ANTECEDENTS FOR IMPROVING PHYSICS TEACHERS' EFFECTIVENESS IN UGANDA: A CASE OF KIGEZI SUB-REGION

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DECLARATION

This dissertation is my original work and has never been presented for a degree in any other university.

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APPROVAL

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DEDICATION

I dedicate this work to my last born, Kiiza Emmanuel Ariho and my whole family

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LIST OF ABBREVIATIONS AND ACRONYMS

AMOS	:	Analysis of Moment Structures
BoGs	:	Board of Governors
CAL	:	Computer Assisted Learning
COVID-19	:	Corona Virus Disease 2019
DEOs	:	District Education Officers
DSRM	:	Design Science Research Methodology
EFL	:	English as a Foreign Language
EIPCS	:	Educators Inc. Private Christian Schools
FGD	:	Focus Group Discussion
FLTE	:	Foreign Language Teaching-Enjoyment
INSET	:	In-Service Education and Training
MKO	:	More Knowledgeable Other
MoES	:	Ministry of Education and Sports
n.d	:	Not Dated
OECD	:	Organization for Economic Cooperation and Development
PISA	:	Programme for International Students Assessment
PPP	:	Public-Private Partnership
PTA	:	Parent-Teacher Association
REACT	:	Relating, Experiencing, Applying, Cooperating, Transferring
REC	:	Research Ethics Committee
SAQ	:	Self-Administered Questionnaire
SCT	:	Social Constructivism Theory
SESEMAT	:	Secondary Science and Mathematics Teachers
SEST	:	Social Ecological Systems Theory
SOPs	:	Standard Operating Procedures
SPSS	:	Statistical Package for Social Sciences
SSA	:	Sub Saharan Africa
STEM	:	Science, Technology, Engineering and Mathematics
TNA	:	Training Needs Assessment
UCE	:	Uganda Certificate of Education
UCU	:	Uganda Christian University
UNCST	:	Uganda National Council of Science and Technology
UNEB	:	Uganda National Examinations Board
UNESCO	:	United Nations Educational, Scientific and Cultural Organization
UPF	:	Uganda Police Force
USA	:	United States of America
USE	:	Universal Secondary Education
VIF	:	Variance Inflation Indicator
ZPD	:	Zone of Proximal Development

ABSTRACT

Science teachers were an important component of Uganda's education system because they contributed to the realisation of policy goals of science, technology, engineering and mathematics. Despite that importance, the academic performance of students at UCE in Physics had been perennially poor for decades. To reverse this trend, the SESEMAT programme was introduced to improve the teaching of science subjects in Uganda and consequently, academic performance. The goal of the intervention was in response to several studies before then that had attributed the declining academic achievement in science subjects to ineffective teaching. However, even after the introduction of the SESEMAT programme, academic achievement in the science subjects had not improved either, Kigezi sub-region inclusive. For that reason, this study focused on assessing the aspect of teacher effectiveness since it determined the academic achievement. Thus, the purpose of the study was to assess the antecedents for improving Physics teachers' effectiveness in Uganda: A case of Kigezi sub region. Specifically, the study aimed at: - establishing the relationship between pedagogical approach antecedents and Physics teachers' effectiveness; finding out the relationship between school environment antecedents and the Physics teachers' effectiveness; and, ascertaining if the school environment moderated the relationship between pedagogical approaches and Physics teachers' effectiveness. The study was anchored on Social Constructivism Theory and Social Ecological Systems Theory. Then the Pragmatism paradigm informed the study, leading to the use of mixed-methods approach and embedded/nested in the mixed-methods research design. In addition, both government-aided and private-owned schools were involved. The study involved 214 respondents comprising 194 teachers, 6 District Education Officers and 14 head teachers. In that case, quantitative data was collected from teachers using questionnaires while qualitative data from head teachers and District Education Officers was collected using interviews. More qualitative data was generated through classroom lesson observation and focus group discussions with Heads of Department. The data was analysed quantitatively, using descriptive and inferential statistics; and qualitatively, using content analysis. The results showed a significant positive influence of SESEMAT pedagogical approaches on teacher effectiveness ($\beta=0.348$, $p<0.001$); a positive significant influence of school environment and Physics teachers' effectiveness($\beta=0.596$, $p<0.001$); and, a positive significant moderating influence of school environment on the interplay between SESEMAT pedagogical approaches and the Physics teachers' effectiveness ($\beta=0.275$, $p<0.001$). It was concluded that the SESEMAT pedagogical approaches influenced the teaching effectiveness; the school environment influenced the teaching effectiveness; and the school environment moderated the influence of pedagogical approaches on teaching effectiveness. The study recommended a need: for instructional supervision by the head teachers; for ensuring regular workshops and trainings of science teachers by the government for improved teaching; for school administrators to provide minimum teaching materials; for vestibule training opportunities for benchmarking and creation of teacher development schemes, among others. Above all, the study added value to the existing body of knowledge on curriculum interventions and school outcomes by exploring the moderating influence of school environment. This provided enriched information for informing educational policy-makers.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

In the 21st century, effective teachers were key to every country's education system. This need was emphasized by the United Nations Education, Scientific and Cultural Organization [UNESCO] (2021) which regarded teachers as one of the most influential and powerful forces for equity, access and quality in education and key to sustainable global development. The need was even greater following the increased attention to science, technology, engineering and mathematics (STEM) owing to their connection with sustainable development (Nguyen et al., 2020). In response to that demand, quality STEM education was emphasized by the national policies. This had paved way for the formulation of interventions aimed at boosting the quality of teachers, giving birth to Secondary Science and Mathematics Teachers (SESEMAT) pedagogical approaches in Uganda. SESEMAT was an international form of teacher professional development and studies had shown that effective teachers used appropriate pedagogical approaches which were capable of inculcating relevant skills, values and knowledge among the learners.

The current study was an investigation into the influence of SESEMAT pedagogical approaches; and the school environment on the effectiveness of Physics teachers in secondary schools in Kigezi Sub region, Uganda. The major aspects of SESEMAT pedagogical approaches had been considered by this study in order to enumerate how they influenced the physics teachers' effectiveness. In otherwards, this chapter presented the background (historical, theoretical, conceptual and contextual perspectives), statement of the problem,

purpose of the study, research objectives, questions, hypotheses, scope, significance of the study and the conceptual framework.

1.1 Background to the Study

Highly effective teachers in an education system are important because they significantly improve skills, values and the students' academic knowledge relevant to the desired content (Anthony & Walshaw, 2023; Killen & O'Toole, 2023; Laraib, 2014; Muijs & Renold, 2011). Therefore, effective teachers were required for science subjects because the quality of science, technology, engineering and mathematics (STEM) education was highly needed (Felder & Brent, 2024; Nguyen et al., 2020) if development goals such as industrialisation and globalisation were to be realised (Maryanti et al., 2022; Mikhailova et al., 2024; Ministry of Education and Sports [MoEs], 2018). The national development goals in the context of industrialisation, self-reliance and globalisation, required quality STEM (MoES, 2018) and physics as a core subject, generated knowledge for scientific discoveries (Faridi et al., 2021). The knowledge was needed for advancements in technology (Mansfield & O'sullivan, 2020) and therefore, the discipline was a focal point for the economic development of any country (Abubakar, 2012; Fidel & Tuncay, 2019; Josiah & Shedow, 2020).

According to a report by Uganda National Commission for United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2017), generally, performance in Physics was dismal in most developing countries. Then, the Uganda National Examinations Board (UNEB) Reports for Uganda Certificate of Education (UCE) for the years, 2016 to 2023 linked that to teachers' ineffectiveness and more so, the continued theoretical teaching of the

subject (UNEB, 2023). Essentially, when teachers handled any science subject theoretically, there was likelihood that students would perform poorly in that subject's examinations (Fauth et al., 2019). Therefore, this study sought to investigate the antecedents of Physics teachers' effectiveness in Uganda and it was contextualized in Kigezi sub-region. Thrust was put on SESEMAT approach antecedents that were introduced to enhance pedagogical skills of teachers who handled science subjects. In addition, the impact of the prevailing school environment antecedents on Physics teachers' effectiveness was assessed to determine whether it was enabling or otherwise. The moderating role of the school environment on the interplay between pedagogical skills applied and the physics teachers' effectiveness was equally assessed by this study.

1.1.1 Historical Perspective

Teachers are an important in-school factor influencing pupils and students' learning (European Parliament, 2014; Tjabolo, 2020). However, this relationship materializes when the teachers are effective (Anthony & Walshaw, 2023; Munna & Kalam, 2021). It followed ,therefore, that educational institutions with effective teachers implemented best classroom practices, which were beneficial to learners (Bardach & Klassen, 2020; Standl & Schlomske-Bodenstein, 2021). That accounted for why teacher effectiveness had become one of the cardinal objectives that all nations were vying to achieve (Organisation for Economic Co-operation and Development [OECD], 2015). That notwithstanding, teacher ineffectiveness continued to be a major challenge to education systems worldwide.

Globally, teacher ineffectiveness had plagued the education systems for a long period. For instance, in the 1960s, teacher ineffectiveness was a major concern in the United States of America (USA). That called for policy intervention leading to, and consequently designing of an evaluation system for counteracting the problem (Mathesz, 2014). Similarly, many European countries also experienced the challenge (OECD, 2005; Wim, 2013). Like their counterparts in the USA, the educational planners and policy-makers in Europe hatched a number of strategies to curb the challenge, including revising the teaching strategies to ensure that learning became more practical and learner-centred (Eurydice Report, 2021). While the foregoing examples of USA and European countries had shown that the education systems in many developed countries had faced the challenge of teacher ineffectiveness, the case of other developing countries provided contrasting information (Kim et al., 2019; Melesse & Gulie, 2019).

In developing countries especially in the Sub- Saharan Africa (SSA), teacher ineffectiveness was a common problem faced by educational institutions. A case in point was Kenya where studies (such as Kobiah, 2024; Kodero et al., 2011; Mabeya et al., 2019) had shown that poor mastery of subject content, wastage of students' time, disrespect of students, low esteem, poor teaching methods, failure to restrain one's emotions and ineffective feedback were common among teachers. Similar to the case of Kenya, teacher ineffectiveness was reported in Nigeria (Bada et al., 2020; Fakunle et al., 2023). Accordingly, limited supervision, lack of instructional materials and insufficient infrastructural resources were cited as the causative factors for prevalence of teacher ineffectiveness in the country (Bada et al., 2020). The case of South

Africa also provided further evidence of teacher ineffectiveness in the developing countries. The challenge was more acute in schools located in the poverty-stricken and hard-to-reach areas. Characteristically, most teachers in such schools have limited pedagogical content knowledge especially in Mathematics (Pretorius, 2017). The prevalence of teacher ineffectiveness had grossly affected the student achievement especially in STEM subjects such as physics. The magnitude of the challenge was reported by PISA (2014) in a survey covering 65 developing countries where it was observed that physics was the worst performed STEM subject in the schools.

In response to the above challenges, nations around the world had formulated reforms to reverse the situation for the better. One of the reforms was promoting the professional development (PD) of in-service teachers (Bautista & Ortega-Ruiz, 2015). The importance attached to teacher professional development lay in the fact that teachers had the greatest potential to impact student learning (Wilichowski et al., 2021) and into adulthood (Popova et al., 2022; Wilichowski et al., 2021). This relationship accounted to why teacher continuing professional development (CPD) was emphasised by governments in order to foster teacher quality in order to realise improved student learning and enhanced educational outcomes (Abakah, 2023; Bognar et al., 2024). In the last two decades, a number of international teacher professional development programmes had been implemented in different countries. Such included LeadNow! Tu Clase, Teach2030 and Communidad Atena, among others (Wilichowski et al., 2021). Those pre-service and in-service teacher training and education programmes aimed at equipping teachers with the soft and hard skills needed to create inclusive quality learning environments for their

students (Björn, 2020). This study, therefore, focused on in-service programmes and specifically, SESEMAT in Uganda.

The SESEMAT programme was an international In-Service Training Programme (INSET) for serving teachers of Mathematics and Science in Uganda's secondary schools (Komakech & Osuu, 2014; Manyiraho, 2020; Mbeya, 2020; MoES, 2006) which was introduced in 2005. The programme was trialled in Butaleja, Tororo and Masaka districts where notable positive impacts were realised (MoES, 2006). The SESEMAT programme was later rolled out to cover all districts of Uganda (Gumisirizah et al., 2022; Kirya et al., 2022; MoES, 2006). The introduction of the programme was in response to the government's White Paper on Education, which emphasized the need for enhancing the teaching effectiveness of science teachers. This imperative, gave the linkage between STEM and the realisation of the desired levels of economic growth and development (Government of Uganda, 1992). The timing of the intervention coincided with the passing of the Science Education Policy, 2006 which made all science subjects (Physics, Chemistry, Biology and Mathematics) compulsory at 'O' level. Therefore, SESEMAT was looked at as a lasting solution to the recurrent cases of poor academic performance in the science subjects (Tinkamanyire, 2010). The high hopes in reversing that trend of poor performance were premised on the fact that unlike the traditional teaching methodologies, SESEMAT pedagogical approaches emphasised hands-on and minds-on teaching and learning (Gumisirizah et al., 2022; Kirya et al., 2022). The programme would therefore be a difference maker by improving the teaching and learning of science subjects (MoES, 2006; Komakech & Osuu,

2014) and consequently, academic performance (Manyiraho et al., 2020; Mbeya, 2020).

Despite the implementation of SESEMAT in many secondary schools, the academic performance in science subjects had not improved greatly (Altinyelken, 2010; Gumisirizah et al., 2022; Kirya et al., 2022; Sikoyo, 2010). Comparably, the worst-case scenarios were reported in Physics. Indeed, the results released by UNEB in recent years (2022 and 2023) had shown that the performance in Physics had not improved as anticipated. That observation reinforced prior findings by Ahimbisibwe (2015) who reported that between 2005 and 2015, the passing rate in Physics had never exceeded 50%. The above incidences cast doubt on the significance of the SESEMAT programme in enhancing teacher effectiveness, hence, the need to examine the relationship between SESEMAT pedagogical approaches and physics teachers' effectiveness.

The influence of SESEMAT teacher professional development (TPD) programme could not best be understood without factoring in the possible impact that the school environment had on teacher effectiveness. The influence of the school environment was rooted in the theoretical predispositions of Kurt Lewin's Field Theory (Lewin, 1936) and Urie Bronfenbrenner's Social Ecological Systems' Theory (Bronfenbrenner, 1979). Both theories underscored the importance of the environment and highlighted that human behaviour was a function of both the person and the environment. For a long time, the influence of the school environment in relation to teacher effectiveness had attracted significant attention and research interest (Cohen et al., 2009; Davis & Jordan, 2000; Nurlailah & Ardiansyah, 2022; Toropova et al., 2021;

Wilson et al., 2020). Unequivocally, the school environment positively influenced teacher efficiency and student learning, among other facets of a school setting (Hoy & Hannum, 2000; Klem & Connell, 2004; Munna &Kalam, 2021; Sokmen, 2021). For that reason, this study assessed the school environment as another antecedent of teacher effectiveness and its moderating effect on teacher effectiveness.

In that case, previous studies (such as Benevene et al., 2020; Kigenyi et al., 2017) had shown that school environment greatly influenced teacher effectiveness. On the teaching performance, Kigenyi et al. (2017) established that a favourable school environment translated into better teacher performance while Benevene et al. (2020) reinforced the above relationship and reported that schools that were focused on performance management enhanced both the professional development of teachers and the respective improvement in teaching. However, none of the studies was conducted in Kigezi sub-region.

1.1.2 Theoretical Perspective

Two theories underpinned the study namely; Social Constructivism Theory (SCT) by Lev Vygotsky (1962) and Social Ecological Systems Theory by Urie Bronfenbrenner (1977). Constructivists such as Vygotsky were critical of the traditional, didactic, memory-oriented teaching methods and argued for their replacement with more learner-centred styles (McLeod, 2024). They believed that people actively created new information whenever they interacted with their environment (Saleem et al., 2021). The constructivist learning was affected by the learners' characteristics, cognitive, social and emotional development, individual differences, cultural diversity, motivational atmosphere and the teachers' classroom strategies, school's location, as well as

the quality of teachers (Zajda, 2021). The constructivism advocated for the use of practical methods of learning which were capable of enabling the learners to gain knowledge, reflect and discuss their work before peers in the classroom. The proponents of this theory discouraged rote learning and outright imitation and memorization of others' conceptions and definitions and settled for the learner own discovery (Saleem et al., 2021; Zajda, 2021). That was necessary because a learner was supposed to create their own understanding and vie to accumulate knowledge through experience and reflection. By reconciling the newly learnt information with our prior knowledge and experience, we are able to modify our beliefs or dismiss what we may deem irrelevant (Zajda, 2021). These efforts made the learner an innovator and active knowledge creator. Thus, asking questions, investigating phenomena and evaluating situations as they happened should be the backbone of learning. The task was therefore with the teachers to encourage the learners to apply active leaning methods such as experimentation and real-world problem solving followed by discussing their findings (Saleem et al., 2021). What was gleaned from the above views was that learners should be engaged actively in their learning. As well, they should be assisted to relate theoretical beliefs with real-life experiences and should equally; construct knowledge in a collaborative manner. That matched with the dimensions of SESEMAT pedagogical approaches, namely: - active learning, contextual learning and collaborative learning that were assessed by this study. The extent to which the teachers applied those learning approaches determined how effective the teaching and learning of physics became. Despite the relevance, the theory was silent about the possible impact that the school environment could have on the teaching and learning. Instead, it made mention

of the environment in reference to the surroundings of a school that could be used as teaching grounds to enable the learners to be detached from the monotony of the classroom and be able to relate theoretical knowledge with what existed in real life. Therefore, the theory fell short of the relevance in providing underpinning information about the influence of the school environment on teacher effectiveness that was equally investigated by the study. To fill this void, the social ecological systems theory by Urie Bronfenbrenner was invoked.

Propounded by Urie Bronfenbrenner in 1977, the Social Ecological Systems Theory focused on the quality and context of the student and teachers' environment. Whereby, the context of the environment was the school setting. The environment had five sub-systems, namely: - microsystem, mesosystem, exosystem, macrosystem and chronosystem (Bukatko & Dachler, 1998). Despite that sub-division, the sub-systems were interrelated (Anand & Ebrahim, 2024; Harney, 2007; Veiga et al., 2023). In that case, the microsystem was a setting with particular physical characteristics, resources, patterns of activities, roles, and interpersonal relations experienced by a person (Newman & Newman, 2020). It was the classroom setting and the available resources therein, that enabled a teacher to perform his roles. Then the mesosystem included the job, the colleagues or fellow teachers and social groups in the school setting. The exosystem referred to the set of rules, regulations and workplace standard operating procedures laid down by the school's policy-makers such as the Board of Governors (BoGs) and the Parent- Teacher Association (PTA); the macrosystem referred to the social forces and cultural expectations. And lastly, the chronosystem considered how the movement of

time affected an individual. It denoted to patterning of events and transitions that occurred over the course of an individual's life (Gonzales & Gonzales, 2021). Such included the socio-historical events that affected an individual including events that might have occurred prior to the individual's birth. These events and their timing in one way or the other, influenced a person's life; for instance, in the present time, a Physics teacher who had expertise in computer mediated teaching and learning was far better than one who was a novice or Luddite. That difference was magnified by the corona virus disease 2019 (COVID-19) that gave rise to increased online teaching and during that time as well as, hybrid teaching. All those subsystems might contribute to the teacher's effectiveness. The theory was relevant to this study given the composite nature of the school environment. Besides, the theory focused on the child, in this aspect the learner, and how the school environment influenced the teaching for their benefit. However, despite the applicability of the theory, it was worth noting that the school environment was not a fixed factor and it varied between institutions. Therefore, the extent to which the school environment influenced the Physics teachers' effectiveness called for an academic inquest.

1.1.3 Conceptual Perspective

The study assessed the antecedents of the physics teachers' effectiveness. The antecedents were the independent variable whereas the teacher effectiveness was the dependent variable. The two major antecedents assessed by the study were the SESEMAT pedagogical approaches and the school environment. The pedagogy focused on how teachers applied their teaching style and related to different theories they used as well as the assessments they prepared and administered; and how they packaged the feedback and (Rejjak et al., 2018).

According to MoES (2006), the pedagogical approaches used in SESEMAT were intended to guide the teacher in developing and delivering lessons that enhanced the learners' growth. In this study, pedagogical approaches were conceptualised to mean active learning, contextual learning and collaborative learning. Under active learning, the learners were fully engaged in the learning process and they were not passive recipients but partners. They participate in class and acquire skills like critical thinking and problem-solving (Demirci, 2017). For the case of this study, active learning included free expression, learners delving hypothesis alone and recording observations alone. The contextual learning focused on facilitating the learners to construct patterns that embodied meaning and linking the academic content with the context of everyday life of a learner (Weimer, 2002). To realise this goal, learners applied locally available materials so that they were able to acquire new knowledge related to their real-life experiences. With collaborative learning, the learners were divided into smaller groups and were assigned tasks to solve. As was the case with active and contextual learning, sessions under collaborative learning are supervised by teachers. Differently however, the students under that type of learning were supported to work together, complete the tasks and to share the knowledge with the reassembled class (Fakomogbon & Bolaji, 2017).

