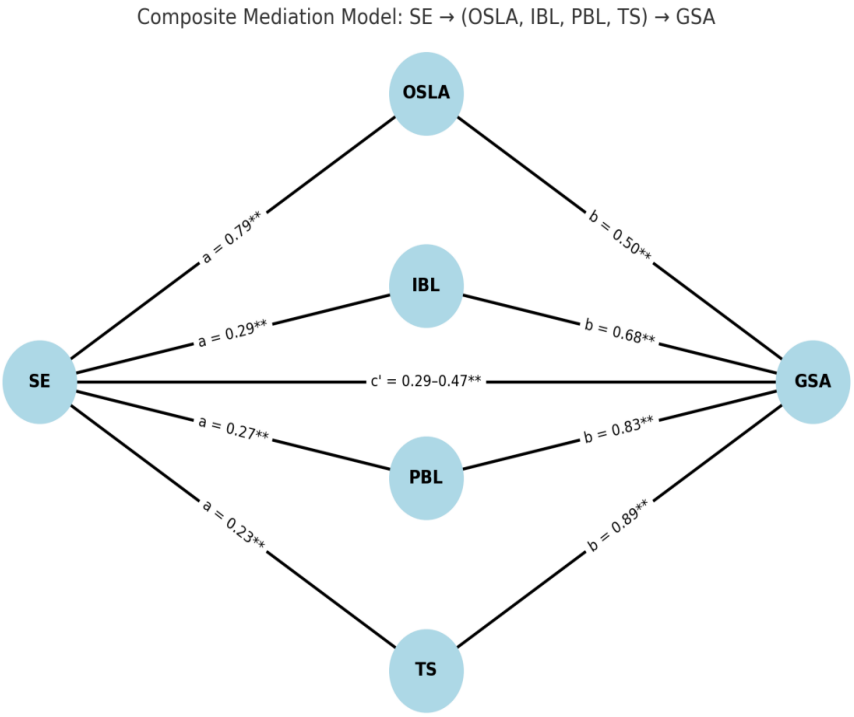


Figure 8: Mediation Effect of participation in learning activities on the Relationship between Self-efficacy and Generic Skills Acquisition

The mediation analyses conducted across the four models consistently confirm that Self-Efficacy (SE) significantly influences Generic Skills Acquisition (GSA) both directly and indirectly through distinct mediating mechanisms. In the first model, Overall participation in learning activities (OPLA) significantly mediated the SE–GSA relationship, with SE strongly predicting OPLA ($\beta = 0.79$, $R^2 = 0.28$), and both SE and OPLA jointly explaining 46% of the variance in GSA. The total effect of SE ($\beta = 0.68$) reduced to a direct effect of $\beta = 0.29$ when OPLA was included, confirming a significant indirect effect ($\beta = 0.39$) and supporting hypothesis Ha4. The second model, using Inquiry-Based Learning (IBL) as the mediator, also confirmed partial mediation: SE significantly predicted IBL ($\beta = 0.29$, $p < .01$), and both SE ($\beta = 0.48$) and IBL ($\beta = 0.68$) were significant predictors of GSA. The indirect effect ($\beta = 0.19$, CI [0.09, 0.37]) was significant, validating the mediational role of IBL and reinforcing the value of engaging pedagogies. Similarly, in the third model, team work Based Learning (PBL) served as a significant mediator. SE predicted PBL ($\beta = 0.27$**), which in turn had a strong effect on GSA ($\beta = 0.83$**), while SE still directly influenced GSA ($\beta = 0.46$**), confirming partial mediation.

Finally, the fourth model showed that Teacher Support (TS) also partially mediated the SE–GSA relationship: SE significantly predicted TS ($\beta = 0.23$**), and TS had a strong predictive effect on GSA ($\beta = 0.89$**), while SE retained a direct effect on GSA ($\beta = 0.47$**). In all cases, the total effect of SE on GSA was notably reduced when mediators were included, and all indirect effects were statistically significant. These findings collectively affirm that hypothesis Ha4 is supported across all models. They emphasize that fostering student self-efficacy alongside promoting engaging learning strategies (OPLA, IBL, and PBL) and strengthening teacher support plays a critical role in enhancing students' acquisition of 21st-century competencies such as collaboration,

critical thinking, communication, and team work. This provides new knowledge to the body of research.

4.5 The level of participation in learning activities designed for students during Biology lessons

Table 14: The analysis from objective one - the Teacher interview

Theme	Codes	Excerpts
Textbook and Syllabus Guidance	Textbook-based activities, Syllabus-driven activities, Library resource activities	"I go with what is in the textbooks provided by the Ministry of Education and Sports." (A) "I develop them from the syllabus specifically, the learning outcomes of the intended chapter." (F) "I normally use textbooks from the library." (E)
Collaborative and Group Learning	Group-based activities, Collaborative group work, Peer presentations, Collaborative sharing	"The teaching should be learner-centred. The teacher observes the learner work in their activities in groups." (C) "I support learners as they work in groups." (C) "I enjoy seeing my students discuss and present their work to their peers." (D) "I ask the students to share with fellow members in the department." (E)
Teacher Facilitation and Support	Teacher as facilitator, Independent student work, Critical thinking questions	"The teacher's role is to facilitate the teaching and learning process and where there are arguments, he/she harmonises." (B) "I enjoy seeing my students do work by themselves as just a facilitator." (C) "I ask them questions which instill thinking." (C)
Research and Inquiry Activities	Student research activities, Inquiry-based learning, Information searching	"Learners have to search information that makes them better other than just pouring knowledge on their heads." (B) "I develop them from the learning outcomes given in the syllabus and text books." (F)
ICT and Technology Integration	Internet-based activities, ICT-assisted learning, Technology-enhanced activities	"The activities are done using internet." (D) "We do research using computers and projectors." (F)
Real-life and Experiential Learning	Experience-based activities, Real-life application activities, Preparation of experiments	"I also design them from my experience and where the materials are not available, I use an alternative one." (B) "I develop them from the laboratory and learners' daily experiences." (F) "I use that free time to prepare the learner activities and experiments." (D)

Theme	Codes	Excerpts
Critical Thinking and Problem Solving	Critical thinking exercises, Analytical tasks, team work activities	"I ask them questions which instill thinking." (C) "Preparing for the activities brings about critical thinking." (B) "I enjoy giving them activities in class so that they do research." (F)

Note *A = Teacher A, B = Teacher B, C = Teacher C, D = Teacher D, E = Teacher E and F = Teacher F*

The findings presented in Table 14 offer insights into how teachers plan and implement participation in learning activities in lower secondary Biology lessons. Seven key themes emerged, illustrating a variety of instructional strategies aligned with Competency-Based Learning (CBL). Textbook and Syllabus Guidance emerged as the most foundational theme. Teachers indicated a strong reliance on government-issued textbooks and the national syllabus when designing lesson activities. For example: *"I go with what is in the textbooks provided by the Ministry of Education and Sports." (Teacher A). "I develop them from the syllabus specifically, the learning outcomes of the intended chapter" (Teacher F).* This reliance reflects a structured approach to content delivery that aligns with national educational expectations. As Udoma and Saliu (2021) argue, using standardized resources ensures consistency and curriculum fidelity.

Secondly, Collaborative and Group Learning featured prominently. Teachers employed group-based tasks to foster peer interaction and collective team work. One teacher observed: *"The teaching should be learner-centred. The teacher observes the learner work in their activities in groups." (Teacher C).* Such practices support students' communication and interpersonal skills an emphasis echoed by Brant et al. (2023), who highlight collaborative learning as a key factor in boosting engagement and self-expression. Under the theme Teacher Facilitation and Support, teachers described transitioning from

direct instruction to a facilitative role. One remarked: *"I enjoy seeing my students do work by themselves as just a facilitator." (Teacher C).* This reflects modern pedagogical trends where teachers act as guides while students explore concepts independently consistent with the work of Zaretsky and Kaminskaya (2020), who assert that facilitation enhances student autonomy and engagement.

Research and Inquiry Activities were also common, with teachers encouraging learners to explore content through investigation. As one teacher put it: *"Learners have to search information that makes them better other than just pouring knowledge on their heads" (Teacher B).* This supports Gonsalves et al. (2023), who argue that inquiry-based approaches stimulate analytical thinking and foster intrinsic motivation. When Teacher F was further probed about how ICT and technology were integrated into teaching and learning, it was revealed that digital tools were not only used for lesson delivery but also for promoting learner engagement and independent study. The teacher explained that learners were occasionally assigned tasks that required internet-based research, often in groups, to foster collaboration and critical thinking. For example, students were guided to search for scientific explanations, educational videos, and digital diagrams related to topics such as ecosystems, human body systems, or chemical reactions.

In addition, digital presentation tools like PowerPoint and interactive whiteboards were commonly used to break down complex concepts visually. Teacher F noted that using multimedia presentations made abstract ideas more tangible for learners, especially those with learning difficulties. It was also observed that students exhibited more enthusiasm and confidence when they were given opportunities to present their findings using digital tools, promoting both communication skills and ICT competence. Furthermore, Teacher F emphasized that access to the school's computer lab had significantly improved teaching

efficiency, particularly during revision sessions. The teacher remarked: *"Learners are excited when they see animations or simulations; it makes science come alive for them.*" However, Teacher F also acknowledged challenges such as unstable internet, limited digital devices for individual learners, and lack of technical support, which sometimes hindered consistent integration of ICT in lessons. According to Alrahabi (2022), such technology-enhanced learning environments enrich content accessibility and student engagement.

In addition, teachers embraced Real-life and Experiential Learning, connecting academic content with everyday experiences and practical work: *"I develop them from the laboratory and learners' daily experiences." (Teacher F).* Tare et al. (2024) emphasize that when learning is grounded in real-world experiences, students retain information better and apply it more effectively. Lastly, Critical Thinking and Problem Solving was integral to classroom practice: *"Preparing for the activities brings about critical thinking." (Teacher B).* This echoes Rahman and Iqbal (2022), who underline the importance of developing learners' capacity for analytical reasoning and solution-focused thinking.

In addressing Research Question 1, this analysis reveals that Biology teachers in lower secondary schools design a rich array of participation in learning activities grounded in both national curriculum requirements and learner-centered methodologies. The integration of collaborative work, critical thinking tasks, inquiry-based research, ICT, and real-life experiences underscores a shift toward Competency-Based Learning. These findings inform both pedagogical improvement and policy considerations for secondary education in Uganda.

Table 15: Observed participation in learning activities in Lower Secondary Biology Lessons (N = 6)

Learning Activity Type	Strong Presence	Moderate Presence	Limited/No Presence
ILO Alignment & Structure	TA, TB, TC, TD, TE, TF	–	–
Collaborative Learning	TA, TB, TC, TD	TE	TF
Group Discussions	TA, TB, TC	–	TD, TE, TF
Student Idea Contribution	TB, TC, TD, TE	–	TA, TF
Real-life Relevance	TB, TD	TA, TC, TE	TF
Creative Thinking	TD	TA, TB, TC, TE	TF
Critical Thinking	TB, TC, TD	TA, TE	TF
Skill Emphasis (e.g., Communication, Logic)	TB, TC, TD	TA, TE	TF
Mastery Attainment	TB, TC, TD	TE	TA, TF

The classroom observations revealed a high level of consistency in aligning teaching activities with Intended Learning Outcomes (ILOs), with all teachers demonstrating structured lesson delivery rooted in the Competency-Based Curriculum. This alignment reflects procedural fidelity to curriculum expectations as outlined by the National Curriculum Development Centre (NCDC, 2020) and further supported by Kyeyune et al. (2022). However, notable differences emerged in the quality and type of student-centered engagement. Teachers TA through TD exhibited a strong integration of collaborative learning, whereas Teacher TF showed no evidence of such activities. This is reflective of continued reliance on traditional, teacher-centered methods in some schools. As Nabukenya and Mugimu (2019) observe: *"Despite the adoption of a competency-based curriculum, many classrooms remain dominated by lecture-based instruction that limits learner participation."* (p. 73). Opportunities for group discussions and student idea

contribution were more prevalent in classrooms of TB through TE. These practices encouraged dialogic learning and positioned students as co-constructors of knowledge. For example, during one observation, a teacher prompted students: *"Share your group's ideas on how respiration supports growth in plants. Let's compare answers and critique each."* (Teacher TB, Field Notes). Such strategies echo the recommendations by Odeke and Ssenyonga (2021), who emphasize the importance of learner voice in promoting agency and ownership of learning.

Incorporation of real-life relevance and creative thinking critical for contextual learning and the development of generic skills was strongest in TB and TD's lessons. These teachers related biological content to students' environments through hands-on demonstrations, such as using local leaves to teach transpiration. This practice supports MoES (2019), which emphasizes relevance and practicality in curriculum design. In contrast, TF consistently failed to integrate these elements, reflecting concerns raised by Muwonge et al. (2020): *"Teacher preparedness and creativity remain uneven, leading to missed opportunities in fostering team work skills."* (p. 56). Further, the presence of critical thinking, communication, and mastery-oriented activities was most evident in the classrooms of TB, TC, and TD. These teachers encouraged reasoning, peer explanation, and iterative practice, which aligns with competency-based instructional expectations. For instance: *"Before we move on, tell me why the stomata closes during hot afternoons? Think critically don't just recall your notes"* (Teacher TC, Field Notes). Such probing reflects a shift toward deeper learning, as advocated by Bwanika and Tusiime (2023), who argue: *"Developing mastery in students requires deliberate scaffolding of cognitive skills through inquiry, dialogue, and reflective feedback"* (p. 88). Conversely, the minimal integration of these strategies by TA and TF suggests persistent challenges in transitioning from

knowledge transmission to competency development, consistent with observations by Ssempala and Kintu (2021).

In sum, while structural alignment with curriculum expectations was consistent across all observed classrooms, there was wide variation in pedagogical execution. Teachers TB, TC, and TD demonstrated stronger adoption of learner-centered, inquiry-based, and skill-enhancing activities, whereas Teachers TA and TF showed limited implementation of such practices. These findings suggest that the implementation of the Competency-Based Curriculum in Biology education remains uneven, particularly in terms of promoting creativity, critical thinking, and collaborative learning. The results call for targeted professional development, focusing on strengthening teachers' capacity to design and facilitate transformative learning experiences. As UNESCO (2023) notes: *"Teacher competence in facilitating student agency and higher-order thinking is essential to curriculum reform success."* (p. 19). The emerging patterns affirm the potential of Uganda's CBC but also reveal implementation gaps that need strategic support, particularly in classroom-level practices (Byaruhanga et al., 2024).

Integrated Interpretation of Interview and Observation Findings

The interpretation of both interview and classroom observation data reveals that while Biology teachers demonstrate strong alignment with the national syllabus and ILOs, the depth, quality, and variety of participation in learning activities vary considerably across classrooms. From both interviews and observations, it is clear that all teachers design activities directly informed by the national syllabus and textbooks. Teachers frequently cited: *"I go with what is in the textbooks provided by the Ministry of Education and Sports"* (Teacher A, Interview). This was consistently observed in the classroom, where all six

teachers (TA–TF) structured lessons clearly around stated ILOs, reinforcing strong procedural compliance with CBC expectations (NCDC, 2020; Kyeyune et al., 2022).

However, alignment alone does not guarantee the development of higher-order skills, as will be discussed below. When Teacher D was further probed about the strategies used to promote collaborative and inquiry-based learning, he elaborated that group discussions and student presentations were deliberately planned to enhance peer learning and build communication skills. He explained that during lesson planning, he often included activities such as think-pair-share, group debates, and mini-research tasks where learners would explore subtopics and present their findings to the class. According to his, these methods were intended to encourage critical thinking and teamwork among learners.

Nevertheless, when observations were conducted, it became evident that while the intention for collaborative learning was clearly articulated, its practical implementation was uneven. In the observed lesson, group activities were briefly introduced, but students were neither given sufficient time nor structured guidance to explore the tasks meaningfully. Groups were loosely formed, and interaction within them was minimal, with dominant students taking the lead while others remained passive. The session lacked follow-up questioning or scaffolding to support deeper inquiry, and presentations, where they occurred, were rushed and teacher-led rather than student-driven.

When these gaps were brought to Teacher D's attention during the follow-up discussion, he acknowledged the discrepancy and cited constraints such as large class sizes, limited time, and lack of training in managing collaborative activities effectively:

> *"Sometimes, I want to let them explore more, but with 80 students and 40 minutes, it becomes difficult to manage group work properly." (*Teacher D)

"Learners have to search for information that makes them better other than just pouring knowledge on their heads" (Teacher B, Interview).

This reflective response highlighted that while teachers like D are conceptually aligned with inquiry-based pedagogy, practical challenges and contextual constraints inhibit full realization of such approaches in the classroom. The gap between espoused theories and classroom practice underscores the need for ongoing professional development and institutional support.

These intentions were mostly confirmed through observations, where TB, TC, and TD integrated group discussions, inquiry tasks, and creative thinking into lessons. However, other teachers (especially TA and TF) showed limited student interaction, real-life relevance, or critical thinking, pointing to a disconnect between stated pedagogical beliefs and observed practice. Both sources of data suggest a partial transition to learner-centered teaching. Interview excerpts emphasized facilitation: *"The teacher's role is to facilitate... I enjoy seeing my students do work by themselves."* (Teacher C, Interview). These statements were corroborated in only some classrooms, where facilitation was evident in student-led discussions, project tasks, and teacher questioning. However, other lessons remained largely teacher-directed, with students functioning as passive recipients. As observed in TF's class, activities were minimal or lecture-based, contradicting the learner-centered claims made in interviews.

Teachers interviewed were generally aware of CBC expectations around generic skills like communication, teamwork, and critical thinking. However, the extent to which such skills were actively nurtured in practice varied. Observations showed that: TB, TC, and TD encouraged reasoning, team work, and mastery. TA and TF, by contrast, used fewer open-ended questions and gave limited opportunities for student autonomy. This confirms

Muwonge et al.'s (2020) findings that while CBC awareness is growing, effective application of skills-based activities remains uneven, often due to limited training or over-reliance on textbook routines. The integration of interview and observation findings for Research Question 1 reveals: Strong curriculum alignment across all teachers. Partial but inconsistent application of CBC-aligned pedagogies. Higher quality of participation in learning activities among teachers who blend curriculum structure with inquiry, collaboration, and reflection (TB, TC, TD). Minimal implementation of core CBC strategies by teachers such as TF, despite verbal awareness. These findings highlight the importance of moving beyond compliance with syllabus requirements to actively embedding creativity, team work, and learner agency into teaching practices. They also suggest the need for continuous professional development that helps teachers bridge the gap between pedagogical awareness and classroom implementation.