A school is a complex environment (Arul, 2012; Mick, 2012) and the environment includes physical conditions such as density, privacy, activity areas, open spaces, green areas, furniture, gadgets for controlling environmental hazards, the nature of relationships that occur among the members (Tapia-Fonllem et al., 2020), the school leadership styles (Kilag et al., 2023b; Uy et al., 2024), the school leadership skills (Daing & Mustapha, 2023); and, the scope

and adequacy of the teaching resources, among others. Schools with adequate physical conditions and teaching resources had a favourable school environment whereas those without did not. In terms of leadership, the schools with democratic leaders encouraged active participation of teachers in decision-making compared to those with autocratic leadership. A positive school environment improved the teacher well-being and consequently, teaching effectiveness (Granziera et al., 2023; Tripon et al., 2023).

Teacher effectiveness was the outcome variable and according to Bardach and Klassen (2020) and Burroughs et al., (2019), much as teachers have a profound effect on student learning and achievement, some are more effective than others are. The teacher quality determines the student quality (Cinches et al., 2017; Mastrokoukou et al., 2022). There are remarkable differences between more effective and less effective teachers (Bardach et al., 2022). Thus, effective teachers were an important component that influenced the achievement of the learners, thereby leading to the realisation of the goal of national education systems (Duckworth et al., 2009; Karim et al., 2021). Although teacher effectiveness in most studies was measured by assessing the academic achievement of the learners, the aspect transcended mere student achievement to include how teachers impacted classrooms, schools and their colleagues as well as how they contributed to other important outcomes of the students (Goe et al., 2009; Schweig, 2019). Despite that extended view of the notion of measuring teacher effectiveness, worldwide, school standards were determined by the position in the league tables using academic grades (Towers & Maguire, 2023). Basing on that assertion, this study adopted academic achievement as the measure of teacher effectiveness. Whereby effective teachers made better

mentors (Matsko et al., 2020). That was possible because they promoted active learning and engaged learners in deliberate practice (Thammasitboon & Brand, 2022). Moreover, that type of teachers also engaged the learners in drills with the intent of invoking or retrieving prior knowledge and experiences for purposes of motivating the learners (Thammasitboon & Brand, 2022). Equally, effective teachers were known for blending the above strategies with an alluring environment that was not only psychologically edifying but also safer for all categories of learners (Bardach et al., 2022; Thammasitboon & Brand, 2022).

1.1.4 Contextual perspective

Declining performance in the science subjects at 'O' level had become a salient feature of Uganda's education system for a long period of time (Bwenvu et al., 2020; Manyiraho et al., 2020), Kigezi sub-region in particular (Namayanja et al., 2021). The poor performance was attributed to the Science Education Policy 2006 which made science subjects compulsory for all 'O' level students without corresponding improvements in the science teaching/ learning environments and quality of teachers, among others (Kasule, 2016). The worst performance in STEM subjects was in Physics (UNEB, 2019, 2020). Recently, studies (such as Gumisirizah et al., 2023; Lugolole et al., 2024) had shown that the academic performance of students in Physics at 'O' level had continued to decline. This observation was supported by the UNEB report on the work of candidates (2021) which attributed the poor performance in Physics to failure of candidates to convert units, poor mastery of basic knowledge in physics such as lower secondary topics like mass, confusing 'force' in physics with 'force' in security, among others. Much as students at 'O' Level had shown high motivation of studying Physics (Kwarikunda et al., 2021), still, in the recently released results

(UCE 2023), physics was among the 3 subjects with a noticeable drop in performance (UNEB, 2024). The UNEB summary reports on the regional performance (2017-2022) had shown that the academic performance of the students in Physics in Kigezi sub-region had continued to decline over the years compared to the neighbouring Ankole sub-region. Further comparison with Buganda region showed that the performance was worse (Table 1.1)

Table 1.1

Comparative analysis of student performance in percentage in UCE Physics in selected sub-regions for selected years (2020-2023)

Sub-region	**2020**				**2022**				**2023**			
	D	**C**	**P**	**F**	**D**	**C**	**P**	**F**	**D**	**C**	**P**	**F**
Buganda	35	20	14	31	42	33	10	15	46	20	20	14
Ankole	16	29	21	44	31	20	11	38	35	20	30	15
Kigezi	8	10	10	72	12	18	16	54	15	20	12	53

Source: UNEB Reports on performance in Physics; D- Distinction, C-Credit, P-Pass, F-Failure

Found in South Western Uganda, Kigezi sub-region comprised of Kabale, Rubanda, Rukiga, Rukungiri, Kanungu, and Kisoro Districts. There was a persistent poor performance in Physics at 'O' level as shown in UNEB Reports for the years 1997 to 2006 (see Appendix 12, Panel A). The empirical evidence from UNEB reports on the work of candidates cited causes of that performance as poor teaching methods, narrow pedagogic content among the teachers and deficiencies in learner assessments (UNEB, 2000, 2005 and 2006). However, that situation was thought to have improved enormously with the introduction of the SESEMAT programme though there was no noticeable improvement (see Appendix 12, Panel B). The recent UNEB reports on the

candidates' performance in Physics (2021-2023) had attributed the poor academic performance in Physics to the poor teaching methods, the narrow pedagogic content, the limited knowledge of the candidates on elementary principles and content of Physics and the failure to relate the requirements of the questions set to the candidates' immediate environment. The above empirical evidence showed that the situation could be worsening possibly because of ineffective teaching of Physics and the lack of an enabling school environment. Hence, the need for this study to generate information that could be used to devise strategic interventions for reversing that trend of poor performance in Physics.

1.2 Statement of the Problem

In the last one decade, 'O' level candidates had continued to perform poorly in Physics. Compared to other STEM subjects, the performance had failed to hit the 50% pass rate (Ahimbisibwe, 2015; Gumisirizah et al., 2023; Lugolole et al., 2024; UNEB, 2024). Compared to the other sub-regions, Kigezi, had continued to register high numbers of students with failure (F9) while others passing marginally (Passes 7 and 8). The UNEB archives and records for 2011(55%), 2012(62%), 2013(60%), 2014(55%), 2015(57%), 2016(55%), 2017(54%), 2018(68%), 2019(57%), 2020(72%), 2022(54%) and 2023(53%), respectively had shown that a high percentage of candidates in the sub-region were failing Physics in each year. The recent UNEB reports (2020, 2022 and 2023) about individual subject case analyses showed that the students had failed questions set on basic knowledge in Physics such as 'Mass' while a big number performed poorly on problem cases that involved graph work. Besides, majority of the candidates rarely followed instructions while many others were unable to

take correct measurements using a metre rule yet. Although the UNEB reports for the years 2020, 2022 and 2023 attributed the above anomalies to teacher effectiveness, no empirical study had been carried out so far to validate the claim, leading to a knowledge gap. To fill the void, this study assessed the antecedents for improving the Physics teachers' effectiveness in terms of SESEMAT pedagogical approaches and the school environment in order to generate information for not only filling the knowledge gap but also informing policy. This study was to assess the antecedents for improving the Physics teachers' effectiveness in Kigezi sub-region in order to inform policy and practice.

1.3 Purpose of the Study

The purpose of the study was to assess the antecedents for improving the Physics teachers' effectiveness in Kigezi sub-region in order to inform policy and practice.

1.4 Objectives of the Study

The study was guided by the following objectives:

1. To determine the relationship between the pedagogical approach antecedents and the Physics teachers' effectiveness in Kigezi sub-region, Uganda.
2. To establish the relationship between the school environment antecedent and the Physics teachers' effectiveness in Kigezi sub-region, Uganda.
3. To ascertain the moderating impact of school environment on the relationship between the pedagogical approaches and the Physics teachers' effectiveness in Kigezi sub-region, Uganda.

1.5 Research Questions

The study sought to provide answers to the following research questions:

1. In which way did the pedagogical approach antecedents applied by Physics teachers affect the teaching effectiveness in Kigezi sub-region?
2. How did the school environment antecedent affect the Physics' teacher effectiveness in Kigezi sub-region?
3. What was the moderating impact of the school environment on the relationship between the pedagogical approaches and the Physics teachers' effectiveness in Kigezi sub-region?

1.6 Research Hypotheses

The study tested the following Null hypotheses:

1. H_{01} The pedagogical approach antecedent did not have a significant relationship with the Physics teachers' effectiveness in Kigezi sub-region.

   H_1 The pedagogical approach antecedent had a significant relationship with the Physics' teachers' effectiveness in Kigezi sub-region.
2. H_{02} The school environment antecedent did not have a significant relationship with the Physics teachers' effectiveness in Kigezi sub-region.

   H_2 The school environment antecedents had a significant relationship with the Physics teachers' effectiveness in Kigezi sub-region.
3. H_{03} The school environment did not have a significant moderating impact on the relationship between the pedagogical approaches and the Physics teachers' effectiveness in Kigezi sub-region.

H_3 The school environment had a significant moderating impact on the relationship between the pedagogical approaches and the Physics teachers' effectiveness in Kigezi sub-region.

1.7 Scope of the Study

1.7.1 Content Scope

The content scope was on Physics teachers' effectiveness as the dependant variable and two antecedents (pedagogical approaches and school environment) as the independent variables. The teacher effectiveness was assessed in terms of effective communication, subject matter expertise, professional competence, teaching style and the classroom management style. Then the pedagogical approaches were assessed under the dimensions of active learning, contextual learning and collaborative learning. The school environment was conceptualised as administrative support, collegiality and professional development. While the Physics teachers, head teachers and sub-region education officials participated in the study.

1.7.2 Geographical Scope

The study was carried out in Kigezi sub-region, South western Uganda. That region comprised of Kabale, Rukiga, Rubanda, Rukungiri, Kanungu and Kisoro Districts. The physics teachers from both private and government-aided 'O' level secondary schools participated in the study since the STEM subjects were compulsory. That region was selected due to recurring poor performance in Physics at UCE (UNEB Reports, 2011 – 2023).

1.7.3 Time Scope

The study was limited to a period of 12 years (2011 to 2022) which was selected basing on the routine evidence relayed by UNEB that indicated a serious drop

in performance in Physics yet, over the said period, the government had allocated funds to implement the SESEMAT programme for improving the pedagogical approaches that were applied by the STEM teachers.

1.8 Limitations and Delimitations

The SESEMAT programme had grand objectives including enhancing the academic achievement of learners, improving the readiness of learners to learn, promoting active and positive participation of the learners, among others. To do so, the teachers had to vary the teaching methods and be flexible in the selection of teaching methods. Therefore, this study would have been robust if the students were also included in the sample. However, this would complicate the entire study as the requisite logistics were not available at the time of the study and that accounted for why the study was delimited to only teachers as the main respondents.

1.9 Significance of the Study

The findings could be of benefit to policy makers, physics teachers, head teachers, students and future researchers and/or scholars in the following ways: The policy makers in the Ministry of Education and Sports and the educational planners from departments and agencies might benefit from the findings of this study by borrowing insights reported by this study as gaps or anomalies hence enabling them to formulate policies or effecting policy updates with rich data. That was likely to cause a potential improvement in the structuring of the policies and the respective interventions using a data-driven approach.

The pitfalls inherent in the application of the SESEMAT pedagogical approaches limiting the acquisition of certain learning behaviours among learners had been identified by this study. Therefore, the findings were

beneficial to the students since they were likely to attract immediate attention from the MoES and the District Education Offices. Consequently, the status of academic performance was likely to improve proportionately.

The Physics teachers could benefit from the findings of the study by differentiating and replicating the practical recommendations provided at end of this study. This might cause a potential revision of the current approaches used in teaching Physics leading to the redemption of the tainted reputation of underwhelming performance in the districts and beyond.

The findings of the study could provide head teachers with documented evidence of the underlying factors leading to poor performance in Physics that were both teacher-and school-environment related. As financial planners and quality control officers, the findings provided litmus to the host of factors bedevilling the performance in science subjects in particular. The information enriched them with key points to differentiate, incorporate in school improvement plans and present to stakeholders such as the foundation bodies and the Boards of Governors for consideration.

There was paucity of data on the association between pedagogical approaches, school environment and teacher effectiveness in Uganda. Therefore, the study provided an immense input to the knowledge body about the efficacy of curriculum improvement interventions and teacher effectiveness. This manuscript provided a source of literature to future researchers and scholars as well as secondary data for biased studies. Moreover, the methodology and the research tools, which formed part of this study, might be benchmarked.

Normatively, the accomplishment of the study had conferred innumerable benefits to the researcher. Firstly, it had displayed his knowledge prowess in the curriculum related interventions. Secondly, the posting of the completed thesis on Kyambogo University Institution Repository and the eventual access and use of the knowledge by other parties would lead to appreciation of the researcher as a subject matter expert. This could therefore, attract future collaborations in form of projects, among others.

1.10 Conceptual Framework

Figure 1.1 represents the relationship between SESEMAT Pedagogical approach antecedents (independent variables), school environment and Physics teacher effectiveness. SESEMAT Pedagogical approach antecedents were further conceptualized as active, contextual and collaborative learning activities. Those activities were supposed to be implemented by the teachers with focus on engaging learners and encouraging higher order thinking. Equally, the right application of contextual learning in a Physics class was expected to make the learning more meaningful, engaging and relevant to the learners while collaborative learning was supposed to translate into expanded knowledge and skills as learners worked together. Teacher effectiveness (dependent variable) was conceptualised as effective communication, subject matter expertise, professional competence and classroom management style.

A conducive school was a necessity for effective teaching to happen. The school environment, was assessed under three dimensions: - administrative support, collegiality and professional development. For instance, a supportive school administration that was receptive and considerate to the requisitions of Physics teachers would promote the eagerness of the teachers to apply

contextual learning in the Physics lessons. Equally, the high affinity of a school head teacher in supporting and sustaining the capacity development programmes would spur the Physics teachers to be motivated to refine, boost and upgrade their pedagogical knowledge compared to one who acted vaguely about the same. On an equal note, the positive associative relationship between pedagogical approach antecedents and the physics teachers' effectiveness was subject to the prevailing school environment at a given time. Therefore, this study equally assessed the moderating role the school environment on the application of the SESEMAT pedagogical approach antecedents for effective teaching of Physics.

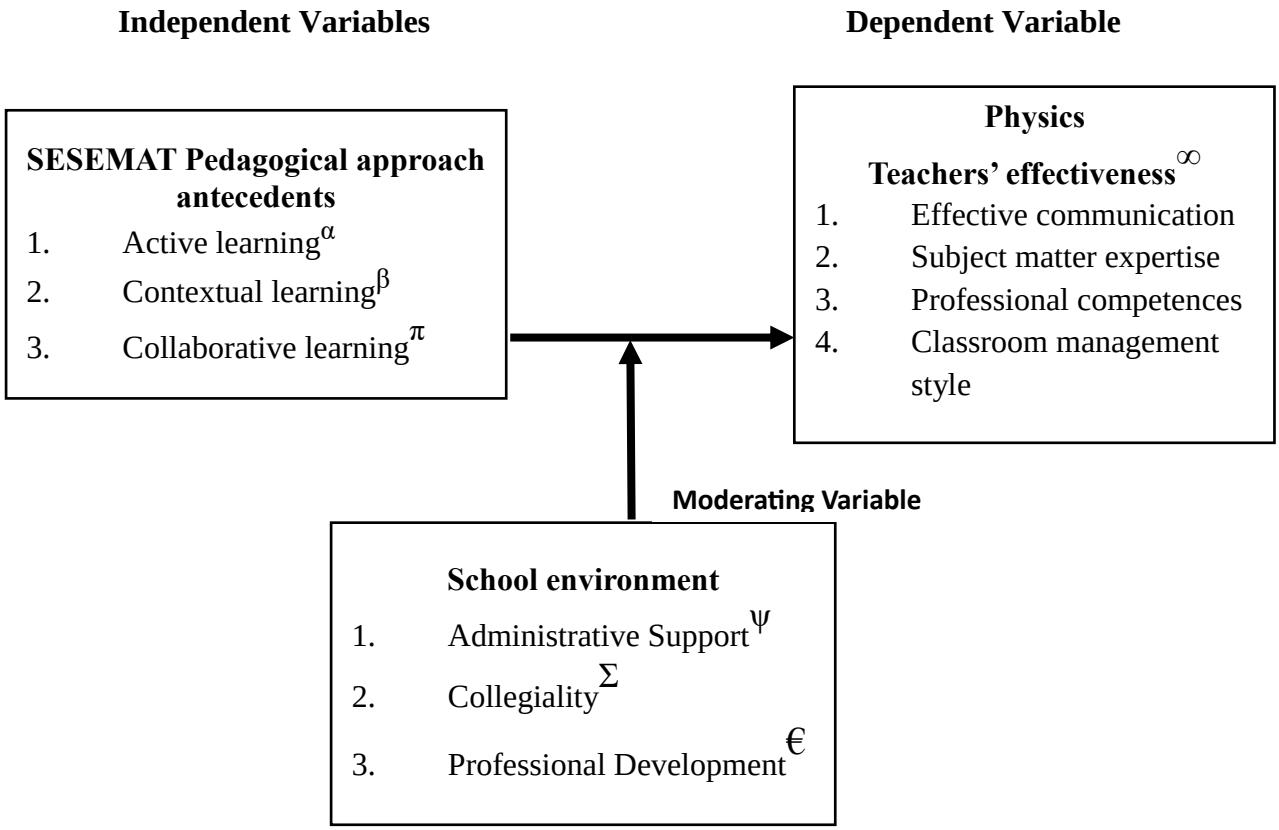


Figure 1.1: Conceptual Framework on SESEMAT Pedagogical approach antecedents, School environment and Physics teachers' effectiveness

Sources

α= Brame (2016), Dogan (2023), Idsardi (2020), Joshi et al. (2021), Sari et al. (2021)
β= Montalbo and Villanueva (2020), Utami et al. (2023), Pedroso et al. (2023)

π= Chounta (2019), Drew (2024), Salma (2020), Lim and Lim (2020), Scager et al. (2019)

∞= Aslantas (2020), Fan (2022), Gupta (2022), Schunk and Zimmerman (2023)

ψ= Crosby (2015), Kuriam (2020), Kilag et al. (2023a, b), Watson (2021)

Σ= Nguyen (2023), Teasly (2017), Longaretti (2020), Chen & Rong (2023)

€= Murray (2021), Parsons (2022), Sims et al. (2023)

1.11 Operational definitions of key terms

1.11.1 Pedagogy: Pedagogy refers to the suite of methods and practices that are applied by teachers to pass knowledge to the learners in a teaching and learning situation (Birendra, 2024). It goes beyond the notion of teaching to incorporate all the activities and strategies that a teacher implements so that they help the students to learn (Alam & Mohanty, 2023; Killian, 2019). In this study, the term was operationally used to mean the SESEMAT approaches prescribed for use by Physics teachers in secondary schools in Uganda.

1.11.2 Active learning: Active learning refers to a range of instructional practices that engage students in learning through activities that turn the learner from a passive listener to an expert (Idsardi, 2020; Marco-Fondevila et al., 2022). The term was operationally used in this study to mean the range of methods that were applied by the physics teachers to involve the students in the lesson such as allowing them to freely express their viewpoints in a lesson, encouraging them to set apparatus on their own and encouraging them to draw

inferences about the Physics content that they were handling in a practical lesson, among others.

1.11.3 Contextual learning: This is an approach where learners relate the material taught to what they are in the environment, which enhances better understanding (Montalbo & Villanueva, 2020). This term was operationally used in the study to mean the industry visits, using local materials and field-excursion studies that were organized by the physics teachers to enable the learners to connect theoretical classroom knowledge with what took place in the real-life situation.

1.11.4 Collaborative learning: Collaborative learning, also known as co-learning (Drew, 2024), is an educational approach in which two or more people engage in learning while working together on a joint task so that they are able to achieve a common goal (Chounta, 2019; Drew, 2024). In this study, the term was operationally defined and used to mean the teaching of students in groups by Physics teachers intended to enhance the physics learning synergy.

1.11.5 Teacher effectiveness: Teacher effectiveness was conceived by Klassen and Kim (2019) to mean a set of teachers within-person attributes-personality, motivation, beliefs and dispositions that interacted with contextual factors (cultural, social, educational) to influence the student's outcomes. According to Jupp (2008), teacher effectiveness denotes practical outputs of teaching; the outputs are both quantitative (such as individual student's learning) and qualitative (such as how well the teacher performs in the classroom as rated by school leadership and peers). This term was operationally used in this study to mean the ability of the physics teachers to communicate effectively, exhibit

subject matter expertise, manifestation of professional competences, ease in adopting and applying varied teaching styles and rigour in applying suitable classroom management styles.

1.11.6 Effective communication: This refers to an individual's act of paying attention to the entire process and not merely the contents of the message (Cornelia, 2024; National Library of Medicine, 2007). An effective communicator focuses attention not only to verbal but also to non-verbal cues such as laughing, smiling, scowling, shoulder shrugging, hand movements, blank face, lip compression, tilting the head back and parting the lips (Burgoon et al., 2021; National Library of Medicine, 2007; Ruyizevna, 2023). This term was operationally defined and used in this study to mean the audibleness of the teacher, feedback, use of non-verbal cues and the relaxed mode of the teacher while teaching such as accompanying the content with a deserved smile.

1.11.7 Subject Matter Expertise: Thimothy (2021) defined subject matter expert as a person who possesses thorough knowledge and in-depth understanding of a specific topic or discipline. This term was operationally defined and used in this study to mean a physics teacher who was well acquainted with content knowledge of the different facets of 'O' level Physics curriculum.

1.11.8 Professional Competences: Competencies refer to a collection of skills, knowledge, behaviours, attitudes and attributes that combine to enable a person to perform designated tasks with agility and diligence (Ashworth, 2023). In relation to this study, professional competences referred to abilities that brought together an individual's soft and hard skills (Ipag Business School, 2022). The professional bodies and employers attached great value to individuals having

both hard and soft skills (University of Victoria, n.d). Professional competences enable an employee to a manage tasks assigned to them as part of their role in the best possible way (Antera, 2021; Qobilovna, 2023; Zacher et al., 2019). Competence development refers to the teachers' education, adapting the method of learning, and conveying their information into practice that learners can use to develop themselves (Avalos, 2011).In this study, this term was operationally defined to mean how diligently and immaculately, a physics teacher handled the teaching and learning activities in the secondary schools in Kigezi sub-region.

1.11.9 Classroom management style: Classroom management is the process of organizing and running classroom business by a teacher (Qassimi, 2021). This refers to the strategies and practices that are applied by educators to create an organized, productive and respectful learning environment (Adedigba & Sulaiman, 2020; Drew, 2024). It embodies a range of techniques such as setting clear expectations and maintaining a structured routine (Drew, 2024). Such skills and techniques help the teachers to maintain sanity in the classroom by keeping it organized, orderly, focused, attentive, on task, and academically productive (Obispo et al., 2021; The Glossary of Education Reform, 2014). In this study, the term was operationally defined and used to mean a set of practices utilized by Physics teachers to make classroom-learning environment serene and joyful for all students.

1.11.10 School environment: Pinquart (2021) defined school environment as institutional and structural features (e.g., size, space, structural organization, availability of resources), social relations (e.g., teacher-student relationships, relations between students), teaching and learning (e.g., quality of instruction),

physical and social-emotional safety, as well as shared beliefs, values, and attitudes (often referred to as school culture or school climate) that characterized an education institution. In this study, the term was operationally defined to mean the degree of administrative support that was provided by the school leadership, collegiality and professional development of the teachers.

1.11.11 Administrative Support: The Collins dictionary (n.d), defines administrative support as the necessary support provided by officials in positions of responsibility to an employee to enable them to succeed in achieving the goals and objectives that are pegged to their routine activities or assignments. Relatedly, while referring to university or other higher education settings, Andama (2020) defined administrative support as the use of non-academic persons for the achievement of its basic objectives such as finance, supply chain, human resources, research administration, student affairs and information technology to deliver services more efficiently and effectively to their business units. In this study, the term was operationally defined to mean the level of technical, emotional, instructional and environmental support provided by the head teachers in Kigezi sub-region to the Physics teachers.

1.11.12 Collegiality: Collegiality is defined as an approach, characterized by equality and a sense of belonging (Javis, 2021). In an organization, it manifests as shared beliefs, values, and vision; shared and supportive leadership; collective learning and application; supportive culture and context; and shared personal practice. Contextualized in a school setting, Longaretti (2020) conceived belonging to mean the relational, behavioural and relational aspect of being and doing, felt or lived, relating and acceptance. The term collegiality

was operationally defined in this study to mean the extent to which a Physics teacher felt valued by the school administrators and his/her peers.

1.11.13 Professional Development: Parsons (2022) defines professional development as gaining new skills through continuing education and career training after entering the workforce. In relation, Frederiksen (2016) professional development is a mechanism that individuals use to learn, update, and improve skills, abilities, and behaviours over time, and that parent institutions or regulatory agencies may encourage, support, or require. From the perspective of education, Czerniawski (2023) defined the term to mean both the formal and informal processes that enabled teachers to improve their professional practice throughout their careers with a commitment to transform education for the better. This study adopted Czerniawski's definition.

1.12 Chapter Summary

This chapter presented background information about the independent, moderating and dependent variables. Generally, the main issues conveyed were that teachers were a fulcrum along which the effectiveness of an education system rotated. They were veins through which the lifeblood of a school pulsed and were conduits through which both the school and the learner performance could be accentuated. However, while this might be a necessary condition, quite often, it might not be sufficient to confer the said benefits. It was sufficient when the teachers were effective and applying the right pedagogical approaches. Moreover, the school environment should equally be enabling for effective teaching to happen. In the next chapter, literature related to the dimensions of pedagogical approaches, school environment and teacher effectiveness was reviewed.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

Knowledge generation is an on-going process and needs to be logical. New knowledge should have a comprehensive connection with the previous relevant knowledge (Lim et al., 2022; Ward & McComb, 2017). The purpose of this chapter was to provide foundational knowledge about pedagogical approaches, school environment and teacher effectiveness (Paul & Criado, 2020; University of South Carolina, 2023). The literature review equally aimed at acquainting the researcher with clearer understanding of the theory(ies) on antecedents of teacher effectiveness so that the study was contextualized in the existing knowledge body (Breslin & Gatrell, 2023; Kraus et al., 2022; Kraus et al., 2023; University of Illinois, 2023). Further, review of literature was fundamental for identifying the appropriate methodologies applied by related studies in the field and in order to establish recurrent knowledge gaps and inconclusive arguments that needed to be filled and/or clarified (Boumezrag, 2022; Editage Insights, 2020; University of North Florida, 2022). In this study, literature was reviewed thematically in tandem with the specific objectives charted in Chapter 1. The actual review of literature was preceded by theoretical review and the conceptual framework.

2.1 Theoretical Framework

The assessment of the antecedents of teacher effectiveness was anchored on the theoretical frameworks. Defined, a theoretical framework referred to a compass used by a researcher to navigate a research journey (Varpio et al., 2021). Varpio and colleagues further conceded that a theoretical framework was akin to a

travel plan or map, which guided someone touring a new environment to relieve himself/herself of the curiosity by locating all the areas of interest with minimal or no external guidance. This argument rhymed with Eriksson-Zetterquist et al. (2021) and Kivunja (2018) who noted that the theoretical frameworks helped a researcher to formalize their study. Furthermore, the frameworks enabled researchers to theorize the: - study's problem, methodology, study results and; to make reflections from the emerging results (Varpio et al., 2020). This study was multidimensional and therefore, a single theory was not sufficient to support the critical assessments of the relationships investigated. Two theories were therefore adopted that were the Social Constructivism Theory and the Social Ecological Systems Theory as discussed below:

2.1.1 The Social constructivism Theory

This theory is a brainchild of a Russian psychologist Lev Vygotsky (1896-1934) which was published and became popular in 1962 (Vygotsky, 1980). The theory acknowledged the role that social interaction played in a child's cognitive development. It was an upgrade of Jean Piaget's cognitive Development Theory, which claimed that development preceded learning. Jean Piaget emphasized the importance of peer interaction while downplaying the critical importance of teachers in the learning process. The educational researchers had also criticized the Piaget's theory for being overly simplistic. For instance, according to Alanazi (2016), educationists believed that most often, when students learnt with minimal instruction by teachers, they became lost and frustrated. That occurred because with minimal guided instruction, the importance and structure of working memory was ignored (Alanazi, 2016). Jean Piaget further emphasized independence among learners with minimal or no

direction from teachers or instructors. In this case, educationists believed that such an undertaking would disadvantage the learners. They argued that learners needed to be guided to demonstrate knowledge for example, in making artefacts (Alanazi, 2016). Thus, lessons that were not facilitated by teachers were lacking largely because in many situations, leaving learners alone could be disruptive leading to ineffective learning. For instance, in a physics lesson, when a teacher embraced constructivist approach, he/she might engage a student in discussing how to measure the refractive index using a glass block and prism in a group or complete problem-solving exercises without minimal teacher-led instruction. In doing so, the learners would have tangible interaction with the said equipment in a laboratory setting and therefore, it was highly doubtable that learners could produce adequate results in practical lessons by relying on the theoretical knowledge acquired during group discussion sessions. Piaget's constructivist approach was further criticized for dwelling more on group thinking, thereby eliminating the importance of individuality of learners. Moreover, when learners were bundled in groups, it hindered the development of learner skills such as self-expression because of domineering (Alanazi, 2016).

On the basis of the above shortcomings, Vygotsky theorized that social learning preceded development. Indeed, Vygotsky reasoned that every function in a child's cultural development appeared twice; first, on social level, and later, on individual level; second, between people (inter-psychological) and then, inside the child (intra-psychological) (Crawford, 1996; Vygotsky, 1978). This argument made the social constructivism superior to the cognitive perspective. Underpinning the social constructivism theory were five key assumptions (Kapur, 2018). Firstly, learners constructed knowledge in which case

constructing new knowledge and information, the learners were supposed to be involved in thinking, accepting wisdom and making judgements. Secondly, knowledge was experience-based whereby that assumption rested on the argument that when learners underwent numerous experiences in life, they could connect theoretical knowledge learned in class with what took place in their immediate environment. Thirdly, learning was a social activity and therefore, learners were able to learn multiple things and to develop viewpoints when they became social. Through social interaction, they became aware of diverse areas in the environments unknown. Fourthly, all aspects of a person were connected including attitudes, emotions, values and actions. Contextualized to education settings, this assumption held that learners required several opportunities and reinforcement for holistic development. Fifthly, learning communities should be inclusive and equitable. That said, institutions such as secondary schools should endeavour to provide shades of opinion to the learners to enable them to construct reality from the distinct points of views (Kapur, 2018).

The proponents of that theory held that we never knew what was universally true or untrue, good or bad, right or wrong because each of us invented our universe based on our impressions of reality (Saleem et al., 2021). To harmonize those differences, collaboration was important and more so, in a group so that ideas were shared and problems were solved jointly. That provided pathways for generating new knowledge which amplified what was already known by the learner (Saleem et al., 2021). That was possible when there was active interaction among learners, the teacher and other components of the teaching-learning process (Evolving Education, n.d; Saleem et al., 2021). Thus,

according to social constructivists, learning became an eliciting venture whenever the teachers or instructors engaged the learners actively (University of Buffalo, 2024). Further still, the social constructivists believed that learning was a social process rooted in a social context [such as a school setting] where learners and teachers worked together to build knowledge. Therefore, the goal of teaching should be to design experiences since experience could not be imparted directly in the learners (University at Buffalo, 2024).

The two main principles of Vygotsky's theory were: - the More Knowledgeable Other (MKO) and the Zone of Proximal Development (ZPD). The MKO referred to a person with a better understanding or a higher intellectual ability than the learner regarding a particular learning task, process or concept. Vygotsky argued that the MKO might not necessarily mean a teacher or an older adult. Rather, it could equally be a child's peers with more knowledge and experience. More on, the MKO could be a gadget such as an electronic performance support system. However, when the MKO in use was an electronic gadget, it was programmed in such a way that it had more knowledge being learned about the topic than what the learner had (McLeod, 2024). An example in the Ugandan setting was the Cyber School (www.cybershooltech.co.ug) which enabled 'O' level students to perform practical exercises in Physics virtually. Then ZPD related to the difference between what a child could achieve independently and what could be achieved when the child was guided and encouraged by a skilled partner. Under the ZPD principle, Vygotsky emphasized the importance of social interaction and argued that when children were left alone, they would develop but could hardly reach their full potential. The gap between actual and potential learning was what

Vygotsky referred to as ZPD. To Vygotsky, that gap was bridged only when there is effective collaboration between the learner and the adults as well as other learners (McLeod,2024).

Vygotsky's Social Constructivism theory was adopted in this study because it emphasized the role of adults [teachers] as an important source of knowledge (McLeod, 2024). The theory focused on how an individual developed a clear understanding of what they were learning, building on past experiences (Kurt, 2023). Furthermore, the theory was relevant to this study because it implored the teachers to create an eliciting learning environment that catered for individual differences. Besides, the theory underscored the need for experimentation with physical objects, which was critical in physics teaching and learning since the experiments enhanced concrete learning. On the other hand, the theory was relevant to the study because it underscored need for teachers to tailor their teaching to the level of learners' concrete understanding of the content (Ahabib, 2021). Among others, the proponents of the theory advocated for the use of multiple learning activities while teaching the same lesson. For example, when a teacher divided a class into groups and assigned each group with a different learning task, the sharing of the outcomes by each group to the reassembled class should be facilitated by the teacher. That was necessary to minimize digressions and misconceptions in articulating the information. Further still, the theory emphasized use of guided learning in which teachers and learners could alternate turns in exploring a problem and open dialogue (McLeod, 2024). The teachers according to this theory, were a vital component of meaningful learning because they scaffolded a child's learning. They did so by engaging the child, while maintaining their interest in the task

through clear instructions on how to go about a given learning activity; keeping a child's frustration under control through supportive interaction and/or adapting instructional methods that suited the understanding capacity of a struggling child; emphasizing important features of a task; and, demonstrating a task to enable a child to establish simpler and clearer ways of executing it (McLeod, 2024). Furthermore, the theory was relevant to this study because it emphasized collaborative learning as a vital pathway through which learners could construct knowledge through social negotiation (McLeod, 2024) yet collaborative learning was a SESEMAT pedagogical approach. Equally, the theory appraised guided learning as a vital source of greater understanding among the learners (McLeod, 2024). This equally meshed with one of the study's research questions that sought to establish whether the SESEMAT pedagogical approaches affected the Physics teachers' effectiveness. Despite the viability of the theory in relating pedagogical approaches to teacher effectiveness, it was silent about the impact of another key antecedent of teacher effectiveness investigated by this study which was the school environment. To fill this gap, the Social Ecological Systems Theory was equally invoked as discussed below:

2.1.2 The Social Ecological Systems Theory

The SEST provided thorough explanations about how the environment affected the development and performance of an individual (El Zaatari & Maalouf, 2022). Propounded by Urie Bronfenbrenner in 1977, the SEST focused on the quality of the environment whereas the context of the environment in this study was the school setting. The SEST originated from development psychology and later, it was widely applied in educational studies especially those focusing

better educational environments (Tong & An, 2024). The educational research fields where the SEST had been utilized included: - child development and parental education research, educational accountability, education transition, computer assisted learning (CAL), early childhood education and higher education (Tong & An, 2024). Accordingly, the theory conceived the environment to consist of five interrelated sub-systems, namely: - microsystem, mesosystem, exosystemic, macrosystem and chronosystem (Anand & Ebrahim, 2024; Harney, 2007; Veiga et al., 2023).

The microsystem was the setting with particular physical characteristics, resources, patterns of activities, roles, and interpersonal relations experienced by a person (Newman & Newman, 2020). It was the classroom setting and the available resources therein, that enabled a teacher to perform. The mesosystem included the job, the colleagues or fellow teachers and social groups in the school setting. Then the exosystem referred to the set of rules, regulations and workplace standard operating procedures laid down by the school's policy-makers such as the Board of Governors (BoGs) and the Parent-Teacher Association (PTA); yet the macrosystem referred to the social forces and cultural expectations. Lastly, the chronosystem considered how the movement of time affected an individual. It denoted patterning of events and transitions that occurred over the course of an individual's life (Gonzales & Gonzales, 2021). Such included socio-historical events that affected an individual including events which might have occurred prior to the individual's birth which events and their timing in one way or the other, influenced a person's life. For instance, in the present time, a physics teacher who had expertise in computer mediated teaching and learning was far better than one

who was a novice or luddite. This difference was magnified by the corona virus disease 2019 (COVID-19) that gave rise to online teaching and in the present time, hybrid teaching. All these subsystems might contribute to the teacher's effectiveness.

In the context of this study, SEST provided us with lenses through which we were able to isolate how some factors in the school environment shaped the cognitive thinking, the emotions of the teachers as wellas their likes and dislikes. The theory was adopted in the study because of its relevance in assessing how the school environment affected the teacher effectiveness as proven by several other studies. For instance, Zhang et al., (2023) used the theory in the prediction of teaching enjoyment by teachers of English as a Foreign Language (EFL) and established that the school climate directly, predicted the foreign language teaching-enjoyment (FLTE). That study further established that the school climate equally affected teaching enjoyment indirectly as a positive mediator of teacher efficacy and psychological well-being. Amali et al., (2023) used the theory in assessing the parameters of the learning environment with focus on (re) determining the learners' preferred learning environment, and the results revealed that when teachers used easy-to-understand language (micro-level); ensured a positive social environment (meso-level); administered the students' learning assessments and provided feedback for self-improvement (exo-level); and used a learning approach that fostered understanding while minimizing memorization (macro-level), a positive learning environment was created and consequently, students were highly motivated to learn. The parameters identified at the various sub-system levels in the foregoing discussion were indicators of teacher effectiveness.

Similarly, Cipriano et al. (2018) applied the theory in assessing the perceptions of students and teachers about the classroom support during early adolescence. Their study focused on the classroom as the microsystem of the school and focused mainly on how the student and teacher perceptions of classroom support related to one another for purposes of identifying which ecological characteristics impacted the student and teacher perceptions of support. The results showed that teachers had varying experiences in the same school, hence underscoring the impact that the school environment could have on a teacher. In the same way, Moore (2012) applied the theory while assessing the role of the school environment in teacher dissatisfaction among the public school teachers in the United States and the results showed that the school environment had a significant effect on the dissatisfaction of teachers and concluded that improvements in school environment could cause a domino effect on job satisfaction.

2.2 The Conceptual Review

In this section, the main variables of the study namely: - the pedagogical approaches, the teacher effectiveness and the school environment were reviewed. The importance of this section was to provide curtain-raising ideas for backstopping the reader before engaging them in empirical debates about the interrelationships between the pedagogical approaches and the teacher effectiveness, the school environment and the teacher effectiveness and the moderating effect of school environment on the pedagogical approaches and the teacher effectiveness.

2.2.1The Pedagogical Approaches

Pedagogy is the method behind the art of teaching (Tirri & Toom, 2020). Broadly, Yadav (2019) described pedagogy as a suite of methods adopted for conducting teaching-learning sessions using various strategies and approaches. The approaches are known as pedagogical approaches (Kapur, 2024). And, Peterson et al. (2018) conceived pedagogy as repeated patterns or sets of teaching and learning practices that shaped the interaction between teachers and learners. In connection with the above, the pedagogical approaches referred to the said teaching and learning practices (Manyiraho et al., 2020; Peterson et al., 2018). These pedagogical approaches provided the best way for organizing and coordinating the teaching and learning process and conferred myriad benefits (Manyiraho et al., 2020; Mladenovic et al., 2022). Indeed, the pedagogical approaches enabled educational managers to choose a learning focus, to manage the learning process; and to determine the length and shape of an "arc of learning" (Peterson et al., 2018).

The changing circumstances across the globe had led to an increase in notional views about what national education systems could offer and how they could be harnessed to match the changing global, regional and national goals (Herodotou et al., 2019). Specifically, emphasis was on how the education systems could be rejigged to empower learners with requisite skills and competences to fit in the changing landscape (Halissy et al., 2013; Herodotou et al., 2019; Meyer & Norman, 2020; Pelekh & Shlikhta, 2024; Tan, 2021). Notable crosscutting skills included critical thinking, problem solving, collaborative skills, innovation, digital literacy and adaptability (Ata & Alpaslan, 2024; Ghare & Kastikar, 2024; Herodotou et al., 2019; Singha &

Singha, 2024). Application of the pedagogical approaches provided facilitating conditions for achieving the above skills (Herodotou et al., 2019). In appreciation of that linkage, Katrina (2024), Kelly et al. (2023) and Yadav (2019) enlisted pedagogy as an important component of an education system that not only led to improvements in the quality of teaching but also the achievement of several learning objectives. On the side of learners, the pedagogical approaches made them more receptive to the content taught and improved active participation in the teaching and learning process. Moreover, an appropriate pedagogy catered for individual differences (Friesen &Su, 2023; Kelly et al., 2023; Yadav, 2019).

In addition, the pedagogy enabled the learners to develop a deeper understanding of the subject matter thereby enabling them to achieve the specific learning outcomes. Furthermore, the adopted pedagogy rooted the learners in academia especially when it supported the development of higher-order cognitive skills such as analysis, synthesis and evaluation. Those according to Yadav (2019), complemented lower-order cognitive skills such as knowledge, comprehension and evaluation and consequently, that led to holistic learning.

The different pedagogical approaches met different learning needs. Firstly, some approaches supported learning of explicit content and secondly, others supported the learning of particular ways of doing things. On the third prong, the pedagogical approaches enhanced the learning of values and habits (Peterson et al., 2018). These approaches were necessary as many curricula included core competences, transversal skills or general capabilities that had to be imparted in learners at the end of a given cycle. The teachers play a key role

in selecting methods or approaches that support the realization of such goals (Peterson et al., 2018). Therefore, the primary objective of pedagogy is to develop effective learning experiences (Friesen & Su, 2023; Yadav, 2019). When pedagogical approaches are applied effectively, the learners achieve most if not all the learning outcomes as anticipated (Kapur, 2024; Yadav, 2019).