4.6 The level of acquisition of generic skills among students during Biology lessons

This section presents findings that address Research Objective Two: To assess the level at which students acquire generic skills during Biology lessons in lower secondary schools. The corresponding hypothesis was: *Ha2: Students acquire generic skills to a significant level during Biology lessons in lower secondary schools.* Qualitative data obtained from interviews with six Biology teachers (coded TA to TF) revealed recurring pedagogical themes associated with generic skill development. These themes include: Student Engagement, Inquiry and Investigation Skills, Hands-On Learning Experiences, Collaborative Teamwork, Effective Teacher Support, and Communication Skills Development. A summary of the findings is presented in Table 16, followed by a detailed thematic interpretation.

Table 16: Themes on Generic Skills Acquisition Based on Teacher Interviews (N = 6)

Theme	Description	Excerpts
Student Engagement	Activities where students present their work, share ideas, and participate in discussions.	"The students present their work." (Teacher A) "I encourage them while they are doing activities." (Teacher E)
Inquiry and Investigation Skills	Focus on students learning to investigate and inquire, developing critical thinking and team work abilities.	"Students observe, they inquire from one another and they also ask for help from the teacher." (Teacher C) "They give solutions to the identified challenges." (Teacher B)
Hands-On Learning Experiences	Emphasizes hands-on activities and experiments that promote practical application of knowledge.	"The students do hands-on activities. They touch and solve tasks when they are doing experiments." (Teacher C) "What normally happens is that they are solving a given question." (Teacher E)
Collaborative Teamwork	Highlights group dynamics, teamwork, and peer collaboration in learning activities.	"I group the learners and regroup them. This will enable them to learn better from the different abilities." (Teacher A) "I attend to them as groups work to find out where they are stuck." (Teacher B)
Effective Teacher Support	Covers the role of teachers in facilitating, guiding, and supporting student learning.	"I move around to see whether everyone is participating in the group activity." (Teacher D) "I move around as they are doing the activity. I also answer their questions." (Teacher C)
Communication Skills Development	Focuses on enhancing students' abilities to express themselves, engage in discussions, and manage time effectively.	"I give them the opportunity to express themselves." "I ask them to give their opinion about the question I ask them." (Teacher B)

Note: *T_A = Teacher A, T_B = Teacher B, T_C = Teacher C, T_D = Teacher D, T_E = Teacher E, T_F = Teacher F*

Student engagement emerged as a central factor in generic skill development. Teachers noted that encouraging students to present and discuss their work enhanced motivation and ownership. For example: *"The students present their work" (Teacher A).* Such practices foster responsibility and confidence, enabling students to play an active role in their

learning process. According to Freeman et al. (2014), active engagement enhances cognitive retention and learner agency, both of which are essential for competency-based learning environments.

Teachers emphasized activities that promoted investigation, questioning, and team work. These behaviors reflect the acquisition of critical thinking and inquiry skills. As Teacher C stated: *"Students observe, they inquire from one another and they also ask for help from the teacher."* This is reinforced by Teacher B's remark: *"They give solutions to the identified challenges."* These findings are consistent with Berg et al. (2018), who argue that inquiry-based learning fosters analytical reasoning and solution-oriented thinking both key generic skills in science education.

Hands-on learning was cited as a regular feature in Biology lessons, particularly through experiments and manipulation of materials. As observed by Teacher C: *"The students do hands-on activities. They touch and solve tasks when they are doing experiments."* This approach allows students to apply theoretical knowledge in practical contexts, which enhances concept mastery and team work, supporting Hattie's (2009) view that experiential learning deepens understanding. Teachers reported using grouping strategies to encourage teamwork, peer support, and shared team work. Teacher A explained: *"I group the learners and regroup them. This will enable them to learn better from the different abilities."* Such practices foster interpersonal communication and mutual support. Johnson and Johnson (2014) affirm that collaborative learning builds interpersonal competence, empathy, and teamwork skills vital for academic and life success.

Most of the teachers emphasized their role as facilitators who guide and support students during activities. Teacher D remarked: *"I move around to see whether everyone is participating in the group activity."* Such support ensures inclusivity, enhances student

confidence, and scaffolds complex tasks. Bandura (1997) posits that guided interaction enhances self-efficacy, which is foundational to learner motivation and skill development. Teachers created opportunities for students to express themselves and engage in discussion. Teacher B noted: *"I give them the opportunity to express themselves. I ask them to give their opinion about the question I ask them."* This instructional approach supports communication competence, encourages voice, and builds student confidence in academic discourse (Bruscia, 2014).

The evidence from teacher interviews suggests strong support for the hypothesis (Ha2) that students acquire generic skills to a significant level during Biology lessons in lower secondary schools. The observed emphasis on student engagement, inquiry, hands-on experiences, collaboration, and communication reflects an environment conducive to generic skill development. However, while the findings affirm the presence and value of these practices, the extent and consistency of implementation may vary across schools and individual teachers. This points to the need for continuous professional development focused on integrating generic skills explicitly and systematically within daily instruction.

The interview analysis demonstrates that Biology teachers in Uganda's lower secondary schools are adopting practices aligned with Competency-Based Education, with a significant focus on fostering generic skills among learners. The presence of learner-centered strategies particularly inquiry, teamwork, practical work, and communication indicates that teachers recognize the importance of these competencies in preparing students for real-life contexts. These findings offer strong qualitative support for the hypothesis and highlight the transformative potential of Biology education in nurturing 21st-century skills.

Table 17: The analysis from Objective Two - the Teacher Interview

Theme	Description	TA	TB	TC	TD	TE	TF
ILO-based Activity	Activity derived from Intended Learning Outcomes	Yes	Yes	Yes	Yes	Yes	Yes
Activity Aligned to ILO	Activity matches curriculum targets	Yes	Yes	Yes	Yes	Yes	Yes
Imitates Learning	Focus on recall and repetition	Yes	Yes	Yes	Yes	Yes	Yes
Instructed Learning	Teacher-directed with limited autonomy	Yes	Yes	Yes	Yes	Yes	Yes
Collaborative Learning	Peer/group work supporting cooperation	Yes	Yes	Yes	Yes	Limited	No
Evidence in Learning	Observable student-generated work	No	Yes	Yes	Yes	Yes	Yes
Group Discussion	Learner-to-learner dialogic exchange	Yes	Yes	Yes	No	No	No
Idea Suggestion	Student contribution of original ideas	No	Yes	Yes	Yes	Yes	Yes
Experience Sharing	Learners link prior experience to task	Yes	Yes	Yes	Yes	Limited	No
Present Findings	Students communicate learning outcomes	Yes	Yes	Yes	Yes	Yes	No
Creative Thinking	Tasks involve imagination/innovation	Moderate	High	Moderate	High	Moderate	Low
Ease of Activity	Students complete tasks comfortably	Yes	Yes	Yes	Yes	Yes	Yes
Explain Work	Learners explain task reasoning	Some	Yes	Yes	Yes	Yes	No
Defend with Evidence	Learners justify responses logically	Some	Yes	Yes	Yes	Partial	No
Perseverance	Students persist despite difficulties	Yes	Yes	Yes	Yes	Partial	Yes

Real-life Relevance	Learning linked to daily life issues	Weak	Strong	Moderate	Strong	Moderate	None
Control of Thinking/Action	Development of cognitive self-control	Yes	Yes	Yes	Yes	Yes	Yes
Transfer of Learning	Applying skills in novel situations	Yes	Yes	Yes	Yes	Yes	Yes
Generic Skill Development	Skills like communication, collaboration, creativity	Yes	Yes	Yes	Yes	Yes	Limited
Responsible Learning Environment	Positive, supportive class dynamics	Some	Yes	Yes	Yes	Yes	Yes
Value Teamwork	Peer respect and collaboration evident	Yes	Yes	Yes	Yes	Yes	Limited
Strategy Evaluation	Learners assess learning approaches	No	Partial	Yes	Yes	No	No
Info Evaluation	Judgment of sources used	Yes	Yes	Yes	Partial	Yes	Partial
Creativity	Original thinking during tasks	Low	Moderate	Moderate	Strong	Moderate	Low
Mastery Attained	Student proficiency observed	Partial	Strong	Strong	Strong	Moderate	Low
Reasoning Promoted	Teacher prompts critical thinking	Prompt	Inquiry	Why/How	Critical	Prompt	Prompt
Skill Emphasis	Key competencies targeted	Comm/Team	Sci. Reason	Peer Collab	Logical	Research	Research
Expected Product	Student-produced evidence	Notes	Reports	Reports	Practical Work	Notes	Notes
Critical Thinking	Use of analytical or evaluative thinking	Some	High	High	High	Moderate	Low
Communication & Teamwork	Peer interaction and expression	Yes	High	Yes	Partial	Limited	None

Note: T_A = Teacher A, T_B = Teacher B, T_C = Teacher C, T_D = Teacher D, T_E = Teacher T_E, T_F = Teacher F

Summary of Classroom Observation Findings on Generic Skills Acquisition

The classroom observation data reveal a generally moderate level of generic skills acquisition among students during Biology lessons in lower secondary schools. While all teachers aligned their instruction with the Intended Learning Outcomes (ILOs) of the curriculum, differences emerged in how these activities fostered the development of key generic skills such as critical thinking, creativity, collaboration, communication, and team work. Teachers such as TB, TC, and TD incorporated diverse pedagogical practices that supported learner-centered engagement. For instance, in TB's classroom, learners not only worked collaboratively but were observed explaining and defending their answers, engaging in discussions, and participating in tasks with real-life relevance. These behaviors reflect strong development of generic competencies and an active learning environment.

"They give solutions to the identified challenges." (Teacher B)

"I move around as they are doing the activity. I also answer their questions." (Teacher C). *"I group the learners and regroup them. This will enable them to learn better from the different abilities."* (Teacher A)

In contrast, teachers such as TA and TF relied more on structured and textbook-driven learning, with fewer opportunities for student voice, peer collaboration, or critical engagement. In these cases, student learning was heavily teacher-directed, which may inhibit the full development of generic skills, particularly those requiring autonomy, innovation, and metacognition. Notably, creativity, reasoning, and critical thinking were found to be most evident in classrooms where activities were open-ended or inquiry-based, particularly in TD's lesson. However, some teachers such as TF did not provide such opportunities, resulting in minimal demonstration of deeper cognitive skills.

"The students do hands-on activities. They touch and solve tasks when they are doing experiments." (Teacher C)

"I give them the opportunity to express themselves" (Teacher B).

The findings also point to a need for improved facilitation of communication and teamwork skills, especially in classrooms where group activities were conducted without true interaction or mutual responsibility. In such cases, students were often seated in groups but worked individually, limiting peer-to-peer learning.

The analysis of classroom observations demonstrates that while the curriculum provides opportunities for generic skill development, the extent to which these are realized depends significantly on the teacher's instructional approach. Lessons that encouraged inquiry, discussion, creativity, and real-world application created better conditions for students to acquire and demonstrate generic skills. Conversely, where instruction remained rigid, repetitive, or overly reliant on textbooks, students showed limited engagement in higher-order thinking and team work. Therefore, fostering generic skills acquisition in Biology lessons requires not only curriculum alignment but also intentional pedagogical shifts including facilitative teaching, reflective questioning, and collaborative learning strategies. The observations strongly suggest the need for continued professional development in learner-centered teaching methods to fully activate the competencies embedded in Uganda's Competency-Based Curriculum.

Interpretation of Interview and Observation Data: Objective Two

The qualitative findings from both teacher interviews and classroom observations provide valuable insights into how generic skills are being developed among learners during Biology lessons in Ugandan lower secondary schools. The interpretation draws from the

thematic analyses presented in Tables 16 and 17 are organized according to recurring themes and their significance in promoting or limiting generic skill acquisition.

From both interviews and observations, it was consistently found that teachers designed classroom activities based on the Intended Learning Outcomes (ILOs) stipulated in the national Biology syllabus. This ILO-driven planning ensured curriculum alignment, demonstrating that teachers understand the formal expectations for instruction. *"I develop them from the syllabus, specifically the learning outcomes of the intended chapter"* (Teacher F). While this alignment provides structure, it was observed that in many cases, the activities were textbook-based and heavily structured, offering limited opportunities for creativity or higher-order thinking. Teachers TA and TF, for instance, were found to follow prescriptive routines, which prioritized content coverage over deeper skill development.

Interview responses and classroom observation data both affirmed that student engagement was a consistent aim across classrooms. Teachers reported using group work, experiments, and presentations to involve students actively in lessons. *"The students present their work"* (Teacher A). *"I group the learners and regroup them… to learn better from different abilities"* (Teacher A). Classroom observations confirmed these efforts, particularly in the lessons of Teachers B, C, and D. Here, students engaged in group discussions, shared ideas, presented findings, and exhibited persistence indicators of growing academic self-efficacy and social learning competencies.

A notable finding from both sources is the use of inquiry-based and team work activities to build critical and analytical skills. Teachers encouraged students to ask questions, conduct investigations, and arrive at their own conclusions. *"Students observe, they inquire from one another and they also ask for help from the teacher"* (Teacher C).

These skills were most visible in the lessons of Teachers B, C, and D, where students were observed justifying their responses and applying concepts to real-life situations. However, in classrooms led by TA and TF, inquiry was minimal, and lessons relied more on factual recall than exploration.

Teachers described and were observed facilitating hands-on experiments and activities to help students apply theoretical concepts. These activities supported experiential learning, especially in TB's and TD's classrooms, where students were involved in preparing solutions, collecting results, and explaining outcomes. *"They touch and solve tasks when they are doing experiments"* (Teacher C). Despite this, in classrooms where practical activities were either absent or superficial (e.g., TF), students showed limited evidence of transferring knowledge beyond the lesson.

Both interviews and observations underscored the use of group work and peer collaboration. Teachers indicated intentional grouping and monitored peer interactions. *"I attend to them as groups work to find out where they are stuck"* (Teacher B). *"I move around to see whether everyone is participating"* (Teacher D). Observationally, however, the quality of collaboration varied. In TB and TC's lessons, peer interaction was rich and purposeful. In contrast, TF's class showed nominal group work, where learners sat together but worked individually limiting teamwork, communication, and peer learning.

The development of critical and creative thinking was evident but inconsistent. Where open-ended tasks were used such as in TD's class students demonstrated higher levels of reasoning, team work, and innovation. *"I ask them to give their opinion about the question I ask them"* (Teacher B). However, in classrooms like TF's, thinking was constrained to procedural recall, suggesting a missed opportunity to nurture students' intellectual independence and imagination.

Findings from the teacher interviews and classroom observations suggest that generic skills acquisition is moderately realized in Biology lessons. While most teachers align instruction with curriculum outcomes and strive to engage students through active and collaborative tasks, the depth of skill development depends largely on the teacher's approach and ability to foster autonomy, inquiry, and creativity. Strong practice examples (TB, TC, and TD) incorporated inquiry, peer learning, real-life application, and student voice conditions that foster self-efficacy and transferable competencies. Weaker examples (TA, TF) adhered to ILOs but offered less opportunity for student-led activity, critical reflection, or creative expression.

The analysis of classroom observations and teacher interviews revealed a range of student learning activities, including textbook-based drills, group discussions, inquiry projects, and real-life applications. These findings align with those of Audo and Kibedi (2025), who similarly reported a reliance on textbook instruction alongside collaborative learning and hands-on practical tasks in Ugandan schools. In conclusion, the observed teaching practices partially fulfill the requirements for generic skill acquisition in a competency-based framework. To enhance outcomes, there is a need for professional development in learner-centered pedagogies, including strategies for promoting critical thinking, creativity, collaboration, and student reflection.

4.7 The Level of Student Self-Efficacy (SE)

This section presents the descriptive findings related to the third study objective: *To assess the level of student self-efficacy (SE), encompassing academic and self-regulatory dimensions, among students during Biology lessons in lower secondary schools.* Self-Efficacy (SE), conceptualized as the learner's conviction in their ability to organize and execute specific tasks required to achieve desired outcomes (Bandura, 1997), was

measured using an adapted version of the Self-Regulatory Self-Efficacy (SSE) Scale (Semilarski et al., 2019).

Descriptive Findings of Self-Efficacy Levels

The quantitative analysis was based on responses from 301 students. The Self-Efficacy construct was divided into two sub-dimensions: Academic Self-Efficacy (ASE) and Self-Regulatory Self-Efficacy (SSE). Results indicated that students demonstrated a moderate-to-high level of confidence in their academic and self-management capabilities, with an overall mean score of M = 80.72, SD = 10.85. The sub-constructs yielded almost identical means: ASE (M = 41.13, SD = 8.49) and SSE (M = 41.09, SD = 7.57), suggesting a balanced confidence in both task performance and self-regulation.

Table 18: **Overall Mean Score for Self-Efficacy**

Variable	N	Mean (M)	Std. Deviation (SD)
Academic Self-Efficacy (ASE)	301	41.13	8.49
Self-Regulatory Self-Efficacy (SSE)	301	41.09	7.57

Source: Researcher's Questionnaire Tool (2025)

The moderate-to-high SE levels align closely with the demographic profile of the respondents. As presented in Table 4, the majority of students were female (59.8%) and predominantly aged 15–16 years, a stage marked by cognitive maturity and social awareness that enhances learners' confidence and self-belief. Female students' high representation reflects the positive impact of increased access under the Universal Secondary Education (USE) policy and suggests growing confidence among girls in science-related learning tasks. This demographic trend may have contributed to the overall elevated SE scores, as adolescent girls increasingly demonstrate persistence, collaboration, and communication skills when engaged in competency-based and inquiry-oriented

Biology lessons. The age structure further supported self-efficacy development, as students in mid-adolescence typically exhibit greater metacognitive control, self-reflection, and willingness to take responsibility for learning critical elements of Self-Regulatory Self-Efficacy (SSE).

Qualitative Manifestation of Self-Efficacy Levels

Insights from teacher interviews and classroom observations provided deeper understanding of how demographic characteristics interacted to sustain high SE levels. As shown in Table 5, teachers demonstrated gender parity (50% male, 50% female), high experience (66.7% with over 11 years of teaching), and strong professional preparation (66.7% with bachelor's and 33.3% with master's degrees). Furthermore, half of the teachers had attended three or more national CBC trainings, equipping them with the pedagogical competence to design learner-centered, problem-solving activities that promote self-efficacy and skill development.

Teachers' demographic strengths particularly experience and training translated into effective classroom scaffolding, observed in their support for persistence, feedback provision, and monitoring of engagement during group tasks. Such professional maturity fostered environments in which students felt secure to take academic risks, defend their reasoning, and persevere through challenges. For instance, in practical Biology activities such as manure making, students' successful execution of procedures under guided supervision reinforced their Academic Self-Efficacy (ASE) through mastery experiences, while teachers' continuous encouragement and feedback sustained their Self-Regulatory Self-Efficacy (SSE).