2.2.2 The School environment

A school setting is a complex environment (Sathasivam & Daniel, 2016). The school environment is a collection of both material and non-material resources in the institution. These include both the hard systems and soft systems (Ayodele et al., 2023). The hard system included the school plant and the auxiliary facilities such as canteens and sports grounds while the soft system included teachers, peers, cohesiveness, the subjects and the methods of teaching. When this environment is healthy and appealing, teaching becomes conducive and consequently, stellar academic achievement is realised by the learners (Ayodele, 2023; Falemu & Akinwumi, 2020). A school environment is a hierarchical system with many sub systems such as school leadership, drainage, classroom, blackboards, school compound, sanitation, toilets and urinals, staffroom, sitting facilities, teaching and learning materials, leadership styles of head teachers, monitoring and evaluation, the school neighbourhood and the community (Kigenyi et al., 2017). Those dimensions affected teacher effectiveness in different ways.

A school institution with dilapidated structures was most likely to divorce many potential parents away. The sight of cracked walls, perforated roofing, missing shutters, bushy lawns and unkempt hedges were signals of substandard services rendered by the school from just a mere outlook. These

inequities provided obtrusive information that teaching and learning was taking place under difficult conditions. Differently, an attractive school environment predicted the existence of an achievement-oriented leadership and therefore, better academic achievement (Ayodele, 2023). Thus, the school environment played a facilitative role on how teachers conducted their routine activities in the school setting. The components of the school environment of concern to this study were administrative support which had an effect on the student composition (class sizes and student ability) and (un)availability of facilities and resources (technology, materials and time). Collegiality was another key facet of the school environment that influenced the teacher effectiveness that was equally assessed by this study. As would be seen later, good collegiality imparted a feel-good factor among teachers and instilled good psychological well-being at the workplace. The third component, professional development, was also assessed as a vital part of the school environment that affected the teacher effectiveness by instance, boosting and amplifying the skillset and competences of the teachers as would be seen later.

2.2.3 The Teacher Effectiveness

It is common belief in the parlance of education that of all school-related factors that affect the performance of learners, teachers are the most important (Aslantas, 2020; Burroughs et al., 2019). The desired levels of academic performance are achieved when schools are staffed by effective teachers (Aslantas, 2020; Fan, 2022; Gupta, 2021). Following this dictum, school leadership always sought to hire effective teachers while parents always selected and enrolled children in quality schools to be served by the best teachers (Abdulkadiroğlu, et al., 2020; Aslantas, 2020).

The teacher effectiveness comprises of three different perspectives: - inputs, processes and outputs (Aslantis, 2020; Mastrokoukou et al., 2022). Inputs here, referred to what a teacher brought to their position. That included elements such as the teacher's background, beliefs, expectations, experience and pedagogical content knowledge. At times, these input measures are referred to as teacher quality (Gupta, 2021; Mastrokoukou et al., 2022). The processes referred to the interaction between the teachers and the learners and included professional activities that were performed by the teachers in a school setting. The outcomes denoted results of the instructional processes and those included student achievement, student behaviour engagement, attitudes and the socio-emotional well-being. Other outcomes might include the contributions made by the teachers to the school such as mentoring fellow teachers or community members in leadership roles (Mastrokoukou et al., 2022). In the same vain, Gupta (2021) noted that an effective teacher was one who was emotionally competent. The emotional competences were reflected in the teachers' ability to show kindness, warmth and compassion for learners. Besides emotions, an effective teacher had to have cognitive competences and these were reflected in how they used innovative teaching strategies as well as dispensing the subject matter knowledge. Lastly, the effective teachers exhibited behavioural competences, which in a school setting, manifested as patience, punctuality and attention to detail (Gupta, 2021).

An effective teacher was the bridge between the school and learners. Such a teacher utilized the available resources in the school environment to plan an eliciting teaching and learning experience which was capable of spurring the learners to academic excellence, thereby promoting school effectiveness and

consequently, its competitiveness among peers (Gupta, 2021). This linkage accounted for why Fan (2022), surmised that the contribution of a teacher toward the academic achievement of the learners was by far greater than the sum total of learner background factors such as poverty, language mastery and other facets of socio-economic life. It was equally important to note that an effective teacher was explorative and created an alluring environment that was capable of bringing out the best from all the learners (Baxodirovna, 2024; Kakharova, 2023; Kilag et al., 2023b). One of the ways through which an effective teacher did so, was by engaging the learners actively in the lesson. An effective teacher also ensured that the learners worked independently by fostering self-regulation (Gupta, 2021; Schunk & Zimmerman, 2023).

2.3 Related Literature

2.3.1 The Pedagogical Approach antecedents and the Teacher Effectiveness

Three pedagogical approaches were assessed namely: - active learning, contextual learning and collaborative learning. The efficacy of the three approaches was reviewed in the prism of teacher effectiveness as discussed below:

2.3.1.1 Active Learning and Teacher Effectiveness

This learning approach transforms learners from passive note-takers into scientific thinkers (Tachibana, 2015) and represents a paradigmatic shift from teacher-dominated to learner-led learning (Idsardi, 2020). Characteristically, this approach is not only focused on learning and practice, but also on giving learners autonomy (Cano et al., 2014). In active learning, there is active construction of knowledge (constructivism), learning declarative knowledge (what?) and procedural knowledge (how?), integration (transference between

domains), collaborative comparison of reasoning; and meaningful learning through articulation (McConnell et al., 2017; Pelley, 2014).

There are different strategies that teachers applying active learning can use (Brame, 2016; Iroegbu & Agboola, 2019). One of the techniques is pause-procedure which involves pausing for 2 minutes every 12 to 18 minutes and encouraging the students to discuss and rework notes in pairs. This strategy helps students to consider their understanding of the taught content, including its organization. Besides, teachers applying active learning could equally make use of retrieval practice. That method involved pausing for two or three minutes every 15 minutes in which the students wrote everything they could remember from the preceding class segment. In the same session, the students were encouraged to raise questions. The intent of this strategy is to improve long-term memory (Brame, 2016; Iroegbu & Agboola, 2019). In addition to the two techniques above, teachers could also use demonstrations (Nair et al., 2018). That method involved asking the students to predict the result of a demonstration and briefly discussing with a neighbour. After the demonstration, the students discussed the observed results and how it might have differed from their prediction. That was followed by explanations from the instructor that helped in identifying and correcting misconceptions which helped to restructure the students' mental model (Brame, 2016; Nair et al., 2018).

The think-pair-share sessions are another form of active learning (Sari et al., 2021). Teachers who apply this method ask students a question that requires higher order thinking (e.g., application, analysis, or evaluation levels within Bloom's taxonomy) (Lee & Shahrill, 2018). The students under this strategy think or write about an answer for one minute and are then requested

to turn to a peer to discuss their responses for two minutes (Brame, 2016). According to Apriyanti and Ayu (2020) and Sari et al. (2021), teachers who apply this technique asks groups to share their responses and to make a follow up with the instructor explanation. This strategy helps the students to articulate newly formed mental connections (Sari et al., 2021).

Active learning could equally be applied by teachers through use of peer instruction with Concept Tests. That method was a modification of the think-pair-share technique and involved personal response devices such as clickers. The Concept Tests were developed by Eric Mazur at Harvard University for large Physics classes (Bauer et al., 2023; Mitsushahi, 2020; Schell &Mazur, 2015). They focus on a single concept, cannot be solved using equations, have multiple-choice answers, are clearly worded and are of intermediate difficulty (Bauer et al., 2023). According to Brame (2016), teachers who apply this strategy pose a conceptually based multiple-choice question. They then, ask students to think about their answer and vote on a response before turning to a neighbour to discuss. The teachers encourage the learners to change answers after discussion, if appropriate. When this method is correctly applied, the teacher shares the class results by drawing a graph of student responses (Joshi et al., 2021). The teacher uses the drawn graph as a stimulus for class discussion. This approach eases teaching large classes especially when tools such as Poll Everywhere, TopHat, Turning Point are used (Brame, 2016).

Teachers can engage learners actively through use of minute papers and strip sequence (Brame, 2016; Deslauriers et al., 2018). Minute papers involved asking the students a question that required them to reflect on their learning or to engage in critical thinking and letting them to write for one minute while the

students share responses to stimulate discussion. The teacher could as well collect all the responses to inform the future class sessions. Like the think-pair-share approach, this approach encouraged the students to articulate and examine the newly formed connections. Strip sequence was used by teachers to give students the steps in a process on strips of paper that were jumbled; asked them to work together to reconstruct the proper sequence leading to the development of logical thinking.

Active learning also involves the use of concept maps and mini maps (Brame, 2016; Chi & Wylie, 2014; Silva et al., 2022). The concept maps as visual representations of the relationships between the concepts (Brame, 2016). That strategy involved placing the concepts in nodes which might be arcs or circles. The labelled arrows were used to relate the nodes. The concept mapping meets learning needs of both small and large classes (Silva et al., 2022). When used appropriately, the concept maps are capable of enhancing both critical and logical thinking among the students (Brame, 2016; Chi & Wylie, 2014). Like the concept maps, mini-maps are applied on small groups of two to three students who are tasked to arrange the concepts in a logical structure and relationships with arrows and words (Brame, 2016). The teachers who use mini-maps ask students to share their mini-maps and to clarify any confusing points. This promotes logical and critical thinking among students (Arduini Van Hoose, 2020; Brame, 2016; Fonseca et al., 2021; Fonseca et al., 2020). The advantage of mini-maps over concept maps was that the mini-maps took short time to accomplish and could help to meet the needs of a large class in a short period.

Categorizing grids are another important strategy under active learning (Brame, 2016). With this strategy, the teacher presents students with a grid made

of several important categories and a list of jumbled terms, images, equations, or other items (Marchak & Shvarts-Serebro, 2021). The students are asked to quickly sort the terms into the correct categories in the grid. The teacher follows this step with asking volunteers to share their grids and answer questions that arise. This approach allows students to express and thus interrogate the distinctions they see within a field of related items thereby helping the teacher to identify misconceptions (Brame, 2016; Sitthiworachart et al., 2022).

Active learning also involved use of student-generated test questions it also involved providing the students with a copy of the learning goals for a particular unit and a figure summarizing Bloom's taxonomy (with representative verbs associated with each category) (Aflalo, 2021). That step was followed by challenging groups of students to create test questions corresponding to the set learning goals at different levels of the taxonomy. To be effective, the teacher allowed every group to share their favourite test question with the whole class or even distributing all student-generated questions to the class as a study guide. This approach helps students to consider what they know as well as the implications of the instructor's stated learning goals (Brame, 2016).

Brame (2016) also proposed that teachers can use content, form and function outlines as well as decision-making activities. The content, form and function outlines involved dividing of the students into small groups and asking them to carefully analyse a particular artifact such as a poem, a story, an essay, a billboard, an image or a graph. That session was followed by identifying the "what" (the content), the "how" (the form), and the function (the why). The technique helped the students to consider the various ways in which the meaning

was communicated. Regarding decision making activities, the teacher asks the students to imagine that they are policy-makers who must make and justify tough decisions (Brame, 2016; Yusal et al., 2021). The teacher provided a short description of a complicated problem and asked the students to work in groups to arrive at a decision, and then have groups share out their decisions and explain their reasoning. According to Brame (2016), this technique is highly engaging and therefore, it helps the students to critically consider a challenging problem for which they are tasked to hatch creative solutions. Lastly, teachers could also apply case-based learning which involved presenting the students with situations from the larger world that required them to apply their knowledge to reach a conclusion about an open-ended situation (Alani, 2020; Brame, 2016). In that strategy, the teacher provided a case and asked the students to decide what they knew that was relevant to the case, what other information they might need, and what impact their decisions might have, considering the broader implications of their decisions (Oliván-Blázquez et al., 2022; Sartania et al., 2022; Tayce et al., 2022). That strategy involved paring the students in small groups of 3 to 5 members and providing time and opportunity for the groups to share their responses (Brame, 2016). That sharing enhanced concrete learning among the group members in particular and the entire class in general (Tayce et al., 2022).

The use of active learning strategies required resolve of the teachers (Dogani, 2023). They should be ready to attend workshops and training sessions; collaborate with colleagues to develop knowledge through sharing resources and ideas as well as peer guidance and support; engage in self-study by reading books and articles, watching videos and taking online courses; and

experimenting with active learning (Dogani, 2023). Besides the above, successful interaction with the students was vital as that enabled the teacher to create a supporting and engaging learning environment for the students. Dogani (2023) argued that when a teacher took time to know their students as individuals, learnt their interests and understood their motivations, the students would be motivated to learn. To realise that goal, the teacher should be approachable thereby creating an ideal environment for students to freely interact and consult the teacher. That provided a tow-way benefit in the sense that the teacher would also realise the best out of the students when he/she used positive reinforcements to motivate the students and communicates the expectations and instructions to the students in the best possible manner (Dogani, 2023). Lastly, the teacher should be an active listener and show the students, utmost respect. A teacher who violated the above standards could hardly realise the positive attributes of active learning.

Active learning is beneficial to students/learners (Aksit et al., 2016; Daouk et al., 2016) including enhanced conceptual understandings, increased learners' focus on instruction, boosting of critical thinking skills; and increased persistence in STEM fields (Idsardi, 2020; Marco-Fondevila et al., 2022). In coherence, the University of University of California (2024) credited active learning for sustaining interactions between learners, improving academic performance, reducing failure rates and catering for learners from underprivileged and excluded communities. Teachers also benefited from active learning through assessing learners and identifying digressions and deficiencies in the learners' work (Miller & Metz, 2014). The entire process of active learning encourages collaboration and transforms the teacher from a "sage on

the stage" to a "guide on the side." (McLean & Attardi, 2023; Miller & Metz, 2014; Seethaler, 2024; Swoboda, 2023). The instructional methods that are applied under this approach to learning include in-class written exercises, games, problem sets, audience-response systems, debates, class discussions, modelling and argumentation, among others (Fazio et al., 2024; Miller & Metz, 2014; Neto & Amaral, 2024; Park & Xu, 2024; Russell & Martin, 2023; Shaaruddin & Mohamad, 2017). Utilization of the above methods not only enhances hands-on and minds-on learning but also hearts-on learning, consequently leading to emotional and social development of the learners (Aupperlee, 2021).

Apart from cognitive gains, active learning enables the learners to acquire several non-cognitive gains too (Aryan & Saman, 2024) namely, critical thinking, problem solving, teamwork, communication and life-long skills among learners (Aryan & Saman, 2024; Linton et al., 2014). The learner becomes confident and defend their viewpoints. In addition, the learners acquire soft skills including decision-making abilities, growth in working knowledge due to instant feedback from the teachers and opportunities for underrepresented students to be prioritized (Brame, 2016). Though the mentioned non-cognitive benefits were realized when teachers applied the active learning strategies in teaching and learning, the arguments of Brame were generalized on higher education institutions such as colleges and universities. Moreover, they were not specific on Physics teaching. That left subject gaps to be filled by this study using Kigezi-sub-region as the context and Physics teachers' effectiveness as the unit of investigation.

2.3.1.2 Contextual Learning and Teaching Effectiveness

Contextual learning was the newest pedagogical approach that was developed in the 21st century (Montalbo & Villanueva, 2020). That type of learning was also known as localized teaching (Lucenara et al., 2023). It derived its meaning from the English root word context, which referred to something related to the local environment (Montalbo & Villanueva, 2020). The context or place might be a home, a community or a workplace and so, contextualizing itself, meant the creation of a connection between the lessons taught in the classroom and the situation prevailing in the real environment (Bortnick et al., 2021; Montalbo & Villanueva, 2020). In that type of learning, learners to were helped to relate the material taught and what they were, in the environment leading to better conceptual and practical understanding of the content taught (Podschuweit & Bernholt, 2018). Consequently, the content was transferred to the long-term memory as the learners were given a touch of experience on the lesson rather than leaving them seated and confined to a classroom setting to engage in mere pure thinking and imagination (Montalbo & Villanueva, 2020; Podschuweit & Bernholt,2018).

In that case, contextual learning involved problem-based teaching where the teachers raised a problem and engaged the learners to reason it out critically and raise probable ways of how the problem could be solved (Aryan & Shaman, 2024; Lotulung et al., 2018). To promote creativity, the teacher used diverse contexts including the school, family, community and so on in order to ensure that the students qualified the knowledge acquired by relating theory to practice. A teacher would succeed with contextual learning when he/she considered the learners' diversity. According to Lotulung et al. (2018), considering diversity

instilled harmony among the learners. This empowered the students to learn on their own as well as to learn through collaboration. Lotulung et al. (2018) recommended that the teachers using that approach should endeavour to develop an authentic scoring system to enable them to ascertain that contextualized and integrated learning had taken place.

In addition, contextual learning involves relating, experiencing, applying, cooperating, and transferring (REACT) (Utami et al., 2023). Relating was concerned with establishing the connection between the newly learnt information with real-life situations that students usually experienced. In that case, experiencing was concerned with the learning where the students were obsessed with exploring new things (Educators Inc Private Christian Schools [EIPCS], 2019). For instance, when a teacher was handling a teaching activity about the gradient, he/she could give the definition of a slope of a line instead of defining a slope as the change in the 'y' for a unit changed in 'x' along the line. The teacher could then create a live learning experience by using a road sign of a steep hill and then explain that a slope was steepness. So, applying was about learning the concepts and information in a useful situation. The teachers supported this virtue by using real-life examples that had just happened or were happening in the students' life. For example, a teacher could use the example of boiling an egg in salted water leading to diffusion of the salt into the egg through the egg shell. Similarly, cooperating was the act of sharing, responding and communicating with other students. Working in groups helped the students to solve complex problems encountered in learning. Lastly, transferring was learning in context of the existing knowledge (EIPCS, 2019). The students used the prior knowledge and applied it to a new setting in what was referred to as

positive transfer of learning. The existing knowledge provided a basis for internalizing the content and meaning of the new information.

There were several contextual learning strategies that teachers could use. In this case, the teachers could use textbooks and other reading materials that quoted examples from the environments known to the students. They could also use reading cut-outs which were pasted in the learners' books as an activity and homework assignment (Pedroso et al., 2023). Use of the local learning materials was beneficial (Wulandari et al., 2018). The contextual learning could equally involve the use of modules whereby modules referred to the ordered collections of topic-relevant information for teaching a subject or a skill (Pedroso et al., 2023). The use of modules was appraised by Nambair et al. (2020) and Betlen (2021) who noted that the learning capacity of students who were taught using that strategy improved greatly as the teacher supplied them with simplified and easy to read materials. That strategy however had pitfalls; for instance, the non-native teachers failed to tailor content to the local environment as they lacked a good command of the local knowledge. To cope with the challenge, such teachers could decide to skip the learning content that required illustrative local examples (Nambiar et al., 2020).

In that same vain, the use of springboard was another strategy for contextual learning (Fisch et al., 2018; Pedroso et al., 2023). That strategy involved the use of standards aligned lessons and assessments. Beyond that, the strategy also involved student-centred instruction; and use of classroom-tested tools. That strategy might be meaning-based or amalgamation. Whereby, meaning-based springboard involved providing learners with sufficient instructional time in a classroom setting while amalgamation entailed merging

the classroom instruction with learner-related settings during class (Pedroso et al., 2023; Reyes et al., 2019). Besides the springboard, contextual learning could also take the form of scaffolding (Gonulal & Loewen, 2018; Pedroso et al., 2023). With that technique, the teacher provided specific help to the students to learn while they learnt and developed new concepts or abilities. One-on-one sessions were another useful strategy of contextual learning (Liebfreund & Amendum, 2017; Pedroso et al., 2023), which was used mainly when the intent of learning was to develop a hands-on learning experience. Such sessions enabled the teacher to know their students, which in turn, enabled the teachers to tailor the lessons to the needs and preferences of the learners (Pedroso et al., 2023; Wisniewska, 2019). The work-integrated learning manifested as another important contextual learning strategy. According to Pedroso et al. (2023), teachers who used that technique connected or integrated the classroom learning (theoretical or academic content) with the surrounding environment or workplace contexts. That type of learning empowered the learners by enabling them to establish the connection between the classroom settings and the environment through reflective learning (Pedroso et al., 2023) by thinking, feeling, doing, and watching (EIPCS, 2019).

Contextual learning enabled the students to understand the content taught from personal, social and cultural contexts (Utami et al., 2023). As a result, they became acquainted with the subject matter when they related the material to their lived or real-life situations (Gitalan, 2022). The approach was constructivist because the students were able to interact and make meaning from the comparisons between the content taught and the familiar events unfolding in the environs (Gitalan, 2022). That enabled students to develop concrete

understanding of the content taught since they connected abstract content from the textbooks and classroom setting to living examples in the environment (Herodotou et al., 2019; Lucenara et al., 2023; Suryawati &Osman, 2017); leading to the decolonization of the curriculum (Herodotou et al., 2019). Moreover, when that pedagogical approach was used effectively, the learners enjoyed the content taught and related it to what was happening in their lives. Consequently, the levels of curiosity became enormous (Herodotou et al., 2019) and the content learned was stored in the long-term memory (Nasution & Rezeqi, 2015).