Integrated Discussion

The interaction between student and teacher demographics thus created a synergistic context for self-efficacy development. The female-dominant, mid-adolescent student group provided a responsive learner base with developmental readiness for self-directed engagement, while the experienced, well-trained teaching force provided the pedagogical grounding necessary to nurture and sustain this confidence through participatory and competency-driven activities. This alignment between learner characteristics and teacher competence strengthened both academic and self-regulatory efficacy, ultimately facilitating meaningful participation in learning activities. Overall, the integrated findings indicate that the study population possessed a robust psychological foundation for active learning. The consistent moderate-to-high self-efficacy levels, supported by balanced teacher-student demographics, confirmed that self-efficacy functions as a pivotal enabler of participation in learning activities and the acquisition of generic skills such as communication, analytical reasoning, and collaboration.

4.8 The integration of quantitative and qualitative findings

The integration of quantitative and qualitative findings offers a robust understanding of how self-efficacy, learning activities, and teacher support contribute to students' acquisition of generic skills during Biology lessons in lower secondary schools. Drawing from both interviews and classroom observations, as well as statistical analyses of student data, the following key implications emerge. Self-efficacy was consistently recognized in both qualitative and quantitative strands as a foundational factor in student learning. In the classroom, it was observed through student persistence, active engagement, and the quality of their responses. Quantitatively, self-efficacy was found to directly predict both Participation in Learning Activities (PLA) and generic skills acquisition (GSA). This dual

validation suggests that students who believe in their ability to succeed are more likely to engage actively with learning tasks, ask questions, and explore content with confidence.

Therefore, fostering self-efficacy is crucial for promoting proactive, self-regulated learners. Participation in learning activities varied significantly in nature and implementation across classrooms. While some teachers emphasized textbook-based, structured drills, others introduced open-ended, inquiry-based projects. The qualitative findings revealed that activities were often teacher-initiated and differed in levels of creativity and collaboration. The quantitative analysis confirmed that PLA plays a strong mediating role in the relationship between self-efficacy and generic skills acquisition. This means that while students may feel confident, it is the nature and quality of learning tasks that determine whether this confidence translates into actual skill development. Thus, pedagogical design is key to unlocking the full potential of self-efficacy.

Generic skills acquisition, such as communication, critical thinking, and team work, was moderately observed in classrooms. It was most evident where teachers provided open-ended tasks, collaborative opportunities, and real-life applications. Quantitative findings reinforced this by showing that both self-efficacy and learning activities significantly predicted GSA. This confirms that effective acquisition of generic skills relies not just on students' beliefs but also on the instructional context in which they learn. A blend of personal motivation and active, skills-based pedagogy leads to optimal learning outcomes.

Teacher support emerged as a critical contextual variable. Although classroom observations showed mixed levels of teacher involvement, its importance was affirmed through qualitative data that highlighted teachers moving around, facilitating group work, and encouraging participation. Quantitatively, teacher support was a significant

independent predictor of GSA. This underscores that a supportive, responsive, and facilitative classroom environment enhances students' ability to apply what they have learned in meaningful ways. In conclusion, the QUAN-QUAL integration highlights that the development of generic skills is a multifaceted process shaped by personal factors (like self-efficacy), instructional strategies (learning activities), and environmental influences (teacher support). To realize the goals of competency-based education, interventions must be aligned across all three areas empowering students, designing engaging tasks, and equipping teachers to support learners effectively.

Summary of the integration of quantitative and qualitative findings

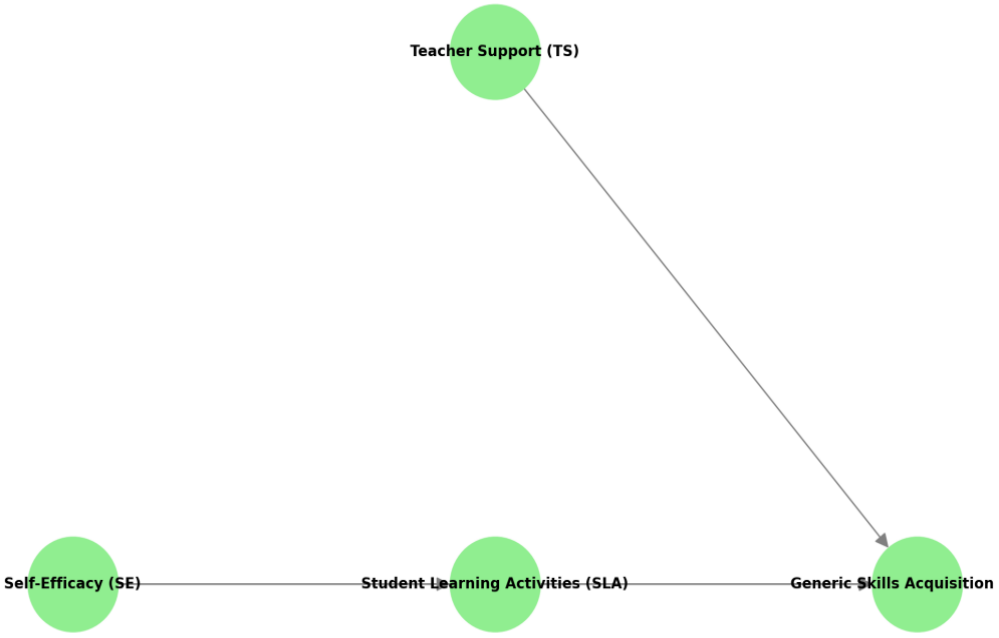


Figure 9: Summary of the integration of quantitative and qualitative finding

The QUAN-QUAL integration model visually represents the dynamic interaction among key constructs in the study Self-Efficacy (SE), Participation in Learning Activities (PLA), Generic Skills Acquisition (GSA), and Teacher Support (TS) as derived from both qualitative and quantitative findings. The model highlights that Self-Efficacy plays a

foundational role by directly influencing students' engagement in Student Learning Activities, and both directly and indirectly enhancing their Generic Skills Acquisition. The mediating role of PLA is critical; it serves as the bridge through which self-efficacy is translated into real competencies, especially when learning activities are inquiry-based, collaborative, and student-led. Moreover, Teacher Support emerges as a significant and independent predictor of GSA, emphasizing the value of a responsive and facilitative classroom environment. The integration of data shows that while the curriculum provides structure, the depth of learning and skill development is highly contingent on the teacher's ability to nurture self-belief, autonomy, and engagement through supportive, interactive pedagogies. This model, therefore, reinforces the conclusion that generic skill acquisition in competency-based Biology education is not merely a function of syllabus alignment, but a complex interplay of psychological, pedagogical, and contextual factors.

4.9 Interpretation of Study Results in Simple and Lucid Language

This section summarizes the quantitative and qualitative findings of the study in clear, simple language, focusing on the fundamental meaning of the statistical relationships and the mediating pathway, contextualized by the realities observed in Central Uganda's lower secondary Biology classrooms.

The Main Message: Belief Drives Action, and Action Builds Skill

The overall finding of this dissertation is straightforward: A student's belief in their ability (Self-Efficacy) is essential, but it is their active involvement in high-quality classroom tasks (Participation in Learning Activities) that actually converts that belief into demonstrable abilities (Generic Skills Acquisition).

1. The Foundation: Student Confidence is High and Necessary

The students surveyed possess a moderate-to-high level of self-efficacy (SE) (Overall M=80.72), meaning they generally feel confident in both their academic competence and their ability to manage their own learning, such as persisting when a task is difficult. Why it Matters: This self-confidence is crucial because the study confirms a significant, positive relationship between SE and Generic Skills Acquisition (GSA) (r=.500, p<.01). Simply put, students who believe they can succeed are indeed more likely to acquire key skills like critical thinking, communication, and teamwork.

2. The Engine: Active Learning Directly Builds Skills

The data clearly shows that active learning activities (PLA) are strongly and positively linked to generic skill acquisition (GSA) (r=.655, p<.01). What this Means: When Biology lessons involve structured activities such as inquiry-based investigations, group problem-solving, and practical experiments, students gain the real-world experience needed to master 21st-century skills. These hands-on tasks effectively serve as the engine for skill development, confirming the foundational approach of the Competency-Based Curriculum (CBC).

3. The Critical Bridge: How Belief Becomes Ability (Partial Mediation)

The most important finding is how these two factors work together. The study used statistical modeling (mediation analysis) to confirm that Participation in Learning Activities (PLA) acts as a crucial "bridge" between a student's self-efficacy (SE) and their final generic skills acquisition (GSA). The Chain of Influence: High self-efficacy motivates students to engage deeply in challenging learning tasks (PLA). It is this deep engagement in the practical tasks (PLA) that then physically develops and refines their skills (GSA). The Nature of the Bridge (Partial): The study found the mediation was partial. This means

that while PLA carries a significant portion of SE's influence to GSA (Indirect effect β=0.39), SE still has a meaningful direct influence on GSA that bypasses the quality of the immediate learning activity (Direct effect β=0.29).

4. The Reality Gap: Why the Bridge is Not Fully Complete

The partial nature of the mediation (why some of the skill development still happens outside the measured effect of PLA) is explained by the qualitative data gathered from teachers and classroom observations. Systemic Constraints: Teachers readily expressed intentions to use high-quality, student-centered methods (inquiry and collaboration), but they face significant practical barriers in government-aided USE schools. These challenges include large class sizes (e.g., 80 students) and limited lesson time (e.g., 40 minutes). Impact on Findings: These constraints often force teachers to limit student autonomy, rush group work, or revert to traditional, lecture-style instruction. This inconsistency means the learning activities were not always effective mediators, which is why the student's initial confidence (SE) retained a strong direct role in their skill outcome. If all learning activities were consistently high-quality, the effect of the mediator would likely have been much stronger, potentially leading to full mediation.

In simple terms, student confidence gives them the desire to run the race (SE), but the learning activities are the actual track they run on (PLA). If the track is poorly maintained or too short due to school constraints, they can’t fully translate their desire into performance, resulting in a partial outcome. This emphasizes the critical need for policy to support teachers in implementing consistent, high-quality learning activities to fully harness students' existing self-belief.

4.10 Chapter Four Summary

Chapter Four presents the analysis and discussion of the research findings regarding the impact of implementing participation in learning activities specifically inquiry-based learning and team work-based learning on self-efficacy (academic and self-regulatory) and generic skills acquisition (analytical skills, communication skills, and collaboration) among lower secondary school students in central Uganda during Biology lessons.

The chapter is divided into three main sections. The first section provides an overview of the respondents' profiles, including gender, age, level of education, and length of service. The second section focuses on presenting and analyzing the data, while the third section discusses the findings based on themes and sub-themes drawn from respondents' responses and classroom observations.

For qualitative data, the chapter explores the research objectives (1, 2&3) related to the level of participation in learning activities and the acquisition of generic skills during Biology lessons. The quantitative data analysis addresses the study's remaining objectives (4, 5, 6&7) and hypotheses, highlighting the relationships between student learning activities, self-efficacy, and generic skills acquisition. The chapter concludes by presenting results on descriptive statistics, variable relationships, and predicted and mediated relationships, offering insights into how participation in learning activities impact self-efficacy and skills acquisition.

CHAPTER FIVE

DISCUSSION, SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the comprehensive discussion, synthesis, conclusions, and recommendations derived from the study's integrated findings. The chapter commence by initiating an integrated discussion of the study's findings on the interrelationships among Self-Efficacy (SE), Participation in Learning Activities (PLA), and Generic Skills Acquisition (GSA) in lower secondary Biology lessons in Central Uganda. This discussion (Section 5.1) was systematically structured to align with the study objectives and hypotheses, utilizing findings drawn from both quantitative (student questionnaires) and qualitative (classroom observations and teacher interviews) data sources. Specific sub-sections detailed the discussion of the measured levels of PLA, GSA, and SE, followed by empirical analysis of the relationships between SE and PLA, SE and GSA, PLA and GSA, and, critically, the mediating role of PLA. The discussion ultimately explained how these psychological, pedagogical, and contextual variables interacted within the realities of the Universal Secondary Education (USE) classrooms.

Following the detailed discussion, the chapter provided a holistic Summary of Findings (Section 5.2), which synthesized the quantitative and qualitative results using the convergent parallel mixed-methods design framework. Based on this synthesis, the chapter formulated the Conclusions (Section 5.3), directly addressing the confirmed relationships and the achievement of the study objectives. Subsequently, the chapter presented pragmatic recommendations (Section 5.4), which were derived directly from the study's findings and targeted various stakeholders, including curriculum developers and teacher training institutions. The chapter concluded with a Final Reflection and

Areas for Further Study (Section 5.5), suggesting directions for future research, such as longitudinal studies to examine the sustained effects of self-efficacy and active learning strategies on generic skill development over time.

5.1 Discussion of the Findings

5.1.1 The Level of participation in learning activities During Biology Lessons

Participation in Learning Activities (PLA) reflected varying levels of alignment with the competency-based curriculum (CBC). Observations and interviews revealed a diverse mix of instructional practices textbook-based exercises, group discussions, inquiry-driven tasks, research projects, and ICT use. While some classrooms demonstrated vibrant, interactive learning environments, others remained largely teacher-centered and focused on rote content delivery. Quantitative results showed a relatively high level of student engagement ($M = 122.72$, $SD = 16.01$), with collaborative strategies like group discussions being especially common. These results are consistent with Brant et al. (2023), who underscore the benefits of peer collaboration for enhancing student engagement and communication.

The study's findings align with Valencia and Leung (2017), who found that active learning in Biology especially inquiry-based approaches contributed significantly to communication and self-regulation. However, while their European study was situated in high-resource schools, the current study extends this finding to low-resource Ugandan contexts, confirming that similar benefits can occur when learner-centered approaches are applied, even under constraints. Likewise, Ogunniyi and Rollnick (2019) reported that constructivist practices in South African science classrooms enhanced students' argumentation and teamwork. This study supports that finding, particularly in classrooms where guided inquiry and peer-led presentations were observed. However, while Ogunniyi and Rollnick emphasized teacher behavior,

the current study goes further by triangulating student engagement data with classroom observations and teacher interviews, thus capturing a broader picture of PLA implementation.

Abas and Imam (2020) found that practical science activities in the Philippines promoted communication and adaptability, yet their study was limited by its reliance on self-report data. The current study overcomes this limitation by using direct classroom observation tools and semi-structured teacher interviews, offering a more robust and triangulated insight into actual practice. From an East African perspective, Ndirangu et al. (2020) reported that group work and hands-on experiments in Kenyan Biology classrooms fostered collaboration and critical thinking. The current findings support this, especially in settings where student experimentation and teamwork were encouraged. However, Ndirangu et al. did not explore the mediating role of student learning activities this study adds new value by modeling PLA as a mediator between self-efficacy and skill acquisition, showing that activities are not merely supportive but instrumental in shaping learning outcomes.

In contrast, some findings from Kipkoech and Odhiambo (2021) who highlighted improved collaboration under activity-based instruction are only partially mirrored here. While collaboration was visible in some lessons, other classrooms observed in this study were still dominated by lecture-style delivery and textbook reliance, suggesting that the transition to activity-based learning is still uneven in Uganda's CBC implementation. This partial disagreement underscores the need for systemic teacher support and consistent pedagogy training. The study also reflects patterns observed by Chisikwa and Makokha (2022) in Tanzania, where integrating real-world group tasks enhanced decision-making and analysis. However, Chisikwa and Makokha did not examine how students' psychological readiness or self-efficacy

shaped engagement. The current study advances this by linking student beliefs to learning activity participation, indicating that without confidence in one's abilities, the full benefits of active learning may not be realized.

The policy-level insights from Klemenčič (2019), who highlighted the alignment between inquiry-based pedagogy and transferable skill development in European reforms, are echoed in this study. However, while Klemenčič emphasized curriculum design, this study focuses on practice, revealing how well (or poorly) curriculum intent is enacted in Biology classrooms. Local studies also confirm the current findings. Mugisha and Nkata (2023) found that group-based learning improved autonomy and communication in Ugandan CBC-aligned classrooms, though uneven instructional quality limited deeper inquiry. This study agrees and further reveals that teachers often express intentions to use active learning strategies, but actual implementation is constrained by time, large class sizes, and limited resources.

Similarly, Nampewo and Musoke (2024) observed that student-led investigations promoted critical thinking in Ugandan secondary schools but noted inconsistencies in pedagogical approaches. The present study builds on their work by showing that learning activities are not only important on their own but also mediate the relationship between self-efficacy and generic skills acquisition, a nuance that earlier studies missed. Lastly, the findings expand on Oyo and Musasizi (2022), who noted CBC's early impact on student responsibility and communication. While they did not disaggregate data by subject or explore psychological dimensions, this study narrows the focus to Biology and explores how student confidence (self-efficacy) and teacher facilitation influence how students engage with learning activities, offering a more complete view of the CBC's classroom impact.

Table 19: Summary of Agreement, Disagreement, and Extension with Literature

Literature Source	Agreement	Disagreement	Extension/Contribution
Brant et al. (2023)	Group work fosters engagement	—	Applied to Ugandan Biology context
Valencia & Leung (2017)	Inquiry enhances self-regulation	Their context was high-resource	Confirmed effects in low-resource settings
Ogunniyi & Rollnick (2019)	Inquiry promotes teamwork	Focused only on teacher behavior	Added student engagement and PLA as mediators
Abas & Imam (2020)	Practical science boosts adaptability	Lacked triangulation	Used mixed methods with observation and interviews
Ndirangu et al. (2020)	Group work promotes critical thinking	No mediation analysis	PLA modeled as a mediator
Kipkoech & Odhiambo (2021)	Activity-based learning improves collaboration	CBC implementation inconsistent	Explained why variation occurs
Chisikwa & Makokha (2022)	Real-world tasks support decision-making	Ignored learner psychology	Added self-efficacy as a shaping force
Klemenčič (2019)	Curriculum design supports skills	No learner/practice focus	Emphasized lived experience in Uganda
Mugisha & Nkata (2023)	Group learning builds autonomy	Limited reflective practice	Linked PLA to psychological factors
Nampewo & Musoke (2024)	Student-led inquiry builds skills	Inconsistent pedagogy across schools	Tested mediation and self-efficacy pathways
Oyo & Musasizi (2022)	CBC improves responsibility	No subject or psychology lens	Biology-specific and psychological focus

5.1. 2 The Level of Generic Skills Acquisition Among Students

Generic skills acquisition (GSA) including communication, critical thinking, and teamwork varied across classrooms. Teachers reported using group discussions, student presentations, and inquiry tasks to nurture these competencies. Observations confirmed that when students engaged in hands-on experiments, peer collaboration, and exploratory tasks, they demonstrated stronger application of generic skills. However, such practices were inconsistently implemented. Quantitative findings revealed

relatively high scores across all three key skills: teamwork (M = 42.73), critical thinking (M = 41.88), and communication (M = 40.67). Among them, critical thinking had the strongest correlation with overall GSA (r = .80), followed closely by teamwork (r = .79) and communication (r = .74). These outcomes align with Fisher et al. (2021), who argue that authentic learning tasks support deep skill development in competency-oriented systems.