Contextual learning further promoted creative thinking among learners (Chaeroh et al., 2021). More so, creative students reassess problems, identify knowledge gaps, generate new ideas and analyse ideas generated before making conclusions. The students were able to express ideas that were versatile, flexible and original (Chaeroh et al., 2021). In relation, Dimacali (2018) established that contextualized learning was insightful to learners because it created awareness about the state of affairs and/or the environment in relation to a particular line or topic of study at hand. Inherent in that relationship, was knitting the learners' interest in the content taught since it was specific, known and closely related to them. Furthermore, that type of learning engaged the learners in meaningful discussions and accorded them with the opportunity of solving issues that were plaguing society. Moreover, in the line of academic achievement, Garin et al. (2017) established that learners subjected to contextualized instruction performed better in both formative and summative assessments.

2.3.1.3 Collaborative learning and Teacher Effectiveness

Collaborative learning is a group-based model of teaching and learning that is applied either to solve a problem or to design a product (Chounta, 2019). The groups may be self-selected by learners or they are compiled by the teacher (Pennsylvania State University, 2024). The most efficacious groups are those compiled by teachers as these are intentioned to include learners with different levels of expertise on a topic or experience in a given field (Pennsylvania State University, 2024). Collaborative learning was the oldest form of learning applied in several disciplines including Sociology, Psychology; and Learning Sciences (Chounta, 2019). Because of that long tradition, collaborative learning had attracted wide scholarship since 1920s (Chounta, 2019; Loveless, 2024). It was constructivist in nature and premised on the idea that learning was a social activity which took place when the learners interacted with the environment (Chounta, 2019; Drew, 2024); and, knowledge was co-created through negotiation and discourse (Drew, 2024). The teaching methods that were commonly used in collaborative learning included group presentations, collaborative writing of assignments, problem-solving, brainstorming, reflection, peer instruction and jigsaw (Pennsylvania State University; 2024; Pozzi et al., 2023).

The relevance of that pedagogical approach was best understood using the following eight basic principles: 1) Cooperation is valued for enhancing the attainment of mutual benefits by group members; 2) Students are grouped in a heterogenous manner so that diverse backgrounds and experiences can increase learning experiences, thereby leading to better achievement 3) There is positive interdependence because participants need each other to excel (Salma, 2020).

Furthermore, in this approach to learning, 4) Individual accountability is ensured since the participants share ideas and knowledge amongst themselves; 5) Simultaneous interactions are encouraged since a participant is able to reap the benefits from the group by equally participating in it; 6) Equal participation is enhanced and ensured by teachers; 7) Collaborative skills are emphasized since the learners or participants are working together ; and 8) Group autonomy is emphasized, obliging participants to take responsibilities (Salma, 2020). The learning approach was grounded in the philosophy that learners achieved a lot from working in groups (Cheng at al., 2021; Scager et al., 2016). So, collaborative learning obliged all the learners in a group to put effort into the task, making mutual and coordinated engagement a prerequisite (Drew, 2024). This learning behaviour was referred to as co-labouring (Drew, 2024). Co-labouring was successful with guidance of the teacher who ensured that there was equitable distribution of tasks among members of a group. To this effect, Drew (2024) conceded that when 20% of the learners performed 80% of the tasks assigned to a group, there was free-riding and that watered down the virtues of true collaboration.

Importantly therefore, collaborative learning was not merely letting learners in groups and giving them a leeway to ‘talk about things in a group’ but rather to be intentional about their learning (Drew, 2024). This type of learning promoted interaction with the learners and those taught using that pedagogical approach encouraged and facilitated one another’s efforts so that group goals were duly achieved (Chounta, 2019; Pozzi et al., 2023; Scager et al., 2019). Scholars (such as Kasimovna, 2024; Laal & Ghodsi, 2012; Rick et al., 2023; Zahroh et al., 2023; Zamecnik et al., 2024) documented numerous benefits of

collaborative learning under social, psychological and academic prongs. For example, they attested that learners taught using that method developed deeper understanding of the subject matter; recognized misconceptions and consolidated knowledge as they related the newly learnt material with the previously learnt content (Cheng et al., 2021; Scager et al., 2019). In doing so, the learners assimilated and accommodated knowledge (University at Buffalo, 2024). In that case, assimilation referred to taking in new information by a learner and fitting it into the existing schema.

Differently, accommodation entailed using the newly acquired information to revise and redevelop the existing schema (University at Buffalo, 2024). Besides the invaluable contribution of the teachers in keeping the group members gelled, Jarvela et al. (2021) noted that collaborative learning became effective when there was metacognition. Defined, metacognition was a central process that supported all modes of regulation among learners (Jarvela et al., 2021; Lim & Lim, 2020). The different forms of regulation-shared, self and co-regulation, enabled the learners to control and adapt their cognition, motivation, emotion and behaviour at both the individual and group levels (Jarvela, 2021; Lim & Lim, 2020).

The learners taught using collaborative approach easily grasped abstract content and developed a deeper understanding of the subject matter (Keith, 2023; Rick et al., 2023; University at Buffalo, 2024). Furthermore, the learners developed a cornucopia of skills (higher-level thinking, oral communication, self-management and leadership); their retention, self-esteem and responsibility improved greatly; they became exposed to and gained understanding of the diverse perspectives; and, it increased willingness of the learners to partake in

their own learning (Boruzie et al., 2022; Pennsylvania State University, 2024). More to say, the learners taught with this method developed meta-cognitive skills which helped them to construct new meaning amongst themselves than relying on the teachers as the only source of knowledge (Pennsylvania State University, 2024; Zamecnik et al., 2024).

2.3.2 The School Environment antecedent and Teacher Effectiveness

The aspect of school environment was assessed under three dimensions. These were administrative support, collegiality and professional development as discussed below;

2.3.2.1 Administrative Support and Teacher Effectiveness

The nature, level and adequacy of administrative support affected the teacher effectiveness; because the support was provided by the school heads and colleagues (Araneta et al., 2020; Watson, 2021). The school heads supported teachers on emotional grounds, by meeting teachers' environmental needs; and by providing instructional and technical support. Emotional support was necessary because in the school settings where teachers were working under undue stress such as double shift schools or those with unacceptably high numbers of students, emotional support provided a strong buffering (Watson, 2021). On the environmental tone, the schools were marooned islands; therefore, teachers had a task of navigating through the social environment within and outside the school. This could be a source of stress and therefore, the teachers who were supported by the school heads easily negotiated the bends and turns in the two environments and enjoyed the teaching compared to those who failed to do so. Lastly, the technical support given by the head teacher equally influenced the teacher effectiveness. For instance, Watson (2021)

observed that in schools where the headteachers provided teachers with adequate support for self-appraisal, teaching effectiveness was realized. As well, when teachers were provided with adequate instructional or instrumental support, the teaching effectiveness was realised (Watson, 2021). Therefore, schools that barely provided all that necessary support, kept ineffective teachers (Araneta et al., 2020).

On the same note, Tran et al. (2023) established that teachers who felt valued and respected by the school administration harboured positive attitudes towards the school and their job. Therefore, the teachers from schools with supportive school heads were most likely to be more effective compared to those who felt little or no support in terms of respect from the school heads. In agreement with Tran and colleagues, Crosby (2015) established that teachers felt valued when the head teachers handled them professionally. Crosby further acknowledged that in cases where there were policy prerequisites that added burden to the teachers, the school heads who worked hand in hand with the teachers to shed off that stress and/or to cope with the changes were more supportive than those who did not do so; which had an impact on the level of teacher effectiveness. Moreover, Martinez and McAbee (2020) observed that when teachers were valued by the school administrators, they developed organizational citizenship behaviour such as trusting relationships. Consequently, they felt at ease with the workplace and were more committed to spearheading the programmes and interventions aimed at improving the competitiveness of their schools.

The supportive school administrators in regard to discipline enforcement also enhanced the teaching effectiveness (Kurian, 2020), In appraisal of that linkage, Crosby (2015) noted that teachers felt supported when the school heads combined efforts with them to fight indiscipline especially in the classroom. Moreso, indiscipline disrupted the tempo of teaching, it bred toxic classroom environment and undermined the classroom learning processes (Caldarella et al., 2021; Obadire &Sinthumule, 2021; Valente et al., 2020). The school heads who helped teachers by implementing some sort of behaviour modification system in instances when there was repeated misbehaviour, did justice to the teachers by helping them to enforce obedience among students. In comparison, the school heads who were carefree and showed less concern whenever the students misbehaved complicated the teachers' lives by making the classrooms ungovernable, with some turning into battlegrounds (Masaaba et al., 2021). Such an undesirable situation led to anxiety, stress and in extreme cases, burnout (Crosby, 2015; Pishghadam et al., 2014). The teacher burnout was an indicator of ineffective teaching in a school (Madigan & Kim, 2021; Onurlu & Pilli, 2024; Shakir et al., 2024).

In addition, the school heads influenced the teacher effectiveness through provision of requisite resources that were needed to improve the teaching and learning (Kilag et al., 2023a). Indeed, the teachers who were supported with adequate teaching resources ably applied various teaching methods that promoted effective learning (Akram et al., 2022; Kilag et al., 2023b). In the context of this study, physics at 'O' level had Papers 3 and 4 that were practical. Therefore, following the above dictum, the school heads that honoured the requisitions of teachers would support active learning because

every learner was provided with an opportunity to set the apparatus for experiment-bound lessons. The school heads who for one reason or the other failed to honour the requisitions, debilitated the active learning. The latter schools would then struggle to retain the high-performing teachers because they craved to run away from the resource-constrained school to escape the inconveniencing work.

2.3.2.2 Collegiality and Teacher Effectiveness

Collegiality was largely influenced by organizational (*sic* school) culture (Hewett & La Paro, 2020; Teasley, 2017; Smollan & Morrison, 2019). The schools that were receptive to staff development had good collegiality because there were patterned norms of interaction among the members of staff compared to the less receptive ones (Little, 1982; Nguyen, 2023). The effect of the school culture was both positive and negative in that on one hand, the schools characterized by healthy behaviours, collaborative decision-making, display of high professional standards, consistently holding students to high standards were conducive for professional satisfaction and collegiality (Teasly, 2017). Such schools had a positive school culture but on the other hand, in schools where was there was inefficiency, low trust among colleagues, a lack of transparency in leadership, low academic expectations and support for students; and resistance to collaboration among the school-based professions, there was a negative school culture and that impeded collegiality (Teasly, 2017). The teachers in the schools that had conducive conditions for collegiality were effective compared to those with unconducive conditions (Nordgren et al., 2021).

Collegiality gave the teachers a sense of belonging (El Zaatari & Maalouf, 2022; Kolleck et al., 2021). Whereby, a sense of belonging referred to the subjective feeling of a deep connection with the social groups, physical places as well as individual and collective experiences (El Zaatari & Maalouf, 2022). It is one of the human needs theorized by Abraham Maslow in the Needs-Hierarchy Theory (Tahir, 2021; Vaccaro & Newman, 2022). Contextualized in a school setting, Longaretti (2020) conceived belonging to mean the relational, behavioural and relational aspect of being and doing, felt or lived, relating and acceptance. When a teacher felt that they were supported and more so, in instances when they were struggling and/or were congratulated for their accomplishments, the sense of belongingness to the school improved (Peacock & Cowan, 2019; Pesonen et al., 2021; Skaalvik & Skaalvik, 2019). The collegial environments did not just happen, rather, they had to be created and cultivated (Baporicar, 2015; Brown, 2021; Sirris & Andersson, 2023).

In a school setting, someone had to be a champion to dedicate time for nursing and nurturing a culture that was enthusiastic, collaborative and intellectual (Ansley et al., 2019; Baporicar, 2015). It followed from the above argument that lack of collegiality was detrimental to institutions as it turned off the workers and even prompted the workforce to disengage or leave altogether (Baporicar, 2015). That argument vindicated the credibility of the dedicated members of staff to develop and maintain a culture that was collaborative and collegial. That, according to Baporicar (2015), was important largely because, the common tendency of employees working in a toxic environment to nurture high hopes that things would get better was not a strategy for dealing with toxic behaviour and neither was waiting for a troublemaker to retire. Therefore,

ensuring collegiality was vital for attaining the desired levels of school and teacher performance.

The good teacher collegiality bred improved learner academic achievement, it fostered improved attitudes in the teachers as well as grand improvements in their actions; and, had a positive impact on the school climate (Chen & Rong, 2023). Studies had also proven that good collegiality reinforced the teaching competence and confidence, leading to increased teacher self-efficacy (Dawson et al., 2022; Karatas & Cankir, 2023; Umezulike & Charles-Ibezim, 2022). Those benefits were lost in an organizational setting when there was contrived collegiality (Chen & Rong, 2023; Davey, 2023). Contrived collegiality was formal, predetermined and fixed in time and space (Chen & Rong, 2023; Davey, 2023). Such culture affected the teachers' participation in collaboration negatively due to withholding of trust, restricted participation and harbouring feelings of quitting the school and the profession altogether (Chen & Rong, 2023; Murray, 2021).

2.3.2.3 Professional Development and Teacher Effectiveness

Across the globe, the teachers' standards had risen to prominence (Murray, 2021). The efforts for supporting and sustaining the teachers' professional development (PD) were needed in schools (Sancar et al., 2021). The ongoing professional growth of teachers was associated with optimized outcomes for both teachers and learners (Jayanthi Rajendran et al., 2023). Good teachers were on high demand and were drivers of stellar performance of the world's best-performing school systems. To keep the teachers to higher performance levels, professional development was important and among others, it helped the teachers to develop a growth mindset. With that mindset, the teacher kept trying,

drew strategies he/she has learned and used mistakes as leverage for new learning, an orientation that was termed as the yearn to learn (Murray, 2021). The professional development of teachers could happen in three ways: - formal participation of a teacher in continuing education, participation in non-formal professional development forums such as workshops and in-service training; and, the teachers' self-initiated informal learning activities (Abakah, 2023). That professional development was a career-long process that enabled the recipients to pursue diverse learning activities, all aiming at refining and augmenting their professional knowledge and skills. It could also mean undertaking personal professional supervision to enhance critically reflective practice (Beddoe, 2015; Frederiksen, 2016; Czerniawski, 2023).

The professional development might take the form of taking classes or workshops, attending professional or industry conferences, or earning a certificate to expand knowledge horizons in one's field (Parsons, 2022) and those might be residential or in-house (Parsons, 2022). According to Frederiksen (2016), while professional development might be a self-directed independent study, it could also take the form of a more structured training plan. The more frequent and longer the professional development programmes were held, the more beneficial they became to the teachers (Van Assen, 2021; Ventista & Brown, 2023). The professional development programmes enabled the teachers to gain a deeper understanding of how teaching and learning was supposed to be conducted (Sims et al., 2023). Besides, professional development enabled the teachers to change their practice accordingly, which made them more innovative and adept to such changes. Principally, the teacher was introduced to a technique that would help them to turn insights into reality

(Sims et al., 2023). Lastly, professional development of teachers should enable them to embed the change in practice.

2.3.3 Moderating impact of school environment on the Relationship between Pedagogical approaches and Physics Teacher effectiveness

The prevailing environment in school affected how teachers applied the pedagogical approaches and consequently, the effective teaching. Following that proposition, it was worth noting that teachers could not ably apply certain methods of teaching when there were inadequate teaching and learning resources in a school. Licorish et al. (2018) provided concrete evidence of that relationship when they noted that learners who were engaged in game-based student response system such as Kahoot, realised dynamic engagement, motivation and improved learning experience. A related observation was made by Winarto (2020) using educational institutions in Indonesia who reported that audio visual media encouraged the students to be active in a learning activity. Those findings highlighted how important, the availability of school resources such as audio and audio-visual materials were in influencing the teachers' selection of active learning methods. However, the findings had shortcomings since they were reporting case examples of New Zealand and Indonesia but not Uganda.

In a related study in Nigeria, Akinbadewa and Sofowora (2020) established that when instructional materials and resources were available in a school setting, the teachers were able to select teaching methods that suited the needs of learners. They contextualized their study on biology and assessed whether the attitude of the students towards biology were shaped by the deployment of multimedia learning packages. Overwhelmingly, the students

agreed that multimedia learning packages improved their attitudes towards learning the subject because of the high degree of engagement by the packages. That observation provided evidence that beyond reasonable doubts, schools with adequate and quality learner-engaging materials guaranteed choice and use of learner-centred pedagogies, leading to teaching effectiveness. Despite that conclusion, Akinbadewa and Sofowora generalized their findings on the case of Nigeria; therefore, the findings might not apply or even be relevant in other settings such as Uganda, hence leaving contextual gaps. In addition, the findings and conclusions were based on Biology and not Physics hence leaving a subject gap. Generally, much as both Biology and Physics were all STEM subjects, the two disciplines were distinct in terms of selection and consequent use of locally available materials for practical sessions.

The school environment could negatively the affect teacher effectiveness by dictating particular teaching methods to be used at a given period. Besides, the status of the school facilities had an impact on the schooling outcomes such as academic achievement. That argument was reinforced by Olujuwon et al., (2022) who examined the influence of school facilities on the students' academic achievement in public secondary schools in Badagry Local Government of Lagos State in Nigeria and confirmed that the more abundant the teaching and learning facilities there were in a given school, the greater would be the students' academic achievement. Implicit in that argument was the fact that conducive school facilities were enablers of students' academic achievement. That associative relationship therefore served to prove that the prevailing environment in a given school in terms of facilities affected the teacher effectiveness and consequently, the learners' academic outcomes. That

notwithstanding, only the case of Nigeria was used as a basis of the findings which raised a need to conduct this study to find out whether secondary schools in Uganda and particularly those in Kigezi sub-region that were stocked with teaching and learning resources had more effective teachers than those with minimal or very limited stocks.

Furthermore, Musa et al., (2017) assessed the effect of Information and Communication Technology (ICT) facilities in teaching and learning in selected schools in Sokoto metropolis. A descriptive study design was adopted while the population comprised of 81 students and 8 teachers. The data was collected using questionnaires and analysed using descriptive means and the results showed that much as the school environments were essentially equipped with ICT facilities, the students were not allowed to frequently access and use the ICT facilities and the teachers never effectively used ICT facilities in teaching and learning. Much as the findings did not attribute the failure of students and teachers to use ICT in learning and teaching, this researcher highly believed that that anomaly could have been caused by failure of the school administration to create appropriate time schedules that would enable the students to use ICT for learning. For the case of teaching, the limited use of those facilities could be related to the failure of the school administration to install supporting infrastructure in classrooms. For example, desktop computers could not run in classrooms without power connection or even if it were to be, there had to be power outlets.

As well, the classrooms without shutters and/or even with shutters but lacked a white background they could not provide excellent conditions for the use of projectors. Therefore, much as a school might have adequate resources

such as projectors for use in the computer-mediated lessons, the nature of administration could hamper their utilization, consequently hindering the teacher effectiveness. The findings reported by Musa and colleagues however, were based on Sokoto metropolis in Ghana, hence leaving contextual gaps.

Oftentimes, the classroom environment variables such as classroom size dictated the teaching methods which teachers had to use. In most developing counties, the teaching and learning of STEM subjects faced the challenge of inadequate instructional materials especially for practical sessions (Akon-Yamga et al., 2024; Hang et al., 2024; Le et al., 2021; Tikly et al., 2018). That challenge could even be worse in Uganda, given the implementation of Universal Secondary Education (USE) in 2007 that led to the skyrocketing of student numbers (Kakuba et al., 2021; Lauterbach, 2024; Twinomuhwezi & Herman, 2020). When there was shortage of equipment for science practical lessons due to the huge numbers of students, active learning approaches could not be implemented. That condition presupposed that the class size and availability of instructional facilities significantly influenced the teaching methods to be adopted by the teachers and consequently, academic performance (Ndidi & Effiong, 2020). Geographically, the findings were focusing on the effect of class size and adequacy of instructional materials while quoting other contexts (Nigeria) and other disciplines (Mathematics), hence leaving contextual and subject gaps for this study to be carried out in Kigezi sub-region, Uganda.

The students' discipline was another aspect of the school environment that diminished effective teaching. Studies such as (Caldarella et al., 2021; Obadire &Sinthumule, 2021; and Valente et al., 2020) had shown that the

student misbehaviour affected the teaching and learning to the extent that when it escalated, the classroom atmosphere became toxic. The school heads had a key role to play in augmenting the efforts of the teachers to contain indiscipline. Thus, the teachers who were supported to create sanity and order were capable of establishing a code of conduct that students had to adhere to while learning whether within or outside the classroom setting. Thus, the more supportive the school heads were in taming indiscipline, the more effective the teaching would be as the teachers found it easier and simpler to apply any teaching methods from the suite of both active, contextual and collaborative pedagogies.

2.4 Chapter Summary and Emerging Gaps

The literature reviewed in the preceding sections had shown that the pedagogical approaches improved the teaching effectiveness. For instance, teachers who used active learning methods engaged the students in their learning, leading to the acquisition of higher-order skills such as critical thinking. In the schools where teachers applied contextual learning approaches, the students related the theoretical maxims obtained from the classroom settings and related it with what was observable and existing in real life. Therefore, the teaching methods such as excursion visits and industrial tours promoted holistic learning and improvement in academic achievement. While the selection and application of the pedagogical approaches promoted effective teaching, the school environment also had a major role to play in shaping the teaching effectiveness. The effect was proportionately greater because it determined how teachers were remunerated, availability of the teaching resources, quality of the classroom environment, and discipline management.