However, qualitative data revealed ongoing gaps, particularly in creativity, reflective thinking, and real-world application, as some teachers continued to emphasize rote content delivery and standard textbook tasks. This partial disconnect between intended curriculum and observed instruction echoes concerns raised by Habimana and Uwitonze (2020) in Rwanda, who found that while CBC policy calls for inquiry-based learning, implementation remains weak due to limited resources and pedagogical capacity. These findings also agree with Kiplangat and Cheruiyot (2020), whose study in Kenya revealed that student-centered activities such as team tasks and peer teaching enhanced autonomy and conceptual understanding. Similarly, this study observed that teamwork and peer-led discussions created conditions for stronger interpersonal communication and collaborative problem-solving. The use of classroom observations here further validates Kiplangat and Cheruiyot's recommendation for real-time monitoring of CBC instructional practices.

Likewise, the study's observations support Mdee and Mwakasangula (2019), who documented that structured scenario-based group discussions and guided laboratory work enhanced motivation and participation. However, their study also noted pedagogical limitations, a theme echoed in this study, where some teachers lacked training to effectively scaffold inquiry and discussion. This validates the current study's methodological choice to incorporate teacher interviews, which revealed

teachers' limited professional development and varying understanding of CBC pedagogy. In Uganda, Kakuru and Tusiime (2021) found that learner-led presentations and classroom demonstrations improved communication and analytical thinking. The present study confirms these benefits, especially in classrooms where students shared investigative findings or presented group work. However, this study further extended those findings by showing that GSA levels were strongest in classes where teachers supported student autonomy while maintaining structure through inquiry scaffolds something not emphasized in the Kakuru and Tusiime study.

The current study also supports the findings of Ngugi and Wambua (2022), who highlighted the value of project-based learning and local resource use in promoting collaboration and engagement. However, while their study was largely survey-based and lacked qualitative depth, this study addressed that gap by triangulating observational data with teacher narratives, offering a more textured view of how specific activities foster specific skills. Further alignment is seen with Musoke and Balidawa (2023), who documented peer-led experiments and creative modeling activities that promoted self-expression and teamwork. These strategies were observed in classrooms with stronger GSA outcomes in the current study, reinforcing their effectiveness. However, not all classrooms demonstrated such innovative practices, pointing to inconsistent pedagogy across schools, a gap also noted by Akello and Nambalirwa (2024).

While Akello and Nambalirwa identified role-plays and group experiments as common in Biology CBC classrooms, they did not explore the measurable relationship between activity type and skill development. This study addressed that gap by incorporating quantitative analysis of GSA dimensions, revealing not only which activities are prevalent but which correlate most strongly with skill acquisition

especially critical thinking. The contrast with Korthagen et al. (2021), who studied CBC-aligned science instruction in Dutch schools, is also notable. Their findings showed that student debates, reflection journals, and lab-based tasks fostered advanced transferable skills. While the current study agrees in principle, it also underscores that resource-rich environments enable more consistent CBC implementation, whereas Ugandan classrooms face infrastructural and instructional constraints that moderate the effects of active learning strategies.

Table 20: Summary of Agreement, Disagreement, and Extensions with Literature

Study	Agreement	Disagreement	Extension/Contribution
Fisher et al. (2021)	Authentic tasks promote skills	—	Applied in a CBC Biology context in Uganda
Kiplangat & Cheruiyot (2020)	Teamwork and peer tasks improve understanding	—	Validated through observation, not self-report
Mdee & Mwakasangula (2019)	Scenario-based labs enhance motivation	Teachers lack scaffolding skills	Interview data added insight into teacher capacity
Kakuru & Tusiime (2021)	Presentations enhance communication	Did not show how autonomy matters	Found teacher-supported autonomy improves outcomes
Ngugi & Wambua (2022)	Local resources encourage collaboration	No qualitative depth	Triangulated with interviews and classroom evidence
Musoke & Balidawa (2023)	Peer experiments foster teamwork	—	Confirmed creativity gaps in some classes
Akello & Nambalirwa (2024)	Group experiments support CBC	Outcomes not measured	Linked activities to measurable GSA outcomes
Habimana & Uwitonze (2020)	Policy-practice gaps in CBC	—	Confirmed in Ugandan classrooms
Korthagen et al. (2021)	Inquiry and reflection build skills	Resource-rich context	Showed CBC is feasible with low-cost adaptations

The current study confirms that GSA is most effectively developed through open-ended, student-centered, and inquiry-based activities that promote autonomy and peer interaction. These findings strongly support international and regional literature advocating for CBC-aligned pedagogy, while also revealing implementation inconsistencies and teacher capacity gaps that hinder full skill development. By combining quantitative outcomes with rich classroom and teacher-level data, the study contributes a nuanced understanding of how generic skills can be strengthened within Uganda's CBC framework particularly in Biology education.

5.1.3 The Level of Student Self-Efficacy among Students

This section discusses the findings related to the third study objective: To assess the level of student self-efficacy (SE), encompassing academic and self-regulatory dimensions, among students during Biology lessons in lower secondary schools. Self-Efficacy, the independent variable in this study, is defined as the learners' belief in their ability to organize and execute the specific tasks required to achieve desired outcomes (Bandura, 1997). The descriptive quantitative analysis of the student sample (N=301) revealed that students possessed a moderate-to-high level of overall Self-Efficacy (SE), establishing a crucial psychological baseline for subsequent correlation and mediation analyses. The overall mean score for SE was M = 80.72 (SD = 10.85). This finding indicates that students generally hold a positive perception of their academic and social capabilities, confirming the existence of the internal motivational driver necessary for engagement in the challenging Competency-Based Curriculum (CBC) tasks.

A detailed examination of the two sub-constructs provided further clarity: Academic Self-Efficacy (ASE): The mean score was M = 41.13 (SD = 8.49). ASE reflects students' conviction in their competence at a given academic level and educational achievement (Ahmadi & Najafi, 2014). Self-Regulatory Self-Efficacy

(SSE): The mean score was M = 41.09 (SD = 7.57). SSE reflects confidence in managing learning behaviors, regulating actions, and persisting through challenges (Zimmerman & Schunk, 2011; Thompson & Jacue, 2017). The near identical mean scores for ASE and SSE suggested that students perceived their confidence in performing academic tasks and their ability to manage their own learning efforts as equally strong. This balanced self-perception is vital, as CBC demands both domain competence (ASE) and sustained personal management (SSE) during complex learning activities.

The quantitative finding of high SE was reinforced by qualitative data gathered through classroom observations and teacher interviews, which captured the behavioral manifestations of this confidence. According to Social Cognitive Theory (SCT), high self-efficacy is crucial for persistence and active participation (Bandura, 1986). Qualitative evidence of high Academic Self-Efficacy (ASE) was observed through students' willingness to engage in application and problem-solving: Observations noted that successful engagement in hands-on activities, such as manure making, directly reinforced competence, as students were described as "capable at solving scientific difficulties".

Students were also observed demonstrating the confidence necessary to articulate and justify their academic viewpoints, being able to "defend their standpoint using scientific evidence while doing a learning activity". Evidence of strong Self-Regulatory Self-Efficacy (SSE) was noted through persistence and self-management behaviors: Students were observed to "continue trying to solve a problem despite difficulties", reflecting the confidence needed to persist in demanding inquiry-based learning tasks. Furthermore, teacher interviews highlighted the critical role of support in maintaining SSE levels. Teacher B reported monitoring groups "to find out where

they are stuck", showing that teachers actively scaffolded students' self-regulatory beliefs when faced with challenges (Thompson & Jacue, 2017).

The findings confirm that students in lower secondary Biology lessons possess a robust psychological foundation (high SE) necessary to engage effectively with the demands of the CBC. This established level of self-efficacy is crucial because, as the subsequent analyses demonstrate, SE is not only a direct predictor of Generic Skills Acquisition (GSA) but is also the psychological fuel that drives active Participation in Learning Activities (PLA) (Zimmerman & Schunk, 2011). This high baseline of self-efficacy confirms the suitability of the sample for investigating the mediation hypothesis, supporting the proposition that when students believe in their capacity (SE), they are more likely to participate in the activities (PLA) required to translate that belief into demonstrable generic skills (GSA). This finding, therefore, sets the stage for the discussion of the correlational relationships and the mediating influence presented in the following sections.

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5.1.4 The Relationship between Self-Efficacy and Participation in Learning Activities

This study sought to examine the relationship between students' self-efficacy and their engagement in Competency-Based Curriculum (CBC)-aligned participation in learning activities in Biology. The first hypothesis (Ha1) that there is a significant positive relationship between self-efficacy and participation learning activities was supported.

Quantitative findings revealed a moderate positive correlation between overall self-efficacy (SE) and Participation in Learning Activities (PLA), with Pearson's $r = .54$ ($p < .01$). Notably, academic self-efficacy (ASE) exhibited stronger associations with inquiry-based learning ($r = .46$) and problem-based learning ($r = .37$) compared to social or self-regulatory self-efficacy (SSE), although both dimensions of self-efficacy positively influenced student participation in CBC-aligned activities such as group work, critical thinking tasks, and peer collaboration.

These findings affirm Zimmerman's (2020) proposition that self-efficacious learners are more persistent, resourceful, and engaged, especially when confronted with challenging tasks. The study demonstrates that both ASE and SSE are integral in shaping learners' participation in CBC contexts, with ASE playing a slightly more prominent role in activating deeper learning strategies such as inquiry and reflection.

Integration with Existing Literature

The current study's findings align with global evidence indicating the critical role of self-efficacy in fostering student engagement in active learning. For instance, Ainscough et al. (2017) found that self-efficacy increased among first-year Biology students exposed to active learning strategies a finding mirrored in this study's emphasis on inquiry and collaboration in the Ugandan lower secondary CBC context. Similarly, Aikens and Kulacki (2023) demonstrated that peer learning and group work enhance self-efficacy, reinforcing this study's conclusion that collaborative activities are positively associated with SSE. However, this study advances the literature by explicitly linking both ASE and SSE to CBC-aligned learning activities, a contribution not fully addressed in previous studies. For example, Bahçepınar and Karakaya (2023) confirmed a general correlation between self-efficacy and student engagement in

STEM but did not focus on the development of generic skills such as critical thinking or teamwork, which are core to CBC.

The current research bridges this gap by showing that students with high self-efficacy not only participate more but do so in ways that develop essential 21st-century skills. The study also builds upon regional findings. In Tanzania, Kiula (2020) observed that extracurricular learning enhanced students' communication and critical thinking skills by improving their self-efficacy. However, Kiula's research was limited to informal learning environments, while the present study provides empirical evidence from formal CBC-aligned classroom settings a contribution particularly valuable to education policymakers and curriculum implementers in East Africa. In the Ugandan context, Ekwutosi et al. (2022) showed that self-regulated learning strategies improve student achievement and interest in Biology, highlighting the importance of SSE. However, they did not account for academic self-efficacy or how both forms of self-efficacy jointly influence engagement in structured CBC activities. The current study addresses this gap by incorporating both ASE and SSE into the analysis and linking them to core CBC competencies.

Areas of Disagreement and Contribution

While the current study supports the central role of self-efficacy in engaging students, it contrasts with findings by Emenike and Okoli (2023) in Indonesia and South Africa, who focused more on external motivators (e.g., parental involvement) as drivers of student interest in Biology. Their studies did not sufficiently distinguish between ASE and SSE, nor did they explore these constructs within an explicit CBC framework. This divergence highlights the added value of the present study in unpacking the internal psychological drivers of engagement in competency-based learning environments. Furthermore, while much of the reviewed literature emphasized either ASE or general

self-efficacy, the current study makes a unique contribution by showing how both dimensions interactively influence participation in CBC learning practices, thereby reinforcing the need for holistic strategies to build students' confidence in both academic abilities and self-regulation.

5.1.5 The Relationship between Self-Efficacy and Generic Skills Acquisition

This study sought to investigate the relationship between student self-efficacy and the acquisition of generic skills specifically communication, critical thinking, and teamwork within the context of Uganda's Competency-Based Curriculum (CBC) in lower secondary Biology education. The results supported the second hypothesis (Ha2): There is a significant positive relationship between student self-efficacy and generic skills acquisition, with a Pearson correlation coefficient of $r = .50$ ($p < .01$) indicating a moderate relationship. Both academic self-efficacy (ASE) and self-regulatory self-efficacy (SSE) were moderately associated with the acquisition of specific skills, particularly critical thinking ($r = .35$), communication ($r = .33–.39$), and teamwork ($r = .25–.29$).

These findings align closely with Bandura's (1997, 2018) social cognitive theory, which posits that self-efficacy influences not only academic performance but also the development of cognitive and social competencies. The current results reinforce Schunk and Zimmerman's (2019) work, which emphasized that self-efficacy enhances students' motivation, effort, and persistence key behaviors required for developing 21st-century skills in learner-centered classrooms.

Agreement with Global Literature

The study's findings are supported by a range of international empirical studies. For instance, Hungnes et al. (2022) found that self-efficacy increased when students received strong teacher support, subsequently enhancing their engagement in

collaborative and cognitively demanding activities much like those observed in CBC-based Biology lessons. Similarly, Brokk et al. (2020) demonstrated that team-based learning in German Physics classrooms improved student self-efficacy and performance on tasks involving critical thinking and teamwork, corroborating the current study's finding that self-efficacy underpins engagement in similar skills-based activities. In Asia, Zheng (2022) and Li & Singh (2023) reported that enhanced student self-efficacy driven by teacher recognition and support was linked to greater participation in communication- and reasoning-oriented tasks. These findings agree with the present study's emphasis on the enabling role of SSE in communication and group learning.

Extension and Conceptual Contributions

While much of the existing research corroborates the link between self-efficacy and skill acquisition, most of it either lacks subject specificity or is situated outside the Biology classroom. The current study extends the literature by offering subject-specific, CBC-aligned evidence from Ugandan lower secondary Biology classrooms a critical gap in both African and global research. In particular, while Onwukeme (2023) explored the impact of self-efficacy on Biology achievement in Nigeria, the link to generic skills like communication or teamwork was not examined. Similarly, although Ayimbila et al. (2024) demonstrated that teachers with high self-efficacy promoted critical thinking, their study was teacher-centered and did not assess how student self-efficacy translated into actual skill acquisition. The present study complements and builds upon these findings by shifting the focus to learners themselves and quantitatively linking their self-beliefs to their observable participation in CBC-aligned activities.

Furthermore, while Mungasia et al. (2022) and Athuman (2022) in Kenya and Tanzania respectively, emphasized the role of teacher and institutional support in building student self-efficacy, they did not fully explore how this self-efficacy impacts specific 21st-century skills a gap that the current study directly addresses through its analysis of ASE and SSE in relation to critical thinking, communication, and teamwork.

Contextual Relevance and Divergence

Within Uganda, literature on self-efficacy and its impact on generic skill development remains sparse. While Nabunya and Ssewamala (2014) established a link between self-efficacy and general academic outcomes among vulnerable learners, they did not investigate skill-based outcomes within a CBC framework. The present study contributes localized, discipline-specific evidence by examining this relationship within real CBC Biology classrooms, thus filling an important contextual void in the literature.

Moreover, most previous studies focused predominantly on academic self-efficacy (ASE) alone. The inclusion of self-regulatory self-efficacy (SSE) in this study is a methodological strength that deepens our understanding of how students manage their learning behaviors, which are essential for engaging in inquiry-based and collaborative activities central to CBC implementation. Overall, the study confirms that both academic and self-regulatory self-efficacy significantly contribute to the acquisition of generic skills in CBC-oriented Biology instruction. It agrees with global and regional literature that underscores the importance of self-efficacy in fostering student engagement and success but goes further by offering context-specific, subject-focused evidence from Uganda. The findings advocate for deliberate instructional and institutional strategies such as scaffolded inquiry, meaningful feedback, and

emotionally supportive learning environments that build learner confidence and unlock their potential to thrive in competency-based education systems.

5.1.6 The Relationship Between participation in learning activities and Generic Skills Acquisition

The third hypothesis that Participation in Learning Activities (PLA) are positively associated with generic skills acquisition (GSA) was supported by the study's findings. A moderately strong and statistically significant correlation was found between PLA and GSA ($r = .655$, $p < .01$), indicating that increased participation in structured, interactive learning activities during Biology lessons contributes to students' acquisition of critical 21st-century skills, including critical thinking, communication, and teamwork. Further analysis revealed specific associations between key learning activities and skill domains: inquiry-based learning was strongly associated with critical thinking ($r = .42–.49$), teamwork-based activities were highly correlated with collaborative skill development ($r = .47$), and peer discussion and group presentations were moderately linked to communication skills ($r = .32–.38$). These results align with Gulbahar and Gungor (2023), who emphasized that active learning fosters deeper understanding and supports transferable skill development. The findings affirm the notion that student-centered pedagogies are essential in cultivating generic competencies central to Uganda's Competency-Based Curriculum (CBC).

Agreement with the Literature

This study confirms and extends global research on the link between active learning and skill acquisition. For instance, Castro and Andrade (2012) found that using a Social Learning Environment (SLE) in Chemistry promoted teamwork and communication, similar to how group projects and discussions in this study supported similar competencies in Biology. Likewise, Liu and Neuhaus (2017) highlighted pedagogical

approaches that encouraged divergent thinking in German Biology classes, underscoring the value of inquiry-based strategies in promoting critical thinking a result echoed in the current study.

At the African regional level, the study aligns with the findings from Rulindo District in Rwanda (Academia.edu, n.d.), where laboratory-based and experiential learning enhanced student engagement, collaboration, and critical analysis. This lends further support to the idea that hands-on, peer-driven activities are critical mechanisms for achieving generic skill outcomes, even in low-resource contexts. Additionally, this study builds on Nabaho (2017), who showed that problem-based learning (PBL) and role modeling at the university level contributed to collaborative and lifelong learning skills. The current findings suggest that these same approaches are also applicable and impactful at the lower secondary level, especially in subjects like Biology that naturally lend themselves to experimentation and cooperative inquiry.

Contribution and Advancement of Existing Knowledge

While prior studies have recognized the theoretical connection between student-centered learning and generic skills, few have empirically examined this relationship within a lower secondary Biology context particularly under Uganda's CBC framework. This study addresses that gap by using quantitative and qualitative data to show that students who actively participate in inquiry, team-based learning, and applied problem-solving are significantly more likely to acquire core generic skills. This represents a meaningful advancement in the field, offering context-specific evidence that supports CBC implementation goals.

Moreover, this study contributes uniquely by demonstrating how Biology, often taught didactically, can be transformed into a skills-oriented learning platform when student engagement strategies are intentionally designed and supported.

Areas of Disagreement or Divergence

While most studies affirm the importance of learning activities in skill acquisition, some gaps and limitations in previous research are addressed by the current findings. For instance, Kanaabi et al. (2023) reported that even with trained teachers in Kampala, systemic issues like lack of resources and difficult assessments inhibited effective implementation of CBC-aligned activities. Although these structural issues were also observed in some Ugandan classrooms during this study, the findings show that even within constrained environments, active and collaborative learning still has a significant impact on skill development if teachers adaptively use available methods and materials.

Similarly, Athuman (2022) found that Tanzanian Biology teachers' low self-efficacy hampered delivery of skill-based learning. In contrast, the present study reveals that where Biology teachers intentionally implement student-centered strategies, students demonstrate clear improvements in teamwork, communication, and analytical thinking. This suggests that teacher mindset and pedagogical planning can, to some extent, mitigate contextual limitations. The findings also go beyond Liu and Neuhaus (2017), who identified differences in instructional focus between German and Chinese Biology classrooms but did not measure skill acquisition. The current study contributes empirical evidence directly linking specific participation in learning activities to the development of measurable generic skills, thus filling a critical empirical gap in Biology education research.

This study confirms a strong and meaningful relationship between participation in learning activities and the development of generic skills during lower secondary Biology instruction. These findings validate CBC's emphasis on student-centered pedagogies and highlight the importance of continued teacher professional development, adequate classroom resourcing, and pedagogical innovation. To ensure

Biology instruction contributes not only to cognitive achievement but also to the development of communication, collaboration, and critical thinking skills, educational stakeholders must prioritize active, engaging, and contextually responsive learning designs.

5.1.7 Mediational Role of Participation in Learning Activities

This study examined whether Participation in Learning Activities (PLA) serve as a mediator between self-efficacy (SE) and generic skills acquisition (GSA) during Biology instruction in lower secondary schools. Mediation analysis using the PROCESS macro revealed that PLA partially mediated this relationship. Self-efficacy had both a direct effect on GSA ($\beta = 0.29$, $p < .01$) and an indirect effect through PLA ($\beta = 0.39$), thus confirming partial mediation. These results support the argument by Zhao and Zhang (2021) that engagement in learning activities is a critical pathway through which self-efficacy translates into skill acquisition.

Agreement with and Extension of Existing Literature

The findings align with a broad literature base that emphasizes the importance of experiential learning in activating self-efficacy and fostering skill development. For instance, Dumas et al. (2020) posit that learning activities are the context in which learners either reinforce or question their self-beliefs. The current study affirms this by showing that Biology learners with higher self-efficacy are more likely to engage in participatory activities such as group discussions, digital tasks, and scientific inquiry which in turn facilitate the development of communication, teamwork, and critical thinking.

Similarly, Borrachero et al. (2014) demonstrated in a Chemistry context that hands-on laboratory work enhanced students' emotional engagement and self-efficacy. Although their study did not measure generic skills directly, the current study extends

these findings by empirically linking hands-on and collaborative learning activities to actual skill acquisition in Biology, a subject with similar pedagogical opportunities for inquiry and real-life application. Schmid and Bogner (2017) also support this view, showing that constructivist learning environments in Biology education positively influenced prospective teachers' self-efficacy and instructional practices. The current study adds to this by shifting the focus from teachers to learners, demonstrating that such environments are not only empowering for educators but also for students, with tangible outcomes in skill acquisition.

Additionally, Luo et al. (2023) found in higher education settings that learning engagement mediated the relationship between self-efficacy and academic achievement. The current study affirms the same principle at the secondary level, within the CBC framework, reinforcing the mediating role of active learning in translating psychological confidence into observable competencies.

Contextual Contributions from the Ugandan and African Literature

Within the Ugandan context, the findings resonate with Namubiru (2019), who reported that learners engaged in group work and discussions showed heightened self-efficacy and academic performance. While her study did not focus on generic skills, the activities she documented inherently involved communication, collaboration, and critical thinking skills central to CBC goals. Ekatushabe et al. (2024) and Ssenyonga et al. (2022) further support the current study's findings by showing that cognitive activation strategies and digital learning tools not only improved self-efficacy but also encouraged critical thinking and self-regulated learning. These strategies integrated into Biology instruction in this study confirmed that PLA acts as a critical mediating bridge between student beliefs and skill outcomes.

Moreover, the study aligns with Adiyiah et al. (2020), who found that concept mapping, a structured student activity, significantly enhanced both motivation and self-efficacy in Biology learners. Similarly, the current study found that structured inquiry-based tasks, including concept mapping and problem-based activities, were effective mediators that supported the development of generic skills. In the East African context, Ongowo and Hungi (2014) observed that demographic factors influenced self-regulation and self-efficacy in Kenyan Biology classrooms but did not explore instructional mediators. The current study fills this gap by confirming that instructional design specifically the inclusion of rich learning activities is essential in translating internal learner attributes (like SE) into concrete skill development.

Divergences and Contributions beyond Existing Research

While many previous studies confirmed that self-efficacy correlates with learning outcomes, few have empirically tested the mediation effect of learning activities particularly within a Biology curriculum aligned to CBC. This study is distinct in its mixed-methods design and its focus on Uganda's lower secondary context, an educational level and subject area often underrepresented in skill-acquisition research. Furthermore, while Nabaho (2017) found that problem-based learning and role modeling promoted generic competencies in higher education, the current study extends these insights downward to the secondary school level, providing evidence that such strategies also work when adapted to younger learners in science classrooms.

Importantly, the study offers quantitative evidence of indirect effects something not provided in many prior qualitative or descriptive studies. It also incorporates teacher support as a mediating factor, showing that learners with high self-efficacy benefit more when exposed to facilitative and responsive teaching. This adds

nuance to existing frameworks by showing that mediation is not solely learner-driven; teacher practices amplify the effect of self-efficacy through learning design.

The findings affirm that participation in learning activities serve as a significant mediating factor between self-efficacy and the acquisition of generic skills during Biology instruction. Learners with high self-efficacy are more likely to engage in participatory tasks, and this engagement, in turn, enhances their development of critical thinking, communication, and collaboration skills. Thus, the Alternative hypothesis (Ha4) that participation in learning activities significantly mediate the relationship between self-efficacy and generic skills acquisition is accepted. These results underscore the dual importance of learner characteristics and instructional design in fostering 21st-century competencies. For Uganda's CBC to succeed, Biology lessons must be intentionally structured to activate student self-beliefs and offer opportunities for inquiry, interaction, and reflection. Teachers, therefore, need ongoing support to design and implement activities that bridge internal learner dispositions and externally valued competencies.

5.1.8 Integration of Quantitative and Qualitative Findings

The integration of data from teacher interviews, classroom observations, and student questionnaires revealed a complex and dynamic relationship between self-efficacy (SE), instructional strategies, and contextual factors influencing generic skills acquisition. Consistent with Bandura's (1997) theory, students with higher SE demonstrated greater persistence, active engagement, and self-regulation (Zimmerman, 2000), which were directly linked to stronger participation in Participation in Learning Activities (PLA) and improved generic skills acquisition (GSA). Quantitative analyses confirmed SE as a significant predictor of both PLA and GSA (Usher & Pajares, 2018; Schunk &

DiBenedetto, 2020), while qualitative data illustrated how these beliefs translated into behaviors such as initiative-taking, peer collaboration, and resilience in learning.

Learning activities functioned as a key mediating mechanism: PLA significantly mediated the relationship between SE and GSA, supporting Deci and Ryan's (2017) emphasis on autonomy-supportive environments. Classrooms that prioritized inquiry-driven, collaborative, and open-ended tasks fostered critical thinking, communication, and teamwork, echoing constructivist pedagogies recommended by Barron and Darling-Hammond (2008) and Trilling and Fadel (2009). Teacher scaffolding and feedback aligned with Vygotsky's (1978) Zone of Proximal Development theory, reinforcing the importance of guided support.

These findings closely align with Audo and Kibedi's (2025) qualitative study of lower secondary Biology classrooms, which highlighted textbook dependence, teacher-led group work, hands-on experiments, limited ICT integration, and real-world applications. Both studies observed that textbook-driven instruction constrained creativity and autonomy, while collaborative and experiential activities supported generic skill development and student motivation (Hattie, 2020). Similar challenges regarding ICT use limited by infrastructure and teacher training were also noted, reflecting a broader digital divide (UNESCO, 2022).

Despite policy mandates for student-centered approaches (NCDC, 2019), classroom observations revealed persistent teacher-centered practices, confirming concerns by O'Sullivan (2006) and Nakabugo et al. (2011) about barriers such as large class sizes and limited resources that hinder CBC implementation. The integrated evidence emphasizes that generic skills are best developed where students' beliefs, engaging pedagogies, and teacher support converge within enabling environments.

The combined findings validate the mediating role of PLA in linking self-efficacy to skill acquisition and underscore systemic constraints particularly in teacher capacity and infrastructure that affect pedagogy and technology use. Addressing these challenges through enhanced teacher training, resource investment, and promoting inquiry-based, ICT-supported learning environments is essential for successful competency-based education reform in Uganda and similar contexts.

5.2 Summary of Findings

This study investigated the influence of students' self-efficacy on their engagement in learning activities and the subsequent acquisition of generic skills within the context of Biology lessons. Employing a mixed-methods design, findings from both quantitative and qualitative strands were integrated using a QUAN–QUAL model. This integration framework visually and conceptually captured the dynamic relationships among four core constructs: Self-Efficacy (SE), Participation in Learning Activities (PLA), Generic Skills Acquisition (GSA), and Teacher Support (TS). The integrated findings reveal that self-efficacy serves as a foundational determinant, exerting both direct and indirect effects on students' acquisition of generic skills. Specifically, SE directly influences student engagement in PLA and enhances GSA both directly and via PLA. Participation in learning activities emerged as a significant mediator, operating as the mechanism through which students' beliefs in their capabilities are actualized into tangible skills particularly when the activities are inquiry-driven, student-led, and collaborative. Teacher Support, on the other hand, was identified as an independent and significant predictor of GSA, underscoring the importance of a facilitative, responsive, and supportive classroom environment.

Quantitative results showed a moderate positive correlation between SE and GSA ($r = .500$, $p < .01$), suggesting that students with higher confidence in their

academic abilities tend to acquire more essential generic skills. The mean self-efficacy score was 80.72, indicating a relatively high level of perceived competence among students, while the mean score for GSA was 124.21, reflecting a strong level of skill acquisition. Further analysis demonstrated strong positive correlations between the sub-components of self-efficacy Academic Self-Efficacy (ASE) and Self-Regulatory Self-Efficacy (SSE) and overall SE, with correlation coefficients of .857 and .810, respectively. Additionally, significant positive associations were observed between SE and the three key dimensions of generic skills: Critical Thinking (CT), Communication (Co), and Teamwork (TW).

Participation in learning activities were also moderately and positively associated with GSA ($r = .655$, $p < .01$). The mean PLA score stood at 122.72, indicating considerable student engagement in learner-centered practices. Regression analysis further confirmed the mediating role of PLA. While SE had a direct effect on GSA ($\beta = 0.29$, $p < .01$), it also exerted an indirect effect through PLA ($\beta = 0.39$), highlighting that active student participation significantly enhances the impact of self-efficacy on generic skill development.

5.3 Conclusion

Biology teachers in lower secondary schools utilize a diverse array of participation in learning activities (PLA), including inquiry-based learning and problem-solving based learning, in alignment with the goals of the Competency-Based Curriculum (CBC). Teachers reported relying heavily on both the national syllabus and textbooks to develop these activities and commonly incorporated methods such as collaborative group work, ICT integration, and real-life experiential learning. However, the study also revealed that the consistency and quality of PLA implementation remain uneven

across classrooms, often showing a gap between espoused learner-centered pedagogy and observed teacher-directed practices in some instances.

Students in lower secondary Biology lessons demonstrate a strong level of generic skills acquisition (GSA), particularly in core competencies such as teamwork, critical thinking, and communication. Qualitative findings indicate that this development is fostered when teachers deliberately design activities that include hands-on experiences, collaborative teamwork, inquiry-based investigations, and opportunities for self-expression and peer discussion. Conversely, in classrooms where instruction was rigid or overly reliant on repetition and factual recall, students demonstrated limited engagement in higher-order thinking or creative expression.

A significant positive relationship exists between student self-efficacy (SE) and generic skills acquisition (GSA), demonstrated by a moderate correlation coefficient of $r=.500$ ($p<.01$). This finding confirms that students who possess a higher belief in their ability to succeed academically and socially are more likely to acquire essential generic skills. This underscores the fundamental role of enhancing self-efficacy in instructional design and student support initiatives, as psychological confidence acts as a critical pathway to equipping learners with competencies required for team work, collaboration, and effective communication.

The study confirms a significant positive association between student self-efficacy (SE) and engagement in Participation in Learning Activities (PLA), with a correlation coefficient of $r=.535$ ($p<.01$). This relationship indicates that students with higher self-efficacy are significantly more likely to actively participate in challenging, inquiry-based, and collaborative learning tasks. Self-efficacy thus serves as an important psychological resource that supports learner motivation and ensures active classroom participation, which is essential for successful implementation of the CBC.

A moderately strong and significant positive relationship exists between Participation in Learning Activities (PLA) and generic skills acquisition (GSA), established by a correlation coefficient of $r=.655$ ($p<.01$). This evidence confirms that increasing student engagement in structured, interactive learning activities is significantly associated with higher acquisition of critical thinking, communication, and teamwork skills. Therefore, participation in learning activities are affirmed as essential components for cultivating the generic competencies mandated by the Competency-Based Curriculum. Participation in Learning Activities (PLA) significantly and partially mediate the relationship between self-efficacy (SE) and generic skills acquisition (GSA). The indirect effect of SE on GSA via Overall participation in learning activities (OPLA) was statistically significant ($\beta=0.39$). This confirms that PLA serves as a crucial mechanism through which students' self-efficacy is translated into observable skills. Effective active learning, including inquiry-based learning, problem-solving based learning, and teacher support, is indispensable for translating psychological confidence into measurable generic competencies.

5.4 Recommendations

The study generated pragmatic recommendations derived directly from the quantitative findings (significant partial mediation and strong correlations) and the qualitative insights (implementation inconsistencies and systemic constraints) observed in the lower secondary Biology classrooms of Universal Secondary Education (USE) schools. These recommendations are structured by target audience: Policy and Curriculum Stakeholders, Teacher Training Institutions, and School Administration/Classroom Teachers.

Recommendations for Policy and Curriculum Stakeholders

The Ministry of Education and Sports (MoES) and the National Curriculum Development Centre (NCDC) must prioritize actions to strengthen the mediating mechanism of PLA, addressing the identified implementation inconsistency. They should issue targeted professional development (PD) guidelines that specifically address managing high-quality inquiry and collaboration in challenging settings, such as those characterized by large class sizes (e.g., 80 students). This action is derived from qualitative data showing that teachers frequently lapse into traditional methods due to these constraints, explaining why the mediation effect was only partial.

Furthermore, the NCDC should ensure that curriculum materials emphasize incorporating open-ended, reflective, and creative activities to genuinely foster critical thinking. This approach is crucial because relying heavily on prescriptive textbook routines resulted in lower integration of creative thinking and critical discourse. The Uganda National Examinations Board (UNEB) should refine its assessment frameworks to explicitly measure and reward the application of generic skills, including critical thinking, communication, and teamwork, through context-based and performance-based tasks. This is necessary because the observed instructional methods favoring recall limited student engagement in higher-order thinking, suggesting that current accountability pressure steers instruction away from complex skill development.

Recommendations for Teacher Training Institutions

Universities and Teacher Colleges (NTCs/PTCs) should strengthen their pre-service and in-service training programs by incorporating rigorous, practical modules focused on scaffolding complex Inquiry-Based Learning (IBL) and Problem-Solving Based Learning (PBL). This is supported by the finding that IBL (β indirect = 0.19) and PBL (β indirect = 0.22) were confirmed as significant partial mediators, yet implementation

quality was uneven across classrooms. By providing clear, quantifiable clarity on these specific pedagogical investments, training institutions can effectively translate theoretical insights into actionable classroom strategies for maximizing skill acquisition within the Competency-Based Curriculum (CBC) framework.

Recommendations for School Administration and Classroom Teachers

School Administration must actively prioritize strengthening Teacher Support (TS) systems, given that Teacher Support was confirmed to partially mediate the SE–GSA relationship. This must include practical measures, such as reducing instructional load or providing teaching assistants, to ensure teachers have sufficient time to monitor student groups and provide targeted, self-efficacy-boosting scaffolding. This qualitative insight is crucial, as teacher monitoring and guidance were highlighted as key factors for sustaining student persistence (Self-Regulatory Self-Efficacy) during challenging tasks.

Classroom Teachers must routinely employ self-efficacy building strategies by setting attainable and clear learning goals, providing timely, constructive feedback, and publicly recognizing students' incremental achievements (mastery experiences). Leveraging this initial confidence is essential, as SE was found to be a significant positive predictor of both PLA and GSA. Furthermore, teachers must consistently move beyond reliance on textbook routines to implement structured, hands-on, and collaborative group tasks, routinely providing explicit guidance on how to execute group work effectively. The strong correlation found between PLA and GSA (r=.655) confirms that this consistent, active engagement is indispensable for achieving core competencies.

5.5 Contribution to the Body of Knowledge

This PhD dissertation, titled *"Self-Efficacy Influence on Generic Skill Acquisition, Mediated by Participation in Learning Activities in Central Uganda"* (Audo, 2025), makes substantial contributions to the theoretical, empirical, and contextual understanding of how students acquire generic skills within competency-based education frameworks. It advances knowledge in educational psychology, curriculum studies, and pedagogy, particularly in resource-constrained secondary school settings.

The first major contribution is theoretical. This study developed and empirically applied the Trans-Theoretical Integration Model for Competency Learning (TTICL, 2025), which bridges a longstanding gap in the literature by integrating external learning processes with internal psychological drivers. Specifically, the model unites Constructivist Theory (CT), which emphasizes participatory and activity-based learning, with Social Cognitive Theory (SCT), which highlights the role of self-efficacy in motivating learners. The TTICL conceptualizes that participatory learning activities can only translate into meaningful Generic Skills Acquisition (GSA) when learners possess strong Self-Efficacy (SE). By formally linking these internal and external dimensions, the model provides a coherent framework for designing educational interventions that simultaneously address psychological readiness and pedagogical practice. This theoretical integration resolves prior fragmentation and offers a dual-lens perspective on competency development, showing how beliefs and engagement interact dynamically to produce 21st-century skills.