Besides, the value beliefs in the school determined the psychological well-being of the teachers such as collegiality. Thus, the schools with a nice teaching environment attracted teachers more than those with a debilitating one. By linking the two observations above, one noticed that the school environment moderated the effect of the pedagogical approaches on the teaching effectiveness. It therefore followed that as long as the school environment was not favourable, adopting pedagogical approaches might not translate into teaching effectiveness.

Despite the above discernible relationships, several gaps stood out in that these are contextual, methodological and subject-based. Contextually, a few studies reviewed (such as Manyiraho et al., 2020), focused on SESEMAT pedagogical approaches in Uganda. A host of other studies were based on other contexts than Uganda, hence leaving contextual or geographical gaps. In the same vain, majority of the studies were purely quantitative whereby the quantitative studies had pitfalls of generating superficial results which minimised chances of tapping into in-depth views of the respondents (Mohajan, 2021). Such studies missed corroborating evidence from qualitative sources (Leko et al., 2023; Schoonenboom, 2023; Vebrianto et al., 2020). Then subject wise, some of the studies focused on Mathematics (Ndidi & Effiong, 2020) and Biology (such as Akinbadewa & Sofowora, 2020) while the rest were generalized on STEM fields. Equally to note, much as the studies related the teaching effectiveness to pedagogical approaches and others to school environment, none of the studies assessed the moderating effect of the school environment on pedagogical approaches and teacher effectiveness, hence

leaving a knowledge gap. To fill these voids, this study focused on Physics and adopted a mixed methods approach as discussed in the following chapter.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

The study assessed the antecedents of Physics teachers' effectiveness in Uganda. The study explored the interrelationships between SESEMAT pedagogical approaches and the teachers' effectiveness, the school environment and the Physics teachers' effectiveness; and the moderating effect of the school environment on the interplay between the SESEMAT pedagogical approaches and the Physics teachers' effectiveness. The study adopted a pragmatism philosophical paradigm, a mixed methods approach and an embedded mixed methods research design. The Physics teachers, the head teachers and officials from District Education Offices participated in the study. The study took place in Kigezi sub-region in Southwestern Uganda whereby qualitative and quantitative data was involved. This chapter discussed the rationale of selecting a pragmatism research paradigm to guide the study, the procedures undertaken and followed in identifying and selecting the study participants, the data collection methods and the tools used, the data quality control strategies applied and the data analysis, presentation and interpretation approaches adopted. The chapter wound with a summary that provided a recap and transition to the next chapter.

3.1 Philosophical Orientation

This study based on a research paradigm where research paradigm refers to the beliefs about reality and how knowledge should be understood (Khatri 2020; Ll, 2024; Nyabuto & Wabwoba, 2024; Ulz, 2023). Also called worldview (Abbadia, 2022; Abi-Hashem,2017; James Cook University, 2023; Kaushik &

Walsh, 2019), observed that a research paradigm guides how we make scientific discoveries and the associated assumptions and principles (Miranda Beltrán & Ortiz Bernal, 2020; Park et al., 2020; Ugwu et al., 2021). The commonly used research paradigms are: pragmatism, positivism, constructivism, naturalism and post-positivism (Gannon et al., 2022; Saliya, 2023; Shook, 2023) however, this study adopted a pragmatism paradigm.

Pragmatism is a loaned word to English which originated from the Greek word *pragma* referring to action (Kaushik & Walsh, 2019). It is a conciliator paradigm and propagates views that belong to both positivism (quantitative methodology) and constructivism (qualitative methodology) thereby giving a multi-oriented worldview (Kelly & Cordeiro, 2023; Ormerod, 2021; Shook, 2023). Pragmatism affords the researchers a high degree of flexibility, which enables them to avoid falling in the trap of rigidities of either positivism or constructivism. The blending of ideas from both paradigms enriches the pragmatic-biased studies with broader and holistic findings since a range of methods are applied to collect, analyse data and report the findings (Allemang et al., 2022). The adoption of pragmatism in this study provided a lens through which vivid understanding of the everyday experiences Physics teachers were assessed.

Ontologically, pragmatism-based research studies are supposed to have a clear view of what reality is. The researcher is positioned in a way that he/she can decide which methods are ideal to apply in discovering the reality (Lohse, 2016). In this study, both qualitative and quantitative methodologies were used and the decision to mix the methods replicated the views of Morgan (2007) that in real life, there is hardly any single source of reality. Therefore, a

comprehensive study ought to settle for multiple sources of reality as well as multiple interpretations of reality (Morgan, 2007). With regard to epistemology, pragmatism generates double-faced knowledge (Maaruf, 2019). In this study, both obtrusive and non-obtrusive data was collected and analysed and therefore, comprehensive and robust findings were reported.

The axiology of pragmatism empowers a researcher to use their own values and experiences to substantiate the study findings so that they mirror or rhyme what exists in the real world (Glasgow, 2013). This is necessary so that correct or near-correct answers to the study's underpinning research questions are generated (Maaruf, 2019). Use of subjective values is unavoidable because in real life, there can never be a research study that is bias-free, in what they refer to as a necessary bias (Muurinen & Shakta, 2020). This researcher's long period of service in teaching Physics in Uganda served as a source of that necessary bias, thereby enabling him to come up with correct or near-correct answers for the research questions that the study sought to answer. Methodologically, pragmatism obliges the researchers to target individuals in an ecological setting so that truthful observations are made (Kelly & Cordeiro, 2020). A researcher is supposed to be flexible and apply the suitable methods for generating the right answers to the study's research questions (Kelly & Cordeiro, 2020). The researcher should also select methods that help in carrying the readers from the world of practice to that of theory back and forth.

According to Foster (2023), educational researchers anchoring their studies in pragmatism are able to break away from opposing beliefs of research paradigms to enjoying the advantages of an inclusive research approach where all applicable research methods falling in either paradigms are mixed. By doing

so, the educational researchers tide over qualitative-quantitative divide and select the best methods (Foster, 2023). This background information on methodological orientation guided this study, which used multiple methods of data collection and analysis as would be seen in the later sections.

3.2 The Research Approach

Pragmatism is an intersection between positivism (quantitative) and interpretivism (qualitative) paradigms. It reconciles the differences between the two paradigms and therefore, the researchers who adopt it have unlimited opportunities for selecting the methods to use in assessing the conditions in the problem space (Felizer, 2024; Shan, 2022; Shook, 2023; Skaamagki, 2024) and that positions the researcher in using a mixed methods approach. This study adopted a mixed methods approach and used both qualitative and quantitative methods of data collection and analysis. As the name suggests, the researcher mixes methods from different worldviews (Ghiara, 2020; Hampson & McKinley, 2023; Karolina et al., 2021). The use of mixed methods approach strengthens the study findings since it enhances the auto reconciliation of weak points that are inherent in a study when either qualitative approach or quantitative approach alone (Creswell, 2021; Dawadi et al., 2021; Mertens, 2023).

3.3 The Research Design

A research design refers to a plan that a researcher chooses to guide their study right from data collection to reporting of the results (Fischer et al., 2023). A research design provides a blueprint for conducting a study (Wisenthige, 2023). A mixed methods research project selects an informing research design from a multi-method research design. There are four types of mixed methods designs,

namely: - the convergence parallel, the explanatory sequential, the exploratory sequential and the nested (also called embedded) mixed methods research designs. The convergence parallel mixed methods design involves the collection and analysis of quantitative data on one hand and qualitative data on the other hand. Then, the outcomes of the study from the two methods are compared to establish the patterns of either divergence or concurrence (Damyanov, 2023; Şahin & Öztürk, 2019).

Differently, studies adopting explanatory sequential design involve two stages: - the first stage involves the collection of quantitative data followed by stage two of collecting qualitative data with qualitative findings used to provide an interpretation of the quantitative data but the reverse is true for exploratory sequential (Şahin & Öztürk, 2019). Then the embedded design differs from the rest of the designs because with it, a researcher is able to collect data at the same time but with emphasis largely on either qualitative or quantitative data and the analysis is also done at the same time. Compared with the rest of the designs, according to Damyanov (2023), embedded design is time and cost saving because it enables a researcher to collect both kinds of data at the same time. To harness the said dividends, this study adopted the embedded or nested mixed methods research design, given that the emphasis was largely on quantitative data, besides the short period within which the data had to be collected. This design was also appealing from both time and logistical perspectives.

3.4 The Study Population

The study targeted a population of 741 subjects from the six districts that made Kigezi sub-region, namely: - Kabale, Rubanda, Rukiga, Rukungiri, Kanungu

and Kisoro. The Physics teachers, the head teachers and the District Education Officers were targeted (Table 3.1).

Table 3. 1:

Target Population

Respondents	Population	Justification
District Education Officials	6	Manage all education activities at the Sub-Region.
Head Teachers (Secondary)	176	Chief supervisors of SESEMAT activities at school level.
Physics Teachers	510	Curriculum implementers using SESEMAT pedagogical approaches.

3.5 The Sample size and Sampling Techniques

The study involved two samples; quantitative and qualitative as discussed below;

3.5.1 The Sampling of Schools

The districts in the sub-region had different numbers of secondary schools depending on the years of existence and operation (Table 3.2). The old districts (Kabale, Rukungiri and Kisoro) had more secondary schools than the somewhat new district (Kanungu) and proportionately higher than newest districts (Rubanda and Rukiga). Thus, the old districts had a higher representation in the schools' sample than the newest districts.

Table 3. 2:

Sampled schools per district

District	Year created	Number of schools	Number of schools selected
Kabale	1966	42	21
Rukungiri	1966	48	24
Kisoro	1966	34	17
Kanungu	2001	20	10
Rukiga	2017	14	7
Rubanda	2017	18	9
Total		**176**	**88**

Table 3.2 shows that 50% of the schools were selected from each district. That decision followed the recommendation of Mora (2019) in the diverse target populations where a researcher anticipates large variability; the researcher should be conservative and use 50% of the population. Mora (2019) supported this decision and argued that 50% (0.5) represented the event probability in the sample size calculations as it represented the highest expected variability in the population. Similarly, Grace-Martin (n.d) noted that if the power was 50% for a study, it implied that the study had a 50% chance of finding the significance for a real effect, given the sample size, the effect size and the statistical test.

3.5.2 The Quantitative Sample

The Physics teachers constituted the quantitative sample for this study whereby in the selected schools, there were two categories of teachers. The first category taught only Ordinary Level while the second, taught both Ordinary and Advanced Levels. In either school types, the Physics teachers crossing between

levels were engaged to fill the emerging gaps due to transfers, voluntary quitting, termination of service and involuntary causes such as sickness and maternity leaves so, this difference was the decision factor for choosing the sample. A quota sampling was used and Simkus (2023) defined quota sampling as a non-probability sampling method in which participants are selected based on specific characteristics, ensuring that they represented certain attributes in proportion to their prevalence in the population. That technique, according to Simkus (2023), allowed a researcher to choose the sample subjectively. The researcher assigned quotas to a group of people in order to create sub-groups of individuals that represented the characteristics of the target population as a whole. Once the groups are formed, the researcher uses their own judgement to select the subjects (Adeoye, 2023; Hazari, 2024; Iliyasu & Etikan, 2021).

Table 3. 3

Sampled schools per district

District	Number of schools selected	Sample size
Kabale	21	66
Rukungiri	24	72
Kisoro	17	51
Kanungu	10	30
Rukiga	7	21
Rubanda	9	27
Total	88	267

The Quota sampling can either be controlled or uncontrolled where in the controlled quota sampling, there are limitations on the researcher's choice of samples such as representation while in uncontrolled, no limitations prevail. In

this study, controlled quota sampling was used and the teachers were categorized into two groups: - “Only O-Level” and “Both ‘A’ Level and ‘O’ level” and the teachers belonging to “Only ‘O’ level” were selected. As earlier noted, a controlled quota sampling was applied and therefore, in the “Only ‘O’ level” category, the teachers who had taught for 5 years and above qualified to participate in the study. Across all schools, an average number of 3 teachers met the two inclusion criteria giving rise to a sample of 267 teachers (Table 3.3).

3.5.3 The Qualitative Sample

The qualitative sample included head teachers, DEOs and Heads of Department (HoDs) and the HoDs were part of the quantitative sample reflected in Table 3.3. Out of all the 88 schools, only 17 head teachers were targeted. The emphasis was on seniority regarding the consecutive number of years served at the sampled institution. The minimum service experience was 8 years and only 17 head teachers met this criterion. From each district, one Education Officer was selected and emphasis was put on the officers in-charge of secondary schools. The head teachers, HoDs and DEOs were selected purposively whereby purposive sampling is the selection of study participants basing on specific characteristics determined by the researcher (Campbell et al., 2020; Magnone &Yezierski, 2024). In this study, the researcher used his discretion to select the information-rich or knowledgeable respondents to participate in a study (Kalton, 2023; Sukmawati et al., 2023). First, the head teachers were involved because they were the planners for schools and at the same time, they were the quality control officers, overseeing the teaching and learning inclusively. Then the HoDs were involved to capture data related to their administrative roles not assessed by the questionnaires. And the District Education officers were

engaged in the study because they were mandated by the national legislative frameworks to ensure that schools were operating in line with the guidelines of Ministry of Education and Sports. This mandate put them in a favourable position to oversee and supervise the performance of government interventions such as SESEMAT programme.

3.6 The Data Collection Methods

The mixed methods approach utilised by this study led to the selection of both quantitative and qualitative data collection methods as discussed below;

3.6.1 The Quantitative Data Collection Methods

Data from the Physics teachers was collected using a survey method. In that case, a questionnaire was structured and therefore, it contained only close ended or forced answer statements (Cheung, 2021; Ranganathan & Caduff, 2023). The use of the close-ended questions helped to increase the response rate and eased the scoring of the statements that measured the study variables. According to Hyman and Seirra (2016), close-ended questions are ideal in questionnaires that contain several items measuring different variables by enhancing speedy response time. Consequent to this, a researcher is able to come up with adequate data on the broad range of variables (Hyman & Seirra, 2016). The questionnaire surveys are cheap to administer, they accommodate very many variables; and help in collecting data from a reasonably big number of respondents (Story & Tait, 2019).

3.6.2 The Qualitative Data Collection Methods

In this case, four methods were used as discussed below:

3.6.2.1 In-depth Interviews

The Encyclopaedia Britannica (2023) and Rutakumwa *et al.,* (2021) define interviewing or interview as a process or activity in which a person talks to another for purposes of obtaining information about a question at hand. This purposed dialogue intends to learn about the person being interviewed (Deterding & Waters, 2021; Encyclopaedia Britannica, 2023). The interviews were administered to the head teachers and the District Education Officials whereby the duo participated in this study as key informants. While interviews can be administered physically (face-to-face) or virtually (through telephone, zoom or any other internet-mediated platform) (Cresswell & Cresswell, 2018), in this study, the face-to-face structured interviews were administered. It was a process that began with booking the day and time for the interviews which involved making formal appointments with the targeted respondents through phone calls. On confirming that the respondents would be available on a given date, the researcher carried a formal letter from Kyambogo University as well as clearances from UNCST and UCU REC in order to cultivate confidence among the Head teachers and the District Education Officials that they were dealing with the right and genuine person. He adjusted whatever activity that there was on a given day in order to meet the scheduled appointments of the interviewees. This was necessary since the participants had tight work schedules and many off-campus and out-of-office assignments to execute.

In order to ensure that the data sought was obtained, the researcher limited the interview duration to 50 minutes. That short time required high precision and therefore, to minimise any omissions, audiotaping was done. Then to cushion against any possible technological glitches, he recorded the interview

proceedings using an audio-recorder and a back-up smartphone. The in-depth interviews were used in the study because they yielded in-depth data (Rutakumwa et al., 2021), allowed rephrasing of questions and improved the relationship between the researcher and the respondents, which guaranteed generation of high-quality data (Kumar, 2018).

3.6.2.2 Observation

Lessons and classroom environments were observed whereby observation referred to the collection of data through use of human senses (Angrosino, 2012; Dzwigol & Barosz, 2020). The senses enable us to perceive and understand the aspects of interest and consequently, to develop a holistic understanding of what that aspect is (Attia, 2020). Researchers observe phenomena through indirect and direct means (Ciesielska *et al*., 2018; Rogers *et al*., 2021). The indirect observation is remote and involves the use of an object such as a mirror, a hidden camera or voice recorder to observe events (Ciesielska *et al*., 2018). On the other hand, the direct observation involves the collection of data by the researcher engaged who is either as participant or non-participant. Participant observation involves acquiring data as a marginal member or visitor while in non-participant observation, the researcher plays a passive role in the environment as they study the phenomena.

In this study, observations were both overt and covert where covert observation involved the researcher conducting an observation without alerting the subjects that they were being observed (Costa, 2020). The quality of classrooms as well as the service points such as the science laboratory and the library were observed by the researcher using covert observation. That involved the use of an observation checklist with the intent of establishing whether the

classrooms had ideal conditions for supporting the application of pedagogical approaches in Physics teaching. In the laboratory and school libraries, the intent was to assess the adequacy of the science equipment and the reference materials respectively. Differently, with overt observation, the researcher notified the subjects that they were being observed (Calvey, 2021; Yoo *et al*., 2019). That type of observation was also used for the Physics lessons. That type of observation was used to assess the degree to which the Physics teachers applied any of the three pedagogical approaches selected for study. The observation method was invaluable to this study because it helped the researcher to come up with first-hand information that was unobtainable through other data collection methods (Calvey, 2021; Costa, 2020).

3.6.2.3 Focus Group Discussion

More qualitative data were obtained from the Heads of Department (HoD) who were Physics teachers assigned a middle managerial role to oversee fellow Physics teachers and to coordinate the entire process of Physics teaching and learning. the data from the HoDs was collected using focus group discussion (FGD) which were predetermined semi-structured interviews led by a skilled moderator (Nyumba et al., 2018; Sim & Waterfield, 2019). People from similar backgrounds or experiences are engaged as a group to discuss a specific topic of interest (Yayeh, 2021). The discussion aims at providing answers to questions about perceptions attitudes, beliefs, opinion or ideas and the participants are free to talk with other group members and this encourages open discussions. The number of participants ranges between 6 and 12 in number (Fazeeha Azmi, 2023; INTRAC, n.d) whereby, the participants are engaged in a loosely

structured discussion and are moderated by the researcher (Nyumba et al., 2018).

In that case, the FGDs were administered after completion of the quantitative survey exercise. Given their administrative role, the HoDs were involved further in order to obtain qualitative responses about the implementation of the SESEMAT programme and how the teachers under the supervision of HoDs applied the teaching strategies specified by SESEMAT pedagogical approaches, the influence of the school environment and how it affected the teacher effectiveness. Sixteen Physics teachers qualified for FGDs, 9 from government-aided schools and 7 from private-owned. Given that the total exceeded the permissible maximum threshold (12), two FGDs were administered, one involving teachers from private secondary schools and the other, for their counterparts from government aided schools.

All the FGDs were conducted in Kabale Municipality and the HoDs selected the area as the most convenient for all participants. Besides, the HoDs played an active part in selecting the venue for the discussions though the researcher suggested the following venues: Highland Hotel, Kigezi Backpackers, Litle Litz, White Horse Inn, Victoria Inn and Cephas Inn. The participants unanimously selected White Horse Inn, rating it as the venue with a more quiet and serene environment. Both female and male HoDs participated in the FGDs, thus eliminating gender blindness. The FGDs were held on a Friday in the morning for private schools and in the afternoon for government-aided schools where each FGD lasted for 120 minutes. The process of the FGDs began with self-introduction before actual discussions and the researcher adjudicated each FGD as a moderator. The discussions were audiotaped with a

backup that recorded using a smartphone. The FGDs were in English, although at certain intervals, some Runyankore-Rukiga illustrations surfaced; however, all the transcription was done in English.

Setia (2017), Sim and Waterfield (2019) and Young (2019) appraised the credibility of using FGDs in research studies by mentioning the generation of new meanings through the hermeneutic effect of participant-to-participant interaction and gathering of critical information through group exchanges and snowballing of ideas as key benefits. In addition, the mentioned scholars cited the quality of discussions, the synergistic effects on the generation of study outcomes not possible with other data collection methods; and the generation of exciting and spontaneous ideas as other notable invaluable contributions of holding FGDs. So, this study administered FGDs on HoDs to realise the said dividends.

3.7 Measurement of Variables

Questionnaires were used basing on the already made instruments adapted from the past researchers as shown in Table 3.4 since the reliability of variables was already guaranteed by the already published instruments and the variables were taken to be valid too.

Table 3. 4

Operationalisation of variables, Instrument, Source and Reliability

Variable	Nature of variable	Indicators	Source & Reliability
SESEMAT Pedagogical approach antecedents	Independent variable (IV)	-Active learning	Boyaci &Kilic (2017) $\propto = 0.95$
		-Contextual learning	$\propto = 0.95$
		-Motivation of students	$\propto = 0.95$
		-Collaborative learning	$\propto = 0.95$
School environment	Moderating variable (MV)		Cara (2012), Farooqi (2014)
		-Administrative support	$\propto = 0.895$
		-collegiality	$\propto = 0.895$
		-Professional development	$\propto = 0.92$
Physics teacher effectiveness	Dependent variable (DV)		Calaguas (2012) $\propto = 0.972$
		Effective communication Subject matter expertise Professional competence Classroom management style	

3.8 The Research Instruments

Both quantitative and qualitative research instruments were used in the study as discussed below:

3.8.1 The Quantitative Research Instrument

A self-administered questionnaire (SAQ) was administered to teachers (Appendix A) which was divided into four sections A to D. Section A was for background information, characteristics of teachers; B was specifically for SESEMAT pedagogical approaches; C captured the teacher effectiveness; while D was on school environment. The statements measuring the SESEMAT pedagogical approaches, the school environment and the teacher effectiveness were structured and measured on a 5-point Rensis Likert scale as follows:- 1 for strongly disagree (SD), 2 for Disagree (D), 3 for Not Sure (NS), 4 for Agree(A) and 5 for strongly agree (SA).