The second contribution is empirical. The study provides a Composite Mediation Model that quantifies how self-efficacy translates into generic skills through multiple, parallel pathways of participation in learning activities. Using advanced mediation analysis (Hayes' PROCESS Macro), the study demonstrated that the

influence of self-efficacy on skill acquisition is partially mediated by both the overarching construct of overall participation in learning activities and its core components. Specifically, Inquiry-Based Learning (IBL) ($\beta = 0.19$), Problem-Solving-Based Learning (PBL) ($\beta = 0.22$), and Teacher Support (TS) ($\beta = 0.21$) each function as significant partial mediators, while overall participation in learning activities exhibited a significant indirect effect ($\beta = 0.39$). This finding provides quantitative and actionable insight into the instructional strategies that most effectively convert psychological readiness into tangible skills. It demonstrates that teachers must purposefully integrate IBL, PBL, and structured support to ensure that self-efficacy manifests as critical thinking, communication, and collaboration skills within a competency-based curriculum.

Finally, the study makes an important contextual contribution. By situating the research in Universal Secondary Education (USE) schools in Central Uganda, the dissertation provides a nuanced understanding of how resource constraints, large class sizes, and limited instructional time can influence the mediation between self-efficacy and skill acquisition. This contextualized knowledge enriches global discourse on competency-based reforms by illustrating how systemic and environmental factors shape the effectiveness of pedagogical strategies in low-resource settings.

In summary, this dissertation contributes new knowledge in three interrelated ways: first, by introducing a theoretical model (TTICL) that integrates psychological and pedagogical dimensions of learning; second, by providing an empirical Composite Mediation Model that clarifies the pathways through which self-efficacy influences skill acquisition; and third, by offering contextualized insights into the practical realities of implementing competency-based learning in resource-limited secondary schools. Collectively, these contributions provide a comprehensive framework for designing,

implementing, and evaluating teaching strategies that foster both self-efficacy and 21st-century generic skills among learners.

5.6 Main Message of the Dissertation

The central message of this dissertation, titled *"Self-Efficacy Influence on Generic Skill Acquisition, Mediated by Participation in Learning Activities in Central Uganda,"* is that students' self-efficacy their belief in their ability to succeed academically serves as the cornerstone for acquiring essential 21st-century skills. However, this psychological confidence leads to meaningful skill acquisition only when teachers purposefully engage learners in participatory and activity-based learning experiences. The study establishes three key insights:

Self-Efficacy Drives Engagement:

Students who believe in their academic capabilities are more likely to engage actively in inquiry-based, problem-solving, and competency-based learning activities. This engagement fosters the development of vital generic skills such as communication, analytical reasoning, and collaboration. The findings confirm that participation in learning activities partially mediates the relationship between self-efficacy and generic skill acquisition—highlighting that both internal motivation (self-efficacy) and external engagement (learning activities) are indispensable for effective learning.

Teachers' Role is Foundational:

The mediating influence of participatory learning depends heavily on teachers' ability to implement learner-centered pedagogies consistently. The study observed that resource constraints, large class sizes, and limited instructional time in Universal Secondary Education (USE) schools often restrict the extent to which teachers can facilitate these activities. Consequently, students' opportunities to translate confidence into competence are sometimes diminished.

Key Takeaway for Educational Practice:

To strengthen students' acquisition of generic skills, teachers must intentionally design and facilitate participatory learning experiences that activate students' self-efficacy. A dual focus on enhancing learners' psychological readiness and providing rich opportunities for active classroom engagement is essential. This integrated approach will produce graduates equipped with the communication, collaboration, and critical thinking skills required to thrive in Uganda's evolving 21st-century labor market.

5.7 Final Reflection and Areas for Further Study

5.6.1 Final Reflection

This study strongly reaffirms the critical importance of fostering self-efficacy (SE) and intentionally integrating student-centered learning activities (PLA) as foundational elements for developing generic skills (GSA) among lower secondary Biology students. The evidence collected highlights that students' beliefs in their capabilities (SE) and their active engagement in learning tasks are not peripheral, but central to effective skill acquisition. These findings necessitate a paradigm shift in both teaching practices and curriculum design. Within competency-based frameworks, skill development should be recognized not as an incidental outcome but as the primary goal of education. Achieving this success demands deliberate and sustained efforts aimed at transforming classrooms into learning environments that simultaneously empower learners psychologically and engage them pedagogically. By effectively adopting and operationalizing the recommendations put forth by this study, educators, curriculum developers, and policymakers can significantly enhance the quality and relevance of education. Such initiatives are essential to better prepare students for lifelong learning and meaningful participation in the dynamic, skills-driven global economy, thereby equipping them with the competencies necessary to thrive in the 21st century.

5.6.2 Areas for Further Study

To expand the scope and depth of understanding established by this study, several areas for future research are recommended. First, a similar study should be conducted in other science subjects such as Chemistry, Physics, and Mathematics to determine whether the patterns observed in Biology lessons regarding self-efficacy (SE), active learning strategies, and generic skills acquisition are consistent across different scientific disciplines. This would help establish the generalizability of the findings and reveal subject-specific variations in how learning activities influence students' self-efficacy and skills development.

Secondly, longitudinal studies are recommended to assess the long-term effects of self-efficacy and participatory learning activities on students' acquisition of generic skills. Such studies would provide insights into the sustainability and progression of these competencies over time. Furthermore, future research should explore the influence of contextual factors such as socioeconomic status, school environment, teacher expertise, and resource availability. Investigating these variables would contribute to a more comprehensive understanding of how contextual dynamics interact with learning processes to shape students' academic and personal growth. Lastly, mixed-methods approaches are encouraged to capture both quantitative patterns and qualitative experiences of learners and teachers.

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APPENDICES

Appendix A: The Formula for Determining Sample Size

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

The following formula is used to calculate sample size in the Table.

Formula for determining sample size

$$s = X^2NP(1-P) \div d^2(N-1) + X^2P(1-P)$$

s = required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

P = the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (.05).

Source: Krejcie & Morgan, 1970

Appendix B: Student Questionnaire

Section A: Background Information (Tick where applicable)

Gender	
Female	
Male	
Age	
15-17	
17-21	
other (specify)	
Class	
School	
Urban	
Rural	

Circle the number you think is most appropriate where; **Strongly Disagree (SD) = 1, Disagree (D) = 2, Not Sure (NS) =3, Agree (A) = 4 and Strongly Agree (SA) = 5**

Section A: Self-efficacy						
	Academic Self-efficacy (AS)	**SD**	**D**	**NS**	**A**	**SA**
ASe1	I can tackle scientific difficulties through creative thinking.	1	2	3	4	5
ASe2	I am capable at solving scientific difficulties.	1	2	3	4	5
ASe3	I can illustrate how Biology and technology co-evolved.	1	2	3	4	5
ASe4	When arguing about scientific matters, I can use scientific evidence to support my position.	1	2	3	4	5
ASe5	Despite the challenges, I keep trying to solve an issue.	1	2	3	4	5
ASe6	Biology lessons, in my perspective, teach valuable abilities for problem solving in everyday life.	1	2	3	4	5
ASe7	Biology lessons, in my opinion, build the skills required to manage one's thoughts and actions during the team work process.	1	2	3	4	5
ASe7	I can adapt what I've learned in Biology class to new scenarios.	1	2	3	4	5
ASe9	Biology lessons, in my opinion, have helped to develop values.	1	2	3	4	5
ASe10	Instead, than passing judgment, I strive to understand the motivations behind other people's acts.	1	2	3	4	5

ASe11	I appreciate other people regardless of their ethnic backgrounds or nationalities.	1	2	3	4	5
ASe12	I can solve scientific problems through creative thinking.	1	2	3	4	5
ASe13	I am capable at resolving scientific problems.	1	2	3	4	5
ASe14	I can demonstrate how Biology and technology progressed in tandem.	1	2	3	4	5
	Self-regulatory Self-efficacy (SS)	**SD**	**D**	**NS**	**A**	**SA**
SS1	When making judgments, I consider both the positive and negative effects on the natural environment.	1	2	3	4	5
SS2	I am responsible for what occurs in the environment.	1	2	3	4	5
SS3	My personal well-being is intertwined with what happens in nature on a global scale.	1	2	3	4	5
SS4	In the future, I hope to work in a position where I can help to conserve the natural environment.	1	2	3	4	5
SS5	In team work, I am sensitive to ethical principles that society values.	1	2	3	4	5
SS6	After achieving the desired result, I assess the efforts and effectiveness of selected techniques.	1	2	3	4	5
SS7	I am capable of assessing the accuracy of information.	1	2	3	4	5
SS7	I can tell the difference between scientific and non-scientific evidence.	1	2	3	4	5
SS9	Creativity and imagination are essential for developing scientific knowledge and skills.	1	2	3	4	5

Section B: Quality of Learning Activities

Circle the number you think is most appropriate

	Inquiry Based learning (IBL)	**SD**	**D**	**NS**	**A**	**SA**
IBL1	What I learn will help me in my daily life.	1	2	3	4	5
IBL2	What I am learning is fascinating.	1	2	3	4	5
IBL3	What I learn is directed by the teacher and valuable to me.	1	2	3	4	5
IBL4	What I study is encouraged and beneficial to me by my classmates.	1	2	3	4	5
IBL5	What I learn is applicable to me.	1	2	3	4	5
IBL6	What I learn from others has practical application.	1	2	3	4	5
IBL7	My curiosity is satisfied by what I discover with my companions.	1	2	3	4	5
IBL7	Learning with people motivates me to think.	1	2	3	4	5

	Problem Solving Based Learning (PSB)	**SD**	**D**	**NS**	**A**	**SA**
PSB1	Even when the chores are tedious, I continue to collaborate with others.	1	2	3	4	5
PSB2	Even if I don't agree with what the class is doing, I work hard.	1	2	3	4	5
PSB3	I work in order to have a product of the activity, and I concentrate in order to not miss key things.	1	2	3	4	5
PSB4	I do my activities and projects on time, and I never give up, even when the work is difficult.	1	2	3	4	5
PSB5	In class, I pay close attention.	1	2	3	4	5
PSB6	I keep working until I complete the task at hand.	1	2	3	4	5
PSB7	Even when the chores are tedious, I continue to collaborate with others.	1	2	3	4	5
PSB7	Even if I don't agree with what the class is doing, I work hard.	1	2	3	4	5
	Teacher Support (TS)	**SD**	**D**	**NS**	**A**	**SA**
TS1	The teacher has me participate in group and duo discussions.	1	2	3	4	5
TS2	During discussion time, the teacher goes out of her/his way to assist me.	1	2	3	4	5
TS3	During presentations, the teacher takes my comments into account.	1	2	3	4	5
TS4	When I am having difficulty expressing our work, the teacher assists me.	1	2	3	4	5
TS5	The teacher encourages me as I collaborate with others.	1	2	3	4	5
TS6	The teacher is interested in the issues I am working on.	1	2	3	4	5
TS7	During group discussion, the teacher travels around the room to interact with me.	1	2	3	4	5
TS7	The teacher's questions assist me in comprehending my findings.	1	2	3	4	5

Section C: Generic Skills Acquisitions						
	Critical Thinking (CT)	**SD**	**D**	**NS**	**A**	**SA**
CT1	I have expanded my horizons and improved my grades since I began learning to think critically.	1	2	3	4	5
CT2	I gain a more in-depth and unique understanding of the task.	1	2	3	4	5
CT3	The learning activities provide me with the opportunity to critically reflect on my personal understanding of my own values.	1	2	3	4	5
CT4	My capacity to critically reflect on how I would use various parts of personal development in my life has	1	2	3	4	5

	improved as a result of the learning methodologies used in class.					
CT5	Group discussions have prompted me to critically evaluate my own behavior and the reasons for it.	1	2	3	4	5
CT6	Working in groups has taught me to be flexible in my perspective and to accept other people's points of view, even if I disagree with them	1	2	3	4	5
	Communication (Co)	**SD**	**D**	**NS**	**A**	**SA**
Co1	I've expanded my horizons and improved my grades since I began learning to think critically.	1	2	3	4	5
Co2	I gain a more in-depth and unique understanding of the task.	1	2	3	4	5
Co3	The learning activities provide me with the opportunity to critically reflect on my personal understanding of my own values.	1	2	3	4	5
Co4	My capacity to critically reflect on how I would use various parts of personal development in my life has improved as a result of the learning methodologies used in class.	1	2	3	4	5
Co5	Group discussions have prompted me to critically evaluate my own behavior and the reasons for it.	1	2	3	4	5
	Team Work (TW)	**SD**	**D**	**NS**	**A**	**SA**
TW1	My active participation in Biology group activities improves as a result of the competency-based learning approach.	1	2	3	4	5
TW2	Working in groups fosters cooperation among students.	1	2	3	4	5
TW3	When we work together, I get to know my classmates better.	1	2	3	4	5
TW4	The group discussion activities allow me to compare my own opinions and value perspectives with those of my classmates.	1	2	3	4	5
TW5	I am helped to remember the principles addressed during group activities in a comfortable and fun manner. I am also assisted in engaging with other students in terms of sharing life experiences.	1	2	3	4	5

TW6	Group activities have helped me remember the information covered in the session.	1	2	3	4	5
TW7	My active participation in Biology group activities improves as a result of the competency-based learning approach.	1	2	3	4	5

Thank you for your participation

Appendix C: Teacher Interview Guide

Section A: Background Information

Gender	Female
	Male
Age	20-30
	31-40
	41 - 50
	51-60
Educational Qualification Post	Diploma
	Bachelors
	Masters
	PhD
Teaching Experience	1- 5 years
	6 -10 years
	11 – and above
No of National CBC trainings received	1
	2
	3
	4 and above
Tribe	Etesot/Atesot
	Muganda
	Mugishu
	Munyankole
	Others (Specify) ……
Religion	Catholic
	Anglican
	Muslim
	Pentecostal
	Others (Specify) ……

Section B: Teaching competence based curriculum

1. Please share what you like about Competency-Based Learning as a teacher?
2. In an ideal world, what should the teaching and learning be like in your competency-based class?
3. In your current role, what do you **enjoy/like** about teaching and learning in Competency-based classroom?
4. Do you think we need **any changes** in teaching and learning in Competency based curriculum? If yes, why? If no why?

5. In your opinion, what would you say is the **goal(s)** of Competency-Based Learning?
6. What do you consider are the **most important factors** necessary for achieving Competency-Based Learning goal(s)?
7. Where do you develop the learning activities from?

Section C: Quality of Learning Activities

Inquiry Based learning

8. What happens in this Biology class during inquiry-based learning?

Problem Solving Based Learning

9. What happens in this Biology class during the team work based learning?

Teacher support

10. How do you get teacher support in this Biology class during the teaching learning process?

Section D: Self-efficacy

Academic self-efficacy

11. How do you ensure that the learning activities you develop promote academic self-efficacy
12. What do you do to enable students apply knowledge from Biology lessons in new situations

Self-regulatory self-efficacy

13. Explain how you can develop students' self-regulatory self-efficacy while using natural environment in the teaching and learning of Biology

Section E: Generic Skills Acquisition

Critical Thinking

14. What do you do to make students think critically during the teaching of the Biology lessons?

Communication

15. Explain the techniques you employ to help students to increase self-reflection and interpersonal skills?

Team Work

16. Describe the different ways you use to promote team work in Biology group activities.

Appendix D: Lesson Observation Checklist

Section A: Learning activities

1. Is the learning activity developed from the intended learning outcome?
2. Is the learning activity aligned to the intended learning outcomes?
3. Do the teacher's activities in turn enable students to imitate learning?
4. Has the teacher designed learning activities that imply instructed learning?
5. Do the learning activities presented promote collaborative learning?
6. Has the teacher designed learning activities that provide evidence in learning?
7. Are activities provided by the teacher allowing students to discuss in groups?
8. Does the teacher give room during instruction for students to suggest their ideas?
9. Does the type of activity give students' opportunity to explain their experiences?
10. Are students able to present their findings?

Section B: Self-Efficacy

Academic self-efficacy

11. Do students use their creative thinking skills to solve the given learning activity?
12. Are students able to do the learning activity with ease?
13. Can students explain their work?
14. Can students defend their standpoint using scientific evidence while doing a learning activity?
15. Do students continue trying to solve a problem despite difficulties?
16. Is the learning activity able to develop useful skills for solving problems in everyday life?
17. Is the learning activity able to develop skills needed to control thinking and action during the team work process?
18. Can students apply knowledge from learning activities in new learning activity?

19. Do the learning activities help students develop generic skills?

Self-regulatory self-efficacy

20. Are students responsible for the working environment?
21. During group activity, are students sensitive to the values of team work?
22. Are students able to evaluate the efforts and the effectiveness of selected strategies for completing the given task?
23. While working in groups, are students evaluating the quality of information
24. Does the learning activity promote students' creative and imaginative skills?

Section C: Acquisition of Generic Skills

25. Is the learner able to attain mastery on the generic skills acquisition?
26. What pattern of reasoning is the teacher providing for the learner to attain mastery of the generic skills acquisition?
27. What specific performance skill is the teacher emphasizing for the learner to attain proficiency and mastery of the generic skills acquisition?
28. What products are students expected to create in order to be proficient and master the skills?
29. Are the learning activities promoting critical thinking among students?
30. As students solve problems within their groups, do the activities provided promote effective communication and teamwork.

Appendix E: Pilot study results

According to Zikmund (2010), a pilot study collects primary data and is intended to be a small-scale exploration that enables a researcher to review his or her instruments and the research procedure prior to the actual data collection phase. It enables the researcher to refine data collection plans (Drucker-Godard, Ehlinger & Grenier, 2000). A pilot test was conducted on all the instruments that were used and on the procedure of data collection. The pilot test was done to ensure that the instruments were reliable and that the respondents would respond in accordance with the instructions. The pilot study also helped the researcher to examine the best way to handle unanticipated problems and gauge how long the respondents would respond to the instruments. The results of the pilot study are discussed below.

Table 1: Demography Information

Gender	**Number**	**Percentage %**
Female	38	76.0
Male	12	24.0
Age Category	**Number**	**Percentage %**
13-15	19	38.0
16-18	31	62.0

Source: Primary Data (2023)

The researcher purposively selected senior three (S3) class who were in one of the secondary schools in Kampala Capital City implementing Universal Secondary Education (USE) to participate in the polit study. The biggest population of respondents were females (76%) more than the males who constituted 24% of the sample. The study respondents age ranged between 16-18 years old (62%) and 13-15 years old (38%).

Validity of the Instrument

The researcher then established the construct validity of the instrument using exploratory factor Analysis. This was done to confirm whether the adapted instrument

would be suitable to the characteristics of the study sample. Data was entered in SPSS version 20 and any item that loaded above 0.30 was considered valid. However, any item that loaded below 0.3 was considered to have a low loading and it was reviewed (Pedrosa et al, 2016). Items with eigenvalues greater than 1 were considered as significant contributors to the variables. The items were rotated using a Varimax rotation, so as to identify items that were more correlated with one another. The findings are presented in the table 2, table 3 and table 4.

Table 2: Rotated Factor Matrix for Self-Efficacy

Component	1	2
1. I use my free time to consultant the teachers on the activities I did not understand.	**.869**	
2. I use my imagination to develop biology knowledge and skills.	**.794**	
3. I understand the current needs of my society.	**.769**	
4. I can work on the learning activity through creative thinking.	**.763**	
5. I can apply what I have learned in Biology lessons in real life situation.	**.759**	.322
6. I am responsible for my learning.	**.759**	.322
7. I am capable of using internet search to solve problem I do not understand.	**.629**	
8. I ask the teacher if I am doing the task the right way.	**.540**	.370
9. I like helping others solve problems.	**.524**	.353
10. I am sensitive to the society values.		**.801**
11. I usually keep away from groups who do not like doing work.		**.785**
12. I can use technology to solve Biology tasks.		**.723**
13. Biology activities give me the abilities to solve everyday problems in life.		**.691**
14. I always work hard in order to get correct information for every given activity.		**.670**
15. Biology activities build my skills that are required in team work process.		**.613**
16. I can use science facts to support my position solving tasks.	.398	**.533**
17. The teacher always concludes the biology lesson by directing us to the correct content.	.317	**.532**
18. I use science facts to solve societal problems.		**.509**
19. Biology activities have helped develop values in me.		**.478**
20. I am capable at solving learning activities.		

Eigen Values	6.2
3.7	
% of Variance	31.1
18.7	
Cumulative Variance	**49.9**

Source: Primary Data (2023)

The results in Table 2 demonstrate that the two elements that were examined heavily influenced the dimensions of self- efficacy. An inspection of the factor matrix above indicates that Factor 1, academic self-efficacy, accounted for 31.1% of the variation, and Factor 2, self-regulatory self-efficacy, accounted for 18.7% of the variation. The two factors accounted for about 50% of the variation making it a good measure of self-efficacy.

Table 3: Rotated Factor Matrix for Student Learning Activities

Component	**1**	**2**	**3**
1. The teacher corrects us during plenary presentations.	**.937**		
2. What I do during the biology lesson is directed by the teacher and good for me.	**.937**		
3. I work in order to have a product of the activity.	**.934**		
4. What I do during the biology lesson gives me freedom to read more about the subject.	**.879**		
5. I am able to explain my findings before the whole class.	**.878**		
6. What I do during the biology lesson with friends motivates me to actively participate in the lesson.	**.580**	.385	
7. I always ask from the teacher when I don't understand the task.	**.580**	.385	
8. What I do during the biology lesson with others has practical application.	**.562**		
9. I always provide varied examples for tasks.	**.562**		
10. The teacher helps me when I have difficulty with my work in biology lessons.	**.497**		-.366
11. The teacher is interested in knowing my challenges during biology lessons.			
12. The teacher is interested in knowing my progress during biology lessons.			
13. I enjoy working on creative tasks.		**.808**	
14. The teacher creates time to help me with my work during biology lessons.		**.786**	
15. What I do during the biology lesson satisfies my understanding.		**.772**	
16. What I do during the biology lesson is applicable to me.		**.709**	
17. I am able to interpret the given task.		**.688**	
18. The teacher always concludes the biology lesson by directing us to the correct content		**.646**	

19. What I do during the biology lesson will help me after school.	.314	**.632**		
20. I do my class activities and projects on time.		**.618**		
21. The tasks give me chance to manipulate my environment.	.399	**.530**		
22. The teacher regularly checks on progress of individual learners in group activities during biology lessons.		**.526**		
23. What I do during the biology lesson is encouraging.	.345	**.451**		
24. I able to find the solution to the given task.		**.325**		
25. The teacher asks prompting questions that lead me understand the activity.				
26. What I do during the biology lesson will help me in my daily life.				**.906**
27. The teacher's questions help me to clearly understand the during biology lessons.				**.902**
28. I enjoy working with others.				**.882**
29. What I do during the biology lesson help me solve problems using information got through discovery and reading other books				**.479**
30. The teacher moves about the class to discuss with me my work during biology lessons.				
Eigen Values		8.2	3.9	3.2
% of Variance		27.4	13	10.7
Cumulative %				**51.1**

Source: Primary Data (2023).

The results in Table 3 show that the three elements that were examined influenced the dimensions of student learning activities. An inspection of the factor matrix above indicates that factor 1, inquiry-based learning, accounted for 27.4 % of the variation, factor 2, problem solving based learning, accounted for 13 % of the variation, and factor 3, teacher support, accounted for 10.7% of the variation. The three factors accounted for about 51.1% of the variation. Given that the items measured more than 50% of the construct, makes them good measure of student learning activities

Table 4: Rotated Factor Matrix for Generic Skills Acquisition

Component	**1**	**2**	**3**
1. I focus on the task given.	**.822**		
2. I interact with other students during the biology lessons	**.822**		
3. I get to the point when presenting my ideas	**.818**		
4. I understand the roles of every group member during biology lessons	**.818**		
5. I find it easy to participate in group learning during biology lessons.	**.665**		
6. I politely ask when I am not sure about what someone is saying to me.	**.649**		.495
7. I like receiving feedback for my presentation.	**.614**		.576

8. I like taking up leading roles for my group	**.612**			.534
9. I understand better when I work with the group during biology lessons.	**.559**			
10. I give reasons considering the results I find in the task	**.537**			
11. Learning as a group enables me to learn how to interact with others during biology lessons.	.525			
12. I observe and consider the results of the observation during the biology activities.	.519	**.364**		
13. I define the key terms in the task before doing it	.474	**.402**		.301
14. Students' interactions in the biology lessons classes are regulated for better individual learning.	.467	**.312**		
15. I use well the opportunities to participate in group activities during biology lessons.	.466			
16. I provide clear ideas that are easily understood by others.	.446			
17. I analyse an argument during a biology lesson.	.408			
18. I have benefited a lot from the freedom to interact with members of any other group during.	.384	**.328**		
19. I get good help from others when we are doing group activities during biology lessons.	.311			
20. I usually work together with group members to achieve the given task during the biology lesson.		**.831**		
21. I take turns while talking with others.		.831		
22. I logically sequence the information I present.		.780		
23. I speak audibly when asking questions for clarification.		.768		
24. I always provide specific examples or explanations when speaking.		.736		**.524**
25. I always listen carefully to the person speaking.		.736		**.524**
26. I make and consider the value of group discussion		.736		**.524**
27. I ask and also answer challenging questions during the biology lesson.	.390	.417		**.309**
28. I decide before taking an action in any given task in biology				**.876**
29. I consider the source of information before using it during the biology lesson.				**.876**
30. I provide correct information, use right choice of words and grammar in my presentations.				**.873**
Eigen Values		8.9	4.5	3.8
% of Variance		29.6	15.1	12.6
Cumulative %				**57.3**

Source: Primary Data (2023).

The results in Table 4 demonstrate that the three elements that were examined heavily influenced the dimensions of generic skills acquisition. An inspection of the factor matrix above indicates that factor 1, critical thinking, accounted for 29.6 % of the variation, factor 2, communication, accounted for 15.1% of the variation, and factor 3, team work, accounted for 12.6% of the variation. The three factors accounted for about

57.3% of the variation. Given that the items measured more than 50% of the construct, which is a good measure of generic skills acquisition.

Reliability of questionnaires

The pilot sample for establishing the reliability of the students' questionnaire was 50 respondents and Data from the pilot study was entered in the Statistical Package for Social Sciences (SPSS) and Cronbach's alpha coefficient test for reliability Cronbach's Alpha coefficients were analysed for all the scales of the students' questionnaires. The results are presented in the table 5.

Table 5: Reliability of the Instrument

Variable	Number of Items	Cronbach's Alpha
Self- Efficacy	20	.843
Student Learning Activities	30	.877
Generic Skills Acquisition	30	.914

While other studies had already recognised the reliabilities of the questionnaire's components, the reliabilities were retested using Cronbach's Alpha method with the aid of pre-test data collected from respondents. The Alpha value was sufficient for research purposes because it was greater than .70 for both complete scale and the subscales (Esses *et at,* 2018) as shown in table 5.

Appendix F: Informed Consent Form (ICF) for Students Aged 17 Years and Above

Title of the Study:

"Participation in Learning Activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills Acquisition in Uganda"

Researcher:

Audo Jesca Harriet, PhD Student

Kyambogo University

Tel: +256 782 570876

Email: jescaaudo@gmail.com

1. Introduction

You are invited to take part in this academic research study. Before you decide whether or not to participate, it is important for you to understand why the study is being done and what it involves. Please take time to read the information carefully and feel free to ask questions if anything is unclear.

2. Purpose of the Study

The study aims to explore how students engage in learning during Biology lessons, and how different activities help develop important skills such as communication, teamwork, and team work. It also investigates how students' confidence (self-efficacy) plays a role in this process.

3. Why You Were Selected

You have been selected because you are a student participating in the new lower secondary Biology curriculum, and you are aged 17 years or above.

4. What Participation Involves

If you agree to take part in this study, you will be asked to complete a questionnaire

that will take approximately **20 to 30 minutes**. The questionnaire will collect information about your learning experiences, your confidence in Biology, and the skills you are gaining.

5. Voluntary Participation and Withdrawal

Participation is completely voluntary. You are free to refuse to participate or to withdraw at any point without giving a reason and without facing any consequences. If you withdraw, the information you provided will not be used in the study.

6. Confidentiality and Data Protection

All information you provide will be kept **strictly confidential**. Your name or identifying details will not appear on any reports or publications. Data will be anonymized and securely stored. Only the research team and authorized bodies such as **GUREC** and **UNCST** may access the data if necessary.

7. Benefits

Your participation will contribute to improving Biology education

a. Practices under the new curriculum.
b. You will receive feedback on the findings and progress of the study.
c. Any new or incidental findings relevant to your well-being will be communicated to you.

8. Risks

There are no known risks involved in participating in this study. You will not be asked to provide sensitive personal information, and your responses will not affect your grades or academic standing in any way.

9. Use of Data

The results of the study may be published in academic journals, presented at

conferences, or shared in educational forums. Your identity will never be revealed in any of these outputs.

10. Costs

You will receiv**e scholastic materials for your participation. Additionally, light refreshments will be** provided as a token of appreciation for your time.

11. Contact Information

If you have questions or concerns about the research or your participation, you may contact:

Researcher: Audo Jesca Harriet

Tel: +256 782 570876

Email: jescaaudo@gmail.com

Chairperson, Gulu University Research Ethics Committee (GUREC):

Dr. Julaina A. Obika

Tel: +256 772 964491

Email: j.obika@gu.ac.ug

11. Statement of Consent

By signing below, you confirm that:

i. You have read and understood the information above.

ii. You are aged 17 years or older.

iii. You voluntarily agree to participate in this study.

iv. You understand that you may withdraw at any time.

Name of Participant: _____	Name of Witness (if applicable): _____	Name of Researcher: _____
Signature: _____	Signature: _____	Signature: _____
Date: _____	Date: _____	Date: _____

Appendix G: Informed Consent for Teachers

Title of the Study:

Participation in Learning Activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills Acquisition in Uganda

Investigator(s):

Audo Jesca Harriet, PhD Student

Institution:

Kyambogo University

Introduction

My name is Audo Jesca Harriet, a PhD student at Kyambogo University. I am conducting a study titled *"Participation in Learning Activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills Acquisition in Uganda."*

This informed consent form explains the purpose and procedures of the study. Please read it carefully and ask any questions for clarification. If you voluntarily agree to participate, you will be asked to sign the form and receive a copy for your records.

Sponsors of the Study

This research is self-sponsored by the researcher as part of her doctoral program and has received ethical clearance from Gulu University Research Ethics Committee (GUREC) and approval from the Uganda National Council for Science and Technology (UNCST).

Purpose

The purpose of this study is to explore participation in learning activities in Biology lessons and how these influence the development of generic skills and self-efficacy under the new competency-based curriculum in Uganda. The findings will support the improvement of teaching and learning strategies in secondary schools.

Procedures

Your participation will involve:

i. **An interview** lasting approximately **30–45 minutes** focusing on your experience with implementing the new Biology curriculum and the participation in learning activities you use.

ii. **Classroom lesson observation**, during which the researcher will observe participation in learning activities during your Biology lesson without interfering with your teaching process.

Who Will Participate in the Study?

You have been selected as a participant because you are a Biology teacher actively implementing the new lower secondary school curriculum. Approximately **07 teachers** and **270 students** from selected secondary schools in Mukono District will participate in this study.

Risks/Discomforts

There are **no foreseeable risks or discomforts** associated with your participation. The only inconvenience may be the time required for the interview and lesson observation.

Benefits

a) You will have the opportunity to reflect on your teaching practices.

b) Your insights may help shape more effective Biology instruction in the future.

c) You will receive **UGX 10,000** and **light refreshments** as tokens of appreciation for your participation.

d) You will be given feedback on the study's progress and findings. Any new or incidental information that may benefit your professional practice will also be shared.

Confidentiality

Your identity will be kept strictly confidential. Your name will not appear on any reports or publications. Data will be coded, and only the research team will have access to it. All digital data will be stored in password-protected files, and physical documents will be secured under lock and key. Only the principal investigator and authorized reviewers from GUREC or UNCST may access the raw data.

Alternatives

You are under no obligation to participate in this study. Your decision not to participate will not affect your professional standing or relationship with the school, researcher, or university.

Cost

There is no cost to you for participating in this study.

Questions

If you have any questions or concerns, please contact:

Principal Investigator: Audo Jesca Harriet

Tel: +256 782 570876

Email: jescaaudo@gmail.com

Statement of Voluntariness

Your participation is entirely voluntary. You may refuse or discontinue participation at any point without any penalty.

If you have concerns about your rights or ethics of the study, please contact:

Chairperson, GUREC – Dr. Julaina A. Obika

Tel: +256 772 964491

Email: j.obika@gu.ac.ug

Uganda National Council for Science and Technology (UNCST)

Plot 6 Kimera Road, Ntinda, Kampala

Tel: 0414 70550

Informed Consent for Audio Recording

Tick ☑ where appropriate

Agree **Disagree**

Statement of Consent

I, _____ (Name of Teacher), have had the study explained to me, including its purpose, procedures, potential benefits, and my rights as a participant. I understand that my participation is voluntary, and that I may withdraw at any time. I also understand that all information will be kept confidential. By signing below, I agree to participate in this study.

Signature of Teacher:	Signature of Researcher:
_____	_____
Date: _____	Date: _____

Appendix H: Informed Assent Form (IAF) for Students below 17 Years

Introduction

You are being invited to take part in a research study titled **"Participation in Learning activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills Acquisition in Uganda."** The study is being conducted by **Audo Jesca Harriet**, a PhD student at **Kyambogo University**.

The purpose of this study is to explore how students learn in Biology lessons and how these learning activities help you develop important skills like team work, communication, and working with others. The study also wants to understand how confident you feel when learning and how this confidence affects your learning.

1. Voluntary Participation

Taking part in this study is completely your choice. If you do not want to take part, you do not have to. If you start and later change your mind, you can stop at any time. Nothing bad will happen if you choose not to participate or if you stop.

2. What Will You Do?

You will be asked to fill in a questionnaire that will ask about how you learn during Biology lessons and what skills you are developing. This will take about **20 to 30 minutes** of your time.

3. Your Privacy

Your name or any information that can identify you will not be written on the questionnaire. Everything you say or write will be kept private and only the research team will look at it. Your answers will only be used for this study and for academic purposes like journal articles or conferences, but no one will know they came from you.

4. What Will You Get?

You will receive some scholastic materials as appreciation for taking part in the study. Also, light refreshments will be provided.

5. Questions or Help

If you have any questions or if something is not clear, you can ask the researcher before you decide to take part. You can also contact the researcher or the chairperson of the research committee using the contact information below:

Researcher: Audo Jesca Harriet

Tel: +256 782 570876

Email: jescaaudo@gmail.com

Chairperson, Gulu University Research Ethics Committee (GUREC):

Dr. Julaina A. Obika

Tel: +256 772 964491

Email: j.obika@gu.ac.ug

6. **Do You Want to Take Part?**

If you agree to participate, please sign or put your thumbprint below to show that you understand and agree to take part in the study.

Name of Participant:	Name of Witness:	Name of Interviewer:
_____	_____	_____
Signature/thumbprint:	Signature:	Signature:
_____	_____	_____
Date:	Date:	Date:
_____	_____	_____

Appendix I: Informed Consent for Parents whose children are under 17 years of Age

Title of the Study:

Participation in Learning Activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills in Uganda's New Lower Secondary Curriculum

Investigator(s):

Audo Jesca Harriet, PhD Student

Institution(s):

Kyambogo University

Introduction

My name is Audo Jesca Harriet, a PhD student at Kyambogo University. I am conducting a study titled *"Participation in Learning Activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills in Uganda's New Lower Secondary Curriculum."*

This informed consent form explains the purpose and nature of the study. You are encouraged to ask any questions for clarification. Once you fully understand the study and voluntarily agree for your child to participate, you will be asked to sign this form and receive a copy to keep for your records.

Sponsors of the Study

This research is self-sponsored by the researcher as part of her PhD study at Kyambogo University and has received ethical clearance from Gulu University Research Ethics Committee (GUREC) and approval from the Uganda National Council for Science and Technology (UNCST).

Purpose

The study seeks to explore participation in learning activities and the acquisition of

generic skills (such as communication, collaboration, and team work) in the context of the lower secondary competency-based Biology curriculum. The findings will inform improvements in teaching approaches and contribute to better curriculum implementation in Uganda.

Procedures

Your child will be asked to complete a questionnaire that will take approximately **20–30 minutes**. The questionnaire will collect information about their learning experiences in Biology, their self-confidence in performing Biology-related tasks, and the skills they are developing through classroom activities.

Who Will Participate in the Study?

Your child has been selected because they are a student participating in the new lower secondary school Biology curriculum and are below 17 years. Approximately **270 students** and **07 teachers** from selected secondary schools in Mukono District will take part in this study.

Risks/Discomforts

There are **no known physical or psychological risks** associated with participation. The only minor inconvenience may be the time spent completing the questionnaire.

Benefits

a) Your child's participation will contribute to improving Biology education
b) practices under the new curriculum. You will receive feedback on the findings and progress of the study.
c) Any new or incidental findings relevant to your child's well-being will be communicated to you.

Confidentiality

Your child's identity will be protected throughout the study. We will use codes instead of names in all documents and data files. The information collected will be stored securely: soft copies will be password-protected, and hard copies will be locked in a cabinet. Only the principal investigator and authorized bodies (e.g., GUREC, UNCST) will access the data.