3.8.2 The Qualitative Research Instruments

Four research instruments were used in the collection of qualitative data as discussed below:

3.8.2.1 Interview Guides: An interview guide was used (Appendices B and C) which helped the researcher to capture data on all the study variables. The motive of administering the interviews using a guide coincided with Tavory (2020) who argued that a well-prepared interview guide charted all the key questions and served to remind the researcher about the key areas for consideration. Thus, the interview guide minimised the possibility of asking questions randomly that might even be out of focus in relation to the study. To this effect, Tavory (2020) surmised that an interview guide aided the purposeful collection of qualitative interview responses that were capable of corroborating and enriching the findings.

3.8.2.2 Observation Guide: A lesson observation guide was used to enable the key aspects of the study as they panned out during the Physics lessons (Appendix E). The key aspects that were included were:- turn taking between teachers and students, the frequency of engaging students in the learning process, the procedures followed in grouping the students, the participation of the students in setting the apparatus, the richness of the classroom environment, the availability or otherwise of learning information materials in the libraries and the use of learning aids among others.

3.8.2.3 Focus Group Discussion (FGD) Guide: The guide was prepared in line with the specific objectives (Appendix D). The guide was followed strictly and this helped in shaping the focus of the discussions and enabled the researcher to avoid missing out any important data.

3.9 Data Quality Control

Data quality control entailled ascertaining the validity and reliability of both the quantitative and qualitative research instruments.

3.9.1 The Quantitative Data Quality Control

The quantitative data collection instrument for this study was a self-administered questionnaire. The validity and reliability of SAQ was ensured as follows:

3.9.2 The Validity of the SAQ

Validity refers to the truthfulness of the statements in a research instrument (Ahmed &Ishtiaq, 2021) and it may be criterion, face, internal, content or construct. However, only two forms, out of the mentioned types, were assessed in this study, given their commonness in other studies (Kumar, 2018) which were content validity and face validity as discussed below:

3.9.3 Content Validity

This type of validity is assessed by researchers in order to ensure that all the dimensions of the study are adequately captured in the statements that are prepared to measure the study's dimensions (Bastilla et al., 2021). When such is ensured, the concepts covered by the study are assessed exhaustively, leading to the generation of adequate data (Bastilha et al., 2021; Drost, 2011). The adequacy and coverage of all the dimensions measuring the SESEMAT pedagogical approaches, the classroom environment and the teacher effectiveness were ensured. The questionnaire was submitted to the researcher supervisors and three subject matter experts from Kyambogo University. These assessed the suitability of the statements and the breadth of coverage. Overall,

content validities of the different sections of the questionnaire were assessed using Content validity index (CVI) where the formula below was applied:

$$\text{CVI} = \frac{\text{Number of Questions judged relevant}}{\text{Total number of questions judged}}$$

The overall CVI for the SAQ was 0.85, which implied that the SAQ contained adequate statements for measuring the study variables. This inference was drawn basing on the views of Dewis *et al.* (2020) that the CVI values that were closer to 1 were indicative of a valid questionnaire.

3.9.4 Face Validity

The questionnaires that are punctuated with rubric, jargon and esoteric language are teasing and tormenting to the respondents (Kumar, 2018). When such mistakes are removed, the quality of emerging data is improved (Kumar, 2018). For that matter, face validity meant the ease, the simplicity and the understandability of the statements in a questionnaire (Gómez-Rodríguez *et al.*, 2020). That type of validity assessed the phraseology of the statements and the aim was to make the statements measuring the dimensions of the study as simple as possible so that every respondent could understand them without seeking for help from a third party (Kumar, 2018). The face validity was ensured by engaging his supervisors, some members of the doctoral committee and one professional language editor at Kyambogo University. This helped in eliminating confusing statements, weeding way unnecessary jargon and restructuring some of the statements to make them clearer and simpler to understand.

3.10 Reliability of the Questionnaire

Randrianarivony et al., (2020) and Koonin (2014) defined reliability as the ability of the questionnaire to yield more or less similar results when

administered in another setting on individuals who share more or less similar characteristics with the actual respondents targeted by the study. That entailed carrying out a pilot study in order to pretest the questionnaires (Koonin, 2014; Kumar, 2018). So, the questionnaire was pretested in Ntungamo Municipality on 14 teachers and 4 head teachers followed by entering of the data obtained in Statistical Package for Social Sciences computer software (Version 12). This was followed by computation of reliability analysis where the average Cronbach Alpha value obtained was 0.88 which was higher than 0.67, the threshold proposed by Dewis *et al.* (2020). Implicit from the above was that the higher Cronbach Alpha suggested that the questionnaire administered by this study was reliable.

3.10.1 Qualitative Data Quality Control

Interviews were used to collect qualitative data. However, they generated biased data (Kriukow, 2020; Tavory, 2020). The bias arose from two fronts: - first because the respondents were considered as information-producing commodities (Holstein & Gubrium, 2020) and second, when the respondents viewed the person administering the interviews as an 'instrument' (Jones & Donmoyer, 2021). Biases might also arise due to:- the researcher's attitude, views and prospects ; the researchers viewing the respondents in their own merit and not according to the research questions at hand; the inclination of the researcher to a certain key point as they perceived it, leading to negation of the actual views of the respondents especially those deemed to be deviating from the researcher's preconceived notions; the misperceptions on the part of the interviewers with regard to what the interviewee was saying and/or misunderstanding on the part of interviewee with regard to what they are asked

(Roberts, 2020). Furthermore, Alshenqeeti (2014) identified other possible ways through which bias arose in an interview, namely:- tendency of an interviewer to use leading questions that stifled possible debates and dialogue between the interviewer and interviewees; relying on audio-taping alone without any side notes taken; failure to carry out pilot interviews; and, the failure to accord ample time to the respondents to enable them to summarize their points of view. The above forces undermined the quality of the generated data.

To ensure data reliability, the interview guides were piloted in Ntungamo Municipality on 3 head teachers and 2 District Education Officers. As indicated by Aung et al., (2021), piloting of the interview guide helped in eliminating phrasal issues in the interview guide and in making questions as direct and simpler as possible. The piloted version of the interview guide was revised and used in Kigezi sub-region.

Reliability was equally ensured through member-checking. Coleman (2020) reinforces the idea of member-checking and argued that working hand in hand with the respondents improved the credibility of the data as it enabled the respondents to ratify the correctness or otherwise of the emerging themes and case summaries. In this study, the transcripts from interviews with head teachers (14) were shared with 6 of them while DEOs' transcripts (6) were shared with 2 of them. This decision followed the recommendations of Varpio et al. (2017) that researchers could engage all or some of the respondents for member-checking. This helped in the validation of truthfulness of the emerging themes and the entire case summaries that were used in this study to corroborate the quantitative results.

One other way in which the validity and reliability of the interview data was strengthened was through providing an elaborate audit trail (Coleman, 2020). An audit trail strengthened the confirmability of the reported results (Carcary, 2020; Nazar et al., 2022). It outlined the scientific procedures undertaken right from the selection of the respondents, the process of administering the interviews, the transcription of the interview voices, the development of the themes and the reporting of the emerging results (Coleman, 2020). The trail of the interviews administered was discussed in the methodology section which was imperative to enable the readers to ascertain the transparency of the reported interview findings and to strengthen the confidence of the readers in appreciating the interview results presented in the results section of the study.

The research assistants were triangulated and according to Carter et al., (2014), engaging different researchers in the entire qualitative data collection and analysis phases increases the reliability of the findings. In this study, the researcher engaged 3 research assistants to administer the interviews and then engaged 3 different research assistants who were specifically assigned to collect quantitative data to transcribe it. That eliminated the bias that would have arisen, had he stuck to the interview team to transcribe the voice notes. Besides the research assistant triangulation, the researcher equally applied methods triangulation. The qualitative data was collected using observation, interviews and FGD which equally provided a means by which any possible biases that would arise from the use of a single qualitative data collection method were minimized considerably.

The efficacy of the interview data was increased by avoiding leading questions. This was ensured by using probing questions throughout. Furthermore, the interview questions were asked randomly that helped in eliminating possible guesswork from the respondents regarding the possible flow of the questions. To eliminate the possibility of preconceived responses, no interviewee accessed a copy of the interview guide. Therefore, they were not sure of the framing of the questions which strategy helped in minimising biased responses.

Transferability of the findings was ensured and according to Nowell et al., (2017), transferability referred to the degree with which the qualitative findings in a study could be generalized with regard to other environments. Much as Nowell et al., (2017) argued that a researcher could not easily tell whether their findings would be transferred or generalized to other environments, it was imperative to ensure that thick descriptions were used in the findings. The thick descriptions were important whenever other scholars picked interest in a study in transferring the study findings into their own studies (Tuvalu-Mashiack, 2021). The thickness of the descriptions in this study was ensured by presenting case summaries and illustrating them with verbatim quotes.

3.11 Data Management

The conclusion of data collection was followed by data management both quantitatively and qualitatively as discussed below:

3.11.1 Quantitative Data Processing

Quantitative data from the self-administered questionnaires was edited, categorised or coded and entered into the computer using the Statistical Package

for Social Sciences (SPSS) for analysis. Further management included data screening to establish missing data and detection of errors. Diagnostic tests included the normality test, linearity and multicollinearity and fulfilling the thresholds of these checks implied that data was fit for analysis. That allowed the researcher to run descriptive statistics using SPSS where frequency counts, percentages, mean and standard deviation were computed. Still in SPSS AMOS, the causal relationships between the variables were assessed using Structural Equation Modelling (SEM). SEM was also applied in this study because it provided a more scientific way to simultaneously model and estimate complex relationships among multiple dependent and independent variables (Hair et al., 2021). In addition, SEM was adopted largely because its use helped to overcome three important limitations namely:- the postulation of a simple model structure, requiring that all variables could be considered observable and the assumption that all variables were measured without error, which were common with the first-generation multivariate analysis techniques (Hair et al. 2021). SEM also helped to ascertain not only the relationship between observed variables and latent constructs but also to uncover the pattern or path of the sets of latent constructs. That step was followed by the interpretation of the results using narrative texts and the meaning assigned to the outputs made Chapter 4 of this dissertation.

3.11.2 Qualitative Data Processing

The processing of data from in-depth interviews and FGDs was carried out in phases. In the first phase, the audio clips were downloaded from the audio-recorder to a laptop. Headsets were plugged in the laptop followed with transcribing the voices word-by-word and sentence by sentence which phase

lasted for 3 days. In the second phase, the transcripts were printed by the researcher to crosscheck whether they matched with the respective audio clips using the hard copies again which also lasted for 3 days. After confirmation was done, in phase 3, the transcripts were fed in MAXQDA 22 for generation of themes and case summaries. MAXQDA 22 was selected because unlike Atlas.ti, NVIvo, Delve, Ethnograph and Dedoose and QD Miner, it was user-friendly and accommodated a large number of data (Guetterman & James, 2023).

3.12 Data Analysis

3.12.1 Quantitative Analysis

Quantitative data was analysed using descriptive and inferential means. In the descriptive analysis for the SESEMAT pedagogical approaches, the teacher effectiveness and the school environment involved frequencies, percentages, mean and standard deviation. At inferential level, the structural equation modelling (SEM) was performed using SPSS AMOS v25. The SEM provided the path model that described the interrelationship between the variables and the indicators (Sander & Lee, 2014), hence helping in the determination of the causal relationships between SESEMAT pedagogical approaches, school environment and teacher effectiveness. Equally, SEM defined a theoretical causal model comprising of a set of predicted covariances between the variables and testing whether the established relationship compared to the observed data (Hair et al., 2021). This study involved several sub-variables for each dimension and these were handled using SEM because it provided the easiest way of computing the relationships between the multiple variables (Sarstedt et al., 2021).

3.12.2 Qualitative Data Analysis

Data from interviews, observations and FGD was analysed by categorization and the results were presented as supporting or confirmatory statements that corroborated the quantitative data. The case summaries beefed quantitative data while at some points, verbatim quotations were included to illustrate the qualitative findings making them vivid. Thus, the above processes (data collection and analysis) were summarized in Table 3.5.

Table 3. 5*:*

Matrix table summarizing data collection methods, instruments, analysis tools and means of presentation

Objective	Data type	Data collection methods	Data instruments	Data Analysis tool	Data presentation
One: determine the relationship between pedagogical approach antecedents and physics teachers' effectiveness	Quantitative	Questionnaire survey	SAQ	SPSS AMOS	Descriptive Statistics, Frequencies and percentages
	Qualitative	Interviews, FGD, Observation	Interview Guide, FGD Guide, Classroom checklist	MAXQDA for interview and FGD data Manual analysis of Observed data	Narratives and Verbatim Quotations for interviews, Narratives for observed data
Two: Establish the relationship between school environment antecedent and physics teachers' effectiveness	Quantitative	Questionnaire survey	SAQ	SPSS AMOS	Descriptive Statistics, Frequencies and percentages
	Qualitative	Interviews, FGD, Observation	Interview Guide, FGD Guide, Classroom checklist	MAXQDA for interview and FGD data Manual analysis of Observed data	Narratives and Verbatim Quotations for interviews, Narratives for observed data
Three: Ascertain moderating impact of school environment on the relationship between pedagogical approach antecedents and Physics teachers' effectiveness	Qualitative	Questionnaire survey	SAQ	SPSS AMOS	Structural Equation Model

3.13 Ethical Considerations and the Researcher's Positionality

Research is a complex process in which matters of integrity are key (Brittain et al., 2020; Jacobs, 2020). Ethics were considered right from Kyambogo University to the field and in the process of reporting results. At Kyambogo University, a transmittal letter was obtained which introduced the researcher to the Research Ethics Committee (REC) of the Uganda Christian University (UCU) (Appendix F). This paved way for obtaining a clearance certificate from

Uganda National Council of Science and Technology (UNCST) (Appendix G) which was followed by ratifying the consent forms for head teachers, Physics teachers and District Education Officers (Appendices H and I). Later, the final REC clearance letter was obtained from UCU (Appendix J). These clearances were the basis for obtaining a transmittal letter for data collection from Kyambogo University (Appendix K). On the visit to each of the districts in Kigezi sub-region, the three letters were submitted to the District Education Office (DEO) and Uganda Police Force (UPF) district offices for permission to engage the respondents. While in the field, no respondent was coerced or hoodwinked by any means to participate in the study and consent was sought from the respondents (see Appendices H and I). All the targeted respondents expressed outright willingness to participate and appended signatures on the consent forms.

The confidentiality of the respondents was greatly respected by the researcher and that case, none of the personal identifiers of the respondents were collected in this study such as personal e-mail addresses or social media account identifiers, among others. The privacy of the respondents and the confidentiality of their submissions were increased by making the questionnaires anonymous. Further still, during data collection especially for FGD and interview findings, only labels were used. The pseudonymization and anonymization of the qualitative findings were communicated before the actual interview and FGD discussion started.

Incidentally, data was collected at a time when corona virus disease 2019 (COVID-19) had swamped the world and caused immense fear to everyone. The government through the Ministry of Health formulated standard

operating procedures (SOPs) as control measures and these included; social distancing, washing of hands with soap, water, and wearing of protection using facemasks and sanitizers were used. So, throughout the data collection process, these SOPs were observed where all respondents sanitized their hands before and after filling questionnaires. The questionnaires were kept in a lockable suitcase that was sanitized every time they were drawn. Similar processes of sanitizing and providing facemasks were observed during the FGD sessions at White Horse Inn which was located at Makanga Hill in Kabale Municipality.

The researcher had participated in the Uganda's education system as a Physics teacher for more than a decade. This work experience was likely to jeopardize his neutrality especially during data collection, with the effect anticipated to compromise the data collected from Rukiga District especially in Bukinda Sub County and in Buhara and Kaharo Subroutines in Kabale District where he had taught for over the said period. This situation was handled by assigning the data collection process in those schools to the research assistants. Besides, the questionnaires used in the same study sites included a hypothetical name for purposes of eliminating bias from the respondent teachers. In the same vain, throughout his tenure of teaching in Kabale District schools, the researcher was always critical of private secondary schools especially with regard to the teaching environment and the way in which they handled teachers and the teaching-learning process. To eliminate the possibility of studying about Physics teachers and the school environment with distorted lenses, he tactically assigned all the private secondary schools to the research assistants except for FGDs which decisions helped in minimising bias.

3.14 Chapter summary

The chapter covered the methodology followed in assessing the interrelationship between the SESEMAT pedagogical approaches. The procedures followed in selecting the respondents were clarified, data collection methods were discussed, the respective instruments used were enumerated, the steps followed in enhancing data quality were explained and the tools of data analysis were defined. In the next chapter, the findings of the study were presented.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter presented the results from descriptive, statistical and qualitative analyses in the gist of the three specific objectives that informed this study. These were to:- determine the relationship between the SESEMAT pedagogical approaches and the Physics teachers' effectiveness in Kigezi sub-region; assess the relationship between the school environment and the Physics teachers' effectiveness in Kigezi sub-region; and, ascertain if the school environment moderated the relationship between the SESEMAT pedagogical approaches and the physics teachers' effectiveness in Kigezi sub-region. The chapter began with the results on the response rate, followed by the data processing and screening process and then, the results on the biographic characteristics of the respondents. That was followed by the actual empirical findings presented objective by objective. The quantitative empirical findings were presented using descriptive means (frequencies, percentages, means and standard deviation) and inferentially using Structural Equation Modelling (SEM). The qualitative empirical data from interviews, FGDs and observation was presented using narrative statements and illustrated using verbatim quotes. Pseudonyms were used for head teachers and DEOs while '*Hedimasita'* was used for the headteachers and '*Offisa'* for the DEOs.

4.1 Response Rate

The study targeted 290 respondents including the Physics teachers, the Headteachers and the District Education Officials and the response rate was summarised in the Table 4.1.

Table 4. 1

Response Rate

Category of respondents	Target	Actual Respondents	Response rate
Education Officials	6	6	100
Head Teachers	17	14*	82.3
Physics Teachers	267	194	72.6
Total	**290**	**214**	

Source: Primary data 2021

As shown in Table 4.1, the study attracted interests from the targeted respondents. Whereby, all the District Education Officials participated fully in the study, giving rise to 100% response rate. While 17 head teachers who met the inclusion criteria were targeted, data from 14 of them was considered for analysis. The study stopped at the 14th head teacher because of saturation, yielding a response rate of 82.3%. This decision borrowed credence from Hennink and Kaiser (2022), Naeem et al. (2024) and Saunders et al. (2018) who recommended that researchers working on qualitative data should discontinue interviews or even suspend interview responses as long as they had confirmed that no new data or themes were emerging from the interviews and/or datasets. That helped in omitting unnecessary results hence, paving way for reporting of consistent and robust findings (Naeem et al., 2024).

On the quantitative part, the study targeted 267 Physics teachers however, only 204 were returned, yielding a response rate of approximately, 72.6%. Nevertheless, only 194 usable questionnaires were analysed since the other 10 were incomplete which avoided the falsification of findings.

Muhammad (2022) argued that incomplete questionnaires were unanalysable and excluded from the sample to be analysed.

The results in Table 4.1 revealed that the response rate for this study was high and by implication, the results were credible. That inference rhymed Morton et al., (2012) who argued that studies reporting results on a sample that had a response rate below 50% reported results that were less accurate whereas the ones with a response rate of 70% and above were regarded as accurate. Implicit in this argument was the fact that a high response rate was litmus of quality results of a study (Holtom et al., 2022). Furthermore, Krishnan and Poulose (2016) and Matthiesen et al., (2021) argued that high response rates were indicative of the high probability that the sample was representative of the population. The higher response rates were indicative of how the study was relevant to the respondents and that cultivated much interest leading to high participation.

4.2 Data Preparation and Screening Process

Quantitative data from 194 Physics teachers was captured using SPSS software version 20.0. Before performing the analysis, data screening confirmed its normality and further, to confirm whether there was missing data and outliers.

4.2.1 Assessment of Missing Data

Missing data was detectable in a dataset to represent the cases of respondents who failed to respond to some of the survey questions or when there was a mistake in the data entry process air et al., 2021; Pallant, 2016; Won et al., 2017). As a result, such data was not available to the investigator (Marino et al., 2021). Missing data was identified in only 10 of the 204 returned questionnaires leading to their disqualification before actual data entry took

place. Thus, none of the 194 questionnaires considered for analysis had missing data (See Appendix M).