Alternatives

You are not obligated to allow your child to participate. Declining will not result in any loss of benefit or penalty for you or your child.

Cost

Your child will receive **scholastic materials** and **light refreshments** as tokens of appreciation.

Questions

If you have any questions related to the study, you may contact:

Principal Investigator

Audo Jesca HarrietTel: +256 782 570876

Email: jescaaudo@gmail.com

Statement of Voluntariness

Participation in this study is completely voluntary. You are free to allow or decline your child's participation. You may also withdraw your child from the study at any point without any penalty or consequence.

For any issues related to your rights or those of your child in this research, contact:

Chairperson, GUREC

Dr. Julaina A. Obika

Tel: +256 772 964491

Email: j.obika@gu.ac.ug

Uganda National Council for Science and Technology (UNCST)

Plot 6 Kimera Road, Ntinda, Kampala

Tel: 0414 705500

Statement of Consent

I, _____ (Name of Parent/Guardian), have had

the study explained to me, including its procedures, benefits, risks, and my rights. I understand that my child's participation is voluntary and that I may withdraw them from the study at any time. I also understand that their identity will be kept confidential. I give permission for my child to participate in this study.

Name of Child (Participant): _____	Name of Researcher: _____
Name of Parent/Guardian: _____	Signature: _____
Signature of Parent/Guardian: _____	Date: _____
Date: _____	

Appendix J: Data collection Letter from the University

KYAMBOGO UNIVERSITY
P. O. BOX 1 KYAMBOGO
Tel: 041 - 4286792 Fax: 256-41-220464
Website :www.kyu.ac.ug Email: drgt@kyu.ac.ug
Directorate of Research and Graduate Training
Office of the Director

APPENDIX 8

Date: June 21, 2024

TO WHOM IT MAY CONCERN

RE: AUDO JESCA HARRIET

Dear Sir/Madam,

This is to introduce to you the above named student Reg: No **20/U/GDED/12988/WKD** pursuing Doctor of Philosophy in Education, Department of Foundations of Education and Educational Psychology, Kyambogo University.

She intends to carry out research on **Self-Efficacy and Generic skills Acquisition in the new Lower Secondary School Curriculum in Central Uganda: The Mediating effect of Student Learning Activities** in partial fulfillment of the requirements of the award of Doctor of Philosophy in Education.

The purpose of this letter therefore is to request you to grant her permission to carry out her study in your institution.

Any assistance rendered to her will be highly appreciated.

Yours sincerely,

Prof. Bosco Bua
AG. DIRECTOR

KYAMBOGO UNIVERSITY
21 JUN 2024
DIRECTOR
DIRECTORATE OF RESEARCH AND GRADUATE TRAINING

Appendix K: Administrative Clearance Letter from Municipal Education Officer Mukono Municipality

LANDLINE:..... 0414 290203/4
Email: info@mukonomunicipalcouncil.go.ug
FOR ANY CORRESPONDENCE ON THIS SUBJECT, PLEASE QUOTE: MMC/SE/64

THE REPUBLIC OF UGANDA

MUKONO MUNICIPAL COUNCIL
EDUCATION DEPARTMENT
P. O. BOX 201
MUKONO - UGANDA

Date: 16th June 2025

To The Executive Secretary
Uganda National Council for Science and Technology (UNCST)

Subject: ***Administrative Clearance for Research Study – "Student Learning Activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills Acquisition in Uganda's New Lower Secondary Curriculum"***

This is to grant you administrative clearance for the above-mentioned research study. This authorization permits you to carry out the study in selected secondary schools within Mukono Municipality.

The study seeks to explore how student learning activities in biology lessons influence self-efficacy and the development of generic skills, in alignment with Uganda's new lower secondary school curriculum.

Details of the Clearance:

- **Research Title:** Student Learning Activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills Acquisition in Uganda's New Lower Secondary Curriculum
- **Researcher:** Audo Jesca Harriet
- **Affiliated Institution:** Kyambogo University
- **Study Duration:** June - to - August 2025

My office recognizes the relevance of this research in enhancing curriculum implementation and learner outcomes. We therefore pledge our support throughout the study period.

Should further information or clarification be required, feel free to contact our office.

Sincerely,

Nassolo Faridah
Municipal Education Officer
Mukono Municipal Council

cc: All Head teachers, Secondary Schools
c.c: Ms.Audo Jesca Harriet

Appendix L: Gulu University Research Ethics -Approval Letter

GULU UNIVERSITY
P.O. Box 166, Gulu (U)
Website: www.gu.ac.ug
Email: gurec@gu.ac.ug
Tel: +256 471 432 096
Fax: +256 471 432 913
Mob: +256 772 964 491
+256 776 812 147
RESEARCH ETHICS COMMITTEE

30/04/2025

To: Jesca Harriet Audo

Type: Initial Review

Re: GUREC-2025-1204: participation in learning activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills Acquisition in Uganda

I am pleased to inform you that at the 124th convened meeting on 20/03/2025, the Gulu University REC meeting voted to approve the above referenced application.

Approval of the research is for the period of 30/04/2025 to 30/04/2026.

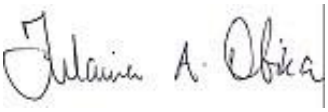
As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re- review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to respondents or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of respondents. All consent forms signed by respondents and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **30/04/2026** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by Gulu University REC:

No.	Document Title	Language	Version Number	Version Date
1	ICF for Students	English	2.0	2024-04-18
2	Ascent Form	English	2.0	2024--19
3	ICF for Teachers	English	2.0	2024-04-23
4	Parent Consent	English	2.0	2024-04-25
5	parents Cosent - Luganda	Luganda	2.0	2024-04-26
6	Dissertation for Study	English	2.0	2025-04-11
7	Teacher Interview Guide	English	2.0	2025-04-11
8	classroom observation checklist	English	2.0	2025-04-11
9	Questionnaire for Students	English	2.0	2025-04-11
10	COVID-19 & EBOLA risk management plan	English	2.0	2025-04-11
11	Community Engagement plan	English	2.0	2025-04-14

Yours Sincerely



Julaina A. Obika (PhD) For: Gulu University REC

Appendix M: Uganda National Science and Technology Research Clearance Letter

Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

Our Ref: SS3915ES

20/06/2025

Jesca Harriet Audo

Kyambogo University

Kampala

Re: Research Approval: participation in learning activities in Biology Lessons as Mediators of Self-Efficacy and Generic Skills Acquisition in Uganda

I am pleased to inform you that on **20/06/2025**, the Uganda National Council for Science and Technology (UNCST) approved the above referenced research project. The Approval of the research project is for the period of **20/06/2025** to **20/06/2026**.

Your research registration number with the UNCST is **SS3915ES**. Please, cite this number in all your future correspondences with UNCST in respect of the above research project. As the Principal Investigator of the research project, you are responsible for fulfilling the following requirements of approval:

1. Keeping all co-investigators informed of the status of the research.
2. Submitting all changes, amendments, and addenda to the research protocol or the consent form (where applicable) to the designated Research Ethics Committee (REC) or Lead Agency for re-review and approval **prior** to the activation of the changes. UNCST must be notified of the approved changes within five working days.
3. For clinical trials, all serious adverse events must be reported promptly to the designated local REC for review with copies to the National Drug Authority and a notification to the UNCST.
4. Unanticipated problems involving risks to research respondents or other must be reported promptly to the UNCST. New information that becomes available which could change the risk/benefit ratio must be submitted promptly for UNCST notification after review by the REC.
5. Only approved study procedures are to be implemented. The UNCST may conduct impromptu audits of all study records.
6. An annual progress report and approval letter of continuation from the REC must be submitted electronically to UNCST. Failure to do so may result in termination of the research project.

Please note that this approval includes all study related tools submitted as part of the application as shown below:

No.	Document Title	Language	Version Number	Version Date
1	Student Questionnaire	English	2.0	09 May 2025
2	Interview guide for Teachers	English	2.0	
3	Lesson Observation Checklist	English	2.0	23 April 2025
4	Informed consent for Parents	Luganda	2.0	10 April 2025
5	Project Dissertation	English	KYAMBOGO UNIVERSITY	
6	Approval Letter	English		
6	COMMUNITY ENGAGEMENT PLAN	English	2.0	17 June 2025
7	PARENT CONSENT FORM	English	2.0	17 June 2025
8	INFORMED CONSENT FOR TEACHERS	English	2.0	17 June 2025
9	ICF FOR STUDENTS	English	2.0	17 June 2025
10	MEASUREMENT FOR COVID PREVENTATION	English	2.0	17 June 2025
11	PARENT CONSENT - LUGANDA	English	2.0	17 June 2025
12	ASENT FORM	English	2.0	17 June 2025

Yours sincerely,

Lamunu Dorcas .O.

Dorcas Lamunu

For: Executive Secretary

UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

LOCATION/CORRESPONDENCE

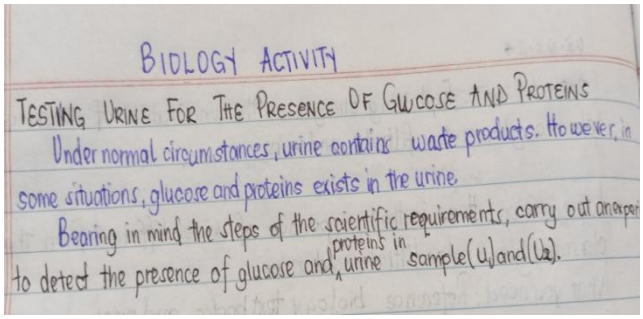
Plot 6 Kimera Road, Ntinda
P.O. Box 6884
KAMPALA, UGANDA

COMMUNICATION

TEL: (256) 414 705500
FAX: (256) 414-234579
EMAIL: info@uncst.go.ug
WEBSITE: http://www.uncst.go.ug

Appendix N: Photos of different activities captured during data collection

Learning activities that were designed by teachers

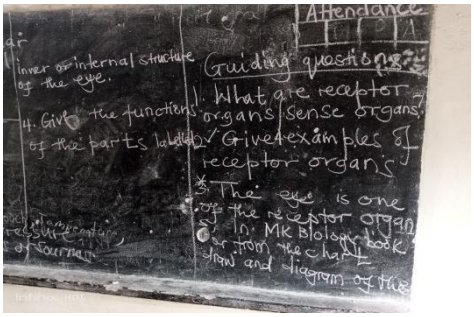


BIOLOGY ACTIVITY

TESTING URINE FOR THE PRESENCE OF GLUCOSE AND PROTEINS

Under normal circumstances, urine contains waste products. However, in some situations, glucose and proteins exists in the urine.

Bearing in mind the steps of the scientific requirements, carry out an experiment to detect the presence of glucose and proteins in urine sample (U1) and (U2).



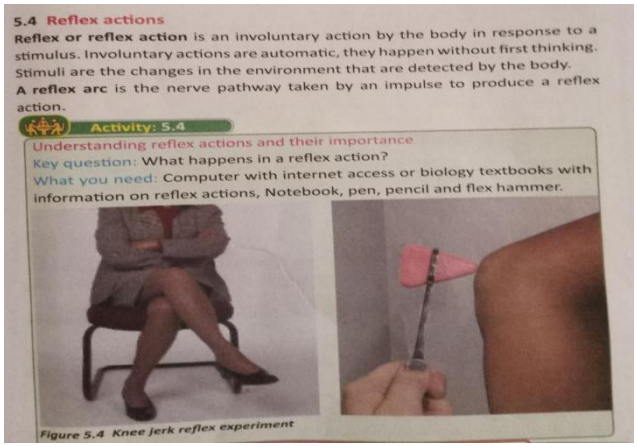
Attendance

Inner or internal structure of the eye.

Guiding questions

1. What are receptor organs/sense organs?
2. Give examples of receptor organs
3. The eye is one of the receptor organ
4. In MK Biology book or from the chart, draw and diagram of the

Some of text book learning activities used by some teachers



5.4 Reflex actions

Reflex or reflex action is an involuntary action by the body in response to a stimulus. Involuntary actions are automatic, they happen without first thinking. Stimuli are the changes in the environment that are detected by the body.

A reflex arc is the nerve pathway taken by an impulse to produce a reflex action.

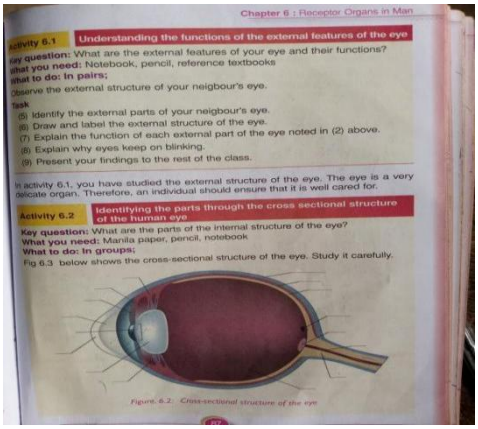
Activity: 5.4

Understanding reflex actions and their importance

Key question: What happens in a reflex action?

What you need: Computer with internet access or biology textbooks with information on reflex actions, Notebook, pen, pencil and flex hammer.

Figure 5.4 Knee jerk reflex experiment



Chapter 6 : Receptor Organs in Man

Activity 6.1 Understanding the functions of the external features of the eye

Key question: What are the external features of your eye and their functions?

What you need: Notebook, pencil, reference textbooks

What to do: In pairs;

Observe the external structure of your neigbour's eye.

Task

(5) Identify the external parts of your neigbour's eye.

(6) Draw and label the external structure of the eye.

(7) Explain the function of each external part of the eye noted in (2) above.

(8) Explain why eyes keep on blinking.

(9) Present your findings to the rest of the class.

In activity 6.1, you have studied the external structure of the eye. The eye is a very delicate organ. Therefore, an individual should ensure that it is well cared for.

Activity 6.2 Identifying the parts through the cross sectional structure of the human eye

Key question: What are the parts of the internal structure of the eye?

What you need: Manila paper, pencil, notebook

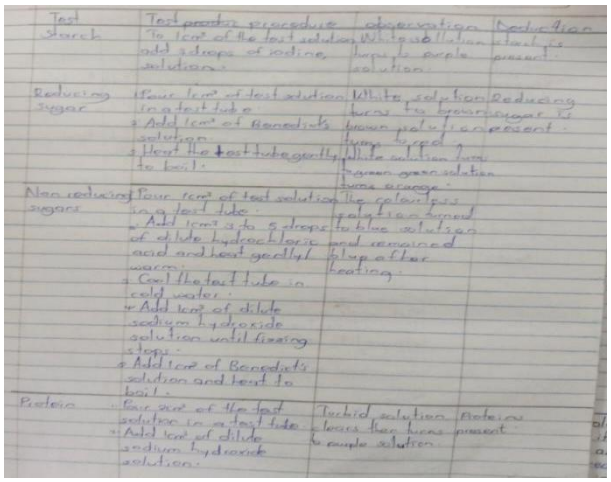
What to do: In groups;

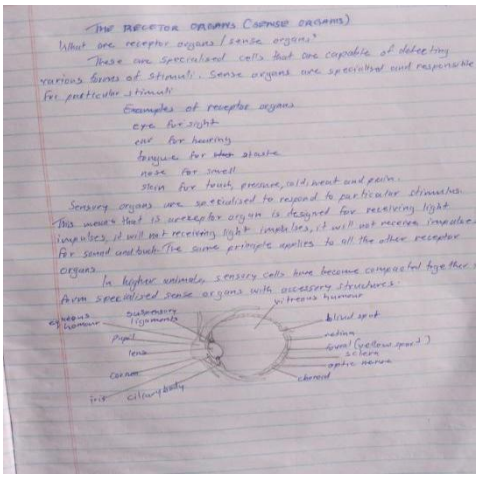
Fig 6.3 below shows the cross-sectional structure of the eye. Study it carefully.

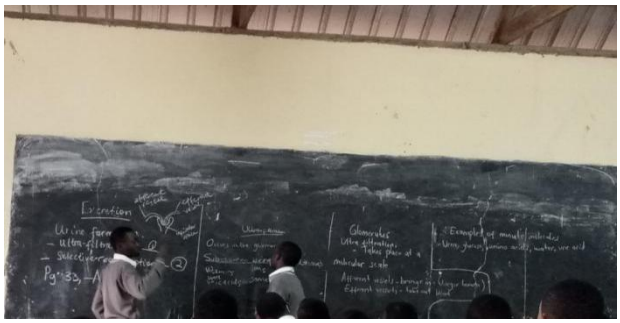
Figure 6.2 Cross-sectional structure of the eye

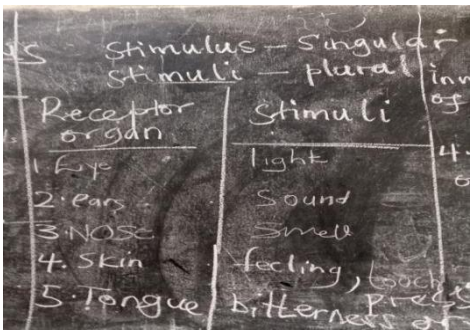
Students working on the learning activities in different groups

Notes written by students during Biology lessons

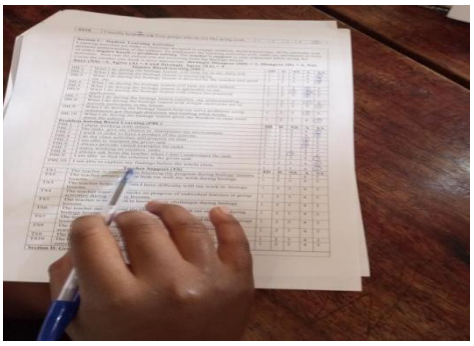








Students filling out the questionnaires



Appendix O: Plagiarism Clearance Certificate

SELF-EFFICACY INFLUENCE ON GENERIC SKILL ACQUISITION, MEDIATED BY PARTICIPATION IN LEARNING ACTIVITIES IN CENTRAL UGANDA

Submission date: 10-Nov-2025 12:39PM (UTC+0100)
Submission ID: 2183790661
File name: Final__Dissertation__Octoter_2025-Jesca_Harriet_Audo_.docx (2.14M)
Word count: 64386
Character count: 404916

SELF-EFFICACY INFLUENCE ON GENERIC SKILL ACQUISITION, MEDIATED BY PARTICIPATION IN LEARNING ACTIVITIES IN CENTRAL UGANDA

ORIGINALITY REPORT

16%	13%	12%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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7	Tine van Daal, Vincent Donche, Sven De Maeyer. "The Impact of Personality, Goal Orientation and Self-Efficacy on Participation of High School Teachers in Learning Activities in the Workplace", Vocations and Learning, 2013 Publication	<1%
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