4.2.2 Treatment of Outliers

Outliers are extreme values that fall outside the normal range of values for a particular variable. If not detected and cleared, they have a significant impact on the study results (Cousineau & Chartier, 2010). In line with this, Hair (2016) & Black and Anderson (2010), reported that outliers affected the efficiency of multivariate analyses. In that case, Mahalanobis Distance (D^2) was used to test for the presence of outliers. Any cases were supposed to be eliminated basing on the critical values and significance levels (Anesthesiol, 2017; Field, 2017). For that matter, no cases of outliers were detected in the dataset (See Appendix N)

4.2.3 Data Normality

Data normality was examined by using graphical Normal P-P plot method and histogram based on linear regression. Figure 4.1 showed that variances followed a normal straight line implying that residual error terms were normally distributed. Normality refers to symmetrically distributed data with no skew (Chattamvelli & Shanmugam, 2023; Diwakar, 2019; Habibzadeh, 2024). Plotting this data on a graph yields a bell-shaped curve testifying that data was collected from a normally distributed population (Orcan, 2020). A normal P-P plot (Figure 4.1) showed that data was normally distributed while Figure 4.2 showed a normal distribution of standard errors. Therefore, the data was normally distributed which made it possible to compute both descriptive and inferential analyses with accuracy.

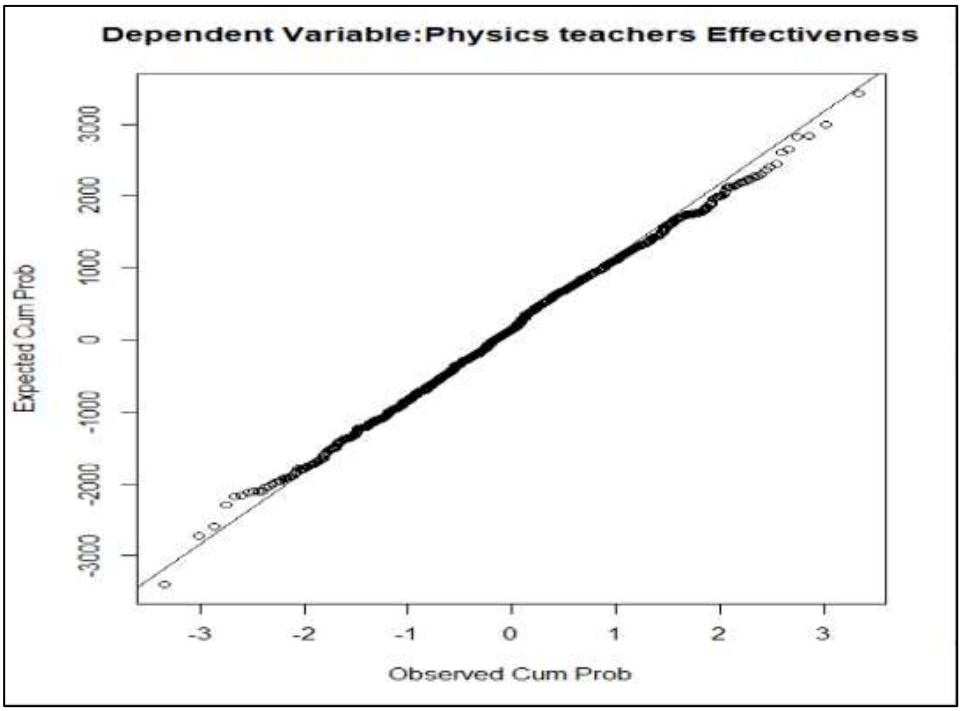
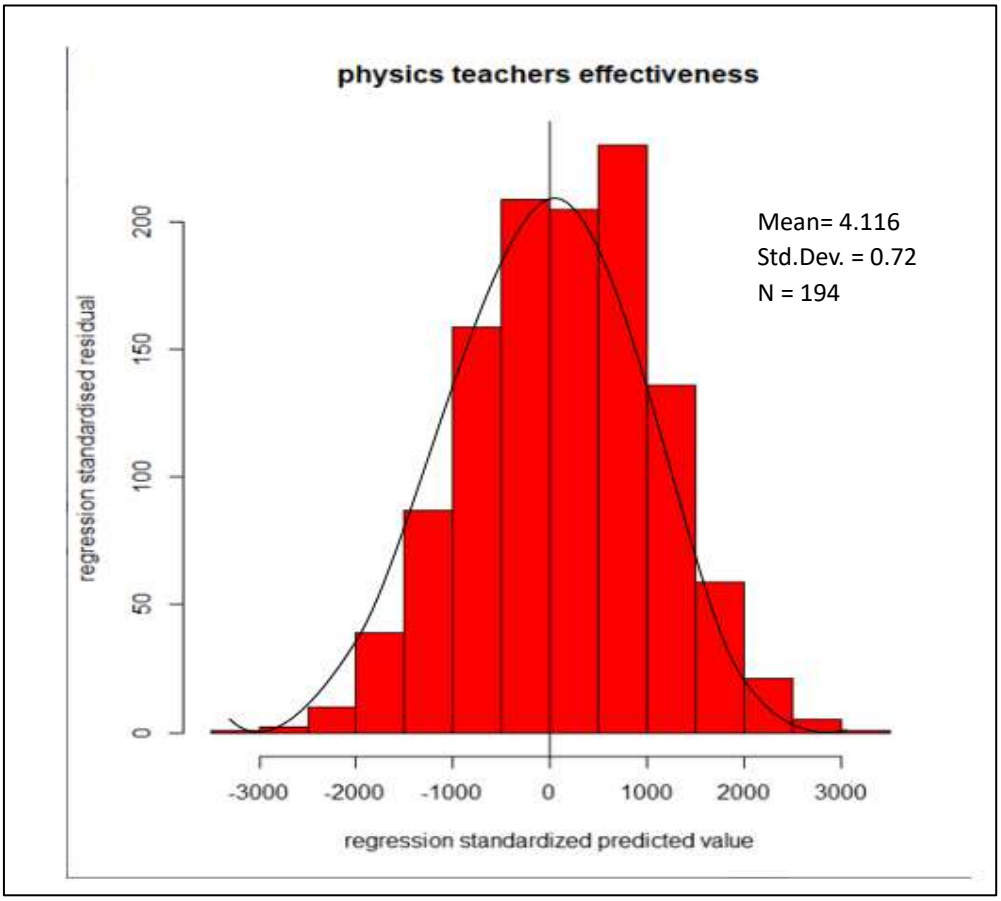


Figure 4. 1: Normal P – P plot of regression standardised residuals



Source: Field data 2022

Figure 4. 2: Histogram for normal distribution of the standardised residuals

4.2.4 Testing for Multicollinearity

Multicollinearity is the correlation between two or more independent variables in a regression model (Kline, 2016; Shrestha, 2020). This is done by examining correlation matrices, variance inflation factor (VIF) and tolerance (Field, 2017; Hair et al., 2016; Kline, 2016). To avoid biased estimates and misleading results, it was important to identify and address multicollinearity issues. In that case, the tolerance statistics served to indicate how much of the variability, and a predictor variable was not explained by other predictor variables in the analysis. In table 4.2, VIF values were acceptable since they ranged between 1.513 and 3.395 (< 10) and so were the tolerance values which ranged between 0.295 and 0.661 (>.10). Shrestha (2020) noted that multicollinearity would exist if the correlation among variables was > 0.7. Thus, the results in table 4.2 implied that there was no multicollinearity in the dataset. That guaranteed the credibility of the data and eased analyses as the presence of multicollinearity complicated the estimation of variables (Kim, 2019; Streukens, & Leroi-Werelds, 2023)

Table 4. 2

Multicollinearity statistics of exogenous latent factors

					Tolerance	**VIF**
Pearson correlation	AL				.661	1.513
	CL	.476			.307	3.252
	CoL	.556	.606	.926	.459	2.179
Sig. (1 – tailed)	AL					
	CL	.000				
	CoL	.000	.000	.000		

N = 194 Key: AL=Active Learning; CL=Contextual Learning; CoL=Continuous Learning; VIF= Variance Inflation Factor

Source: Field data 2022

4.2.5 Linearity

Correlation coefficients in the dataset showed that independent and dependent variables were related. That was evidenced by p-values (<0.01) which indicated a significant relationship between the variables (Pallant, 2016) while high R-values indicated a strong relationship between the variables. The positive correlation implied that when one variable changed, the other variable changed in the same direction and therefore, the data was related. Table 4.3 gave details of the correlations for the predictor variables.

Table 4. 3

Correlations of the predictor variables

		CL	**CoL**	**AL**
CL	Pearson Correlation	1	.606**	.476**
	Sig. (2-tailed)		.000	.000
CoL	Pearson Correlation	.606**	1	.556**
	Sig. (2-tailed)	.000		.000
AL	Pearson Correlation	.476**	.556**	1
	Sig. (2-tailed)	.000	.000	

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

N = 194 CL=Contextual Learning; CoL= Collaborative Learning; AL= Active Learning

Source: Field data 2022

4.3 Biographic data of the Respondents

The respondents' profile provided data on the research participants. According to Huff and Tingley (2015), the respondent profile provides an informed understanding to the readers about the study participants and their knowledge of the study phenomenon. Gallegos (2022) coheres with Huff and Tingley

(2015) by advancing the view that high-quality research needs high-quality respondents. Gallegos (2022) illustrated his belief by citing the importance of embodying the respondents' socio-demographic characteristics as an indicator of high-quality research. In this study, respondents were profiled along critical characteristics namely, gender, age, marital status, current position, type of school, teaching experience, academic qualification, and position in the organisation/school and the respondents' profiles were summarized in tables 4.4- 4.11.

4.3.1 Description of Physics teachers by Gender

The teachers responded to a question that sought for their gender and the results obtained were summarized in table 4.4.

Table 4. 4

Gender of the Respondents

	Frequency	Percent	Cumulative Percent
Male	171	88.1	88.1
Female	23	11.9	100.0
Total	**194**	**100.0**	

Source: Field data 2022

Table 4.4 presented the gender of the respondents where majority of the Physics teachers, 171 (88.1%) were male compared to 23 (11.9%) females. Those statistics showed under representation of females in teaching of Physics in secondary schools of Kigezi sub-region. That finding resonates D'ujanga et al. (2019) who noted that there was underrepresentation of women in Physics both in schools and in the workplaces. Elsewhere, Matete (2022) and Gosling and Gonslaves (2020) established that there was gross underrepresentation of

women in Physics and other STEM disciplines. Larsson and Danielson (2023) surmised that that low representation of women Physicists in school and industry made them double outsiders. The finding was vital to this study largely because underrepresentation of women in Physics teaching could suggest that there were few role models to support the female Physics teachers, consequently affecting their teaching effectiveness.

4.3.2 Description of Physics teachers by experience

The teaching experience was assessed in terms of the number of years spent teaching. Table 4.5 provided a summary where majority of the respondents, 169 (87.1%) had taught for more than 5 years and 25 (12.9%), for less than 5 years. The finding showed that majority of the teachers had accumulated experience about Physics teaching and learning. That experience was relevant to the study since the teachers were able to respond genuinely to the questionnaires and the FGDs by invoking experiential information which attribute guaranteed the quality of the findings. Draper (2021) ceded that the respondent experience presupposed the best quality data and therefore, better data and better respondents predicated better research surveys and generally, the overall quality of the research output.

Table 4. 5

Experience as a Physics Teacher

	Frequency	**Percent**	**Cumulative Percent**
<5 years	25	12.9	12.9
5 - 9 years	73	37.6	50.5
10 - 14 years	50	25.8	76.3
15 years +	46	23.7	100.0
Total	**194**	**100.0**	

Source: Field data 2022

4.3.3 Description of the Physics teachers by current position

Views were sought from the Physics teachers regarding their status in terms of position of responsibility in their school and in the SESEMAT programme where table 4.6 summarized the results obtained.

Table 4. 6

Current Position

	Frequency	Percent	Cumulative Percent
Regional Physics Trainers	5	2.6	2.6
Ordinary Teacher	173	58.2	60.8
Head of department	16	39.2	100.0
Total	**194**	**100.0**	

Source: Field data, 2021

Table 4.6 showed that a large proportion of Physics teachers, 173 (60.8%) never held a position of responsibility other than teaching while 21(39.2%) doubled as teachers and Heads of Department and an insignificant number were participating in the SESEMAT programme as Regional Physics Trainers. The blended pool of respondents with different lines of responsibility implied that quality responses were reported from both classroom and administrative domains.

4.3.4 Description of Physics teachers by school type

Efforts were made to establish the type of schools that were selected for the study and table 4.7 provided the summary.

Table 4. 7

Type of school

	Frequency	Percent	Cumulative Percent
Mixed Day	103	53.1	53.1
Single Day	7	3.6	56.7
Mixed Boarding	60	30.9	87.6
Single Boarding	24	12.4	100.0
Total	**194**	**100.0**	

Source: Field data 2022

The participating schools belonged to two categories of mixed and single sex. Majority of the schools in the 'mixed' category admitted day scholars, 103(53.1%) compared to those that had boarding students. The single-sex schools contrasted with mixed counterparts as majority, 24 (12.4%) had boarding facilities and an insignificant number, 7(3.6%) operating on day-schooling basis. That eliminated gender-biased results since statistics had shown that boys performed better in Physics than did the girls. Therefore, acknowledging the gender aspect was vital in the assessment of teacher effectiveness in the study area. Figueroa Vélez and Vélez Ochoa (2021) observed that gender sensitivity was important while in the parlance of educational institutions, Kwauk and Bever (2017) provided comporting views that teachers were gendered beings with a responsibility of creating gender-inclusive learning situations. Following those submissions, assessing that background characteristic was important to this study that assessed the Physics teachers' effectiveness.

4.3.5 Description of teachers by school ownership

The dimension of distribution of the Physics teachers by school ownership was assessed, given its influence on the school outcomes including teaching and learning. Table 4.8 provided the summary:

Table 4. 8

Category of the school

	Frequency	Percent	Cumulative Percent
Government-aided	157	80.9	80.9
Private	37	19.1	100.0
Total	**194**	**100.0**	

Source: Field data 2022

Table 4.8 showed that majority of the Physics teachers served government-aided secondary schools, 157 (80.9%) compared to 37(19.1%) from privately owned. That parameter implied that the study findings were comprehensive, given that both government-aided and privately owned secondary schools participated and were equally affected by the 2006 Science Education Policy. Furthermore, the differences in academic achievement in the STEM subjects between the two school types differed as reported recently by Bwenvu et al. (2020) and Gumisirizah et al. (2022). Therefore, that qualified the importance of including the above parameter in assessing the teacher effectiveness in Kigezi sub-region.

4.3.6 Description of Physics teachers by school location

The site or structural advantages provided by a given location had an influence on the performance of institutions established in such a setting. Basing on that

proposition, the study sought to characterize the Physics teachers in the prism of school location and table 4.9 summarized the results obtained.

Table 4. 9

Status of the school

	Frequency	Percent	Cumulative Percent
Rural	122	62.9	62.9
Urban	72	37.1	100.0
Total	**194**	**100.0**	

Source: Field data 2022

Most of the Physics teachers worked in rural-based schools 122(62.9%) while a reasonable proportion, 72(37.1%) plied trade in urban-based schools. That dimension was important in the study because past studies assessing the school and academic performance in Uganda along the facet of school location, had shown that urban schools outpaced rural schools by a high degree (Sumida & Kakwata, 2021; Wodon & Tsimpo, 2021; Wokadala, 2012). This study anticipated that the very dimension could be influencing the Physics teachers' effectiveness in one way or the other and therefore it was worth assessing.

4.3.7 Description of Physics teachers' by SESEMAT-in-service training attendance

The Physics teachers were equally categorised on the horizon of experience with SESEMAT programme. The teachers were required to indicate the number of training cycles attended and the results obtained were summarized in table 4.10.

Table 4. 10

Number of In-Service SESEMAT Training Cycles

	Frequency	Percent	Cumulative Percent
One	33	17.0	22.2
Two	60	30.9	53.1
Three and more	91	46.9	100.0
Total	**194**	**100.0**	

Source: Field data 2022

Nearly, half of the Physics teachers who participated in the study, 91(46.9%) had attended the SESEMAT training cycles three or more times; a sizeable number, 60(30.9%) had attended twice and a small number 33(17%) had attended once. Generally, a greater number of Physics teachers were knowledgeable about the SESEMAT programme since they had attended the training cycles more than once. By implication, they possessed knowledge for responding to the statements about the pedagogical approaches promoted by the programme. That provided explicit evidence that the data provided on SESEMAT pedagogical approaches and the Physics teachers' effectiveness was informative and reliable.

4.4 Empirical findings on the SESEMAT Pedagogical approaches

The SESEMAT pedagogical approaches were conceptualized into three: - active learning, contextual learning and collaborative learning. The statements measuring these dimensions were based on Likert's scale ranging from 1 to 5, where 1 represented strongly disagree, 2 for disagree, 3 for not sure, 4 for agree; and 5 representing strongly agree and the highest percentages were used to

interpret results. The quantitative findings were corroborated by qualitative findings from the interviews, observation and FGDs.

4.4.1 Application of Active Learning strategies in Physics Teaching in Kigezi sub-region

Active learning was assessed using 13 statements where majority of the teachers strongly agreed and disagreed respectively to most of the statements. On whether use of AL encouraged learners to freely express ideas during Physics lessons, majority (62.8%) strongly agreed and disagreed respectively. That was indicative that the teachers barely allocated activities in Physics lessons that would engage the students and therefore, there were limited avenues through which the students could freely express their ideas. As a result, there was limited sharing of experiences with majority of the teachers, 67.5% strongly disagreeing and consequently, the students had no or limited avenues of deriving hypotheses for the questions on their own. This was not possible in both government-aided and private secondary schools hence a reflection that active learning strategies prescribed by SESEMAT were not taken seriously by the teachers.

The results from lesson observation provided confirmatory evidence of the above challenges where of the 12 lessons observed, only 3 showed inclination towards active learning. In the two of the 3 lessons, the teachers conducted the lessons in the Physics laboratory and used computers to teach about Waves and Modern Physics while in the other, the teacher carried some equipment and taught the students in groups. In either case, the students were actively engaged in recording results and discussing with fellow students, which obviously, promoted active learning. In the other 9 lessons, the teachers became sage on the stage and engaged the students minimally. They did not have lesson

plans, focussed on learner centred but actually teacher centred plans were used and, in most cases, the teachers had no lesson plans at all.

Secondly, the students never participated in group activities despite the fact that SESEMAT pedagogical approaches encouraged the physics teachers to engage students in active group work. Active participation usually led to hands-on and minds-on which when emphasised usually led to improved student engagement and better grades. In most of the lessons observed, the teachers seemed to still be the generators of knowledge. They did not allow learners to participate fully in the teaching-learning process and they simply introduced a topic, explained with a few examples and dictated notes for the students to copy. In addition, because of a lot of part-timing in different schools, there was no time for the teachers to make preparations and on the point of giving feedback to learners there was no marking of learners' work and hence no timely feedback. This scenario featured in the FGDs especially for teachers from the private schools who indicated that they were not under pressure to engage students actively in setting apparatus, running experiments and group work because of logistical and structural rigidities. Doing so, would disadvantage many students especially in schools where there were abnormally high numbers of students. The teachers from the government-aided schools revealed that the schools under USE scheme had big numbers of students and as a result, active learning methods could not be applied in Physics teaching on a regular basis.

Further evidence from table 4.12 showed that majority of the teachers, 65.5% strongly disagreed that students explained their findings to the rest of the class which impeded active learning. The students had limited avenues for

individual engagement in Physics lessons since the majority of the teachers indicated that the students rarely performed experiments on their own, set apparatus from instructions on their own and to record observations for their own experiments as disagreed to by 64.9%, 66.5% and 73.2% respectively. The HoDs from government-aided schools revealed that Physics teachers rarely engaged students in experiments due to lack of spacious classrooms, limited number of equipment to use and lack of well-stocked laboratories. More evidence of limited school resources was provided by the headteachers that most rural-based government aided secondary schools and a considerable number of private secondary schools operated on thin budgets and therefore, the available funds were committed to UCE Physics practical and the views were summed up below:

> *"…Proprietors of this school normally plan for science practical lessons only for candidate classes. While it is undeniable that we have a science laboratory, compared to the number of students, the equipment is not adequate even for group work….in most of the cases, we hire the equipment at a fee from well-established schools in this area…these schools have more equipment than they need for their UCE examination bound students. So, this situation means that our students in lower classes cannot have adequate exposure to this equipment since they have to be returned immediately after UCE science practical have been completed…"* (Hedimasita E, 10 June 2022).

In relation to the above, a headteacher of a rural-based government-aided secondary school said:

> *"…the old adage 'cut the coat according to your cloth' applies greatly to the way how business is run in this*

> *school…we are running on very small budgets and this has become a culture…we normally implore the teachers to improvise and animate the teaching. Undeniably, I am sure that even improvisation has a limit. In laboratory bound lessons, there are several situations when a teacher, however creative they are, cannot organize a lesson unless certain equipment is available……teachers cope with this challenge by using the little available to their entire class. They teach practical lessons theoretically…imagine!"* (Hedimasita F, 27 June 2022).

The above submissions painted a clear image that the Physics practical lessons in most schools of the study area were least taught because of inadequate resources. The teachers could not engage the students in practical lessons because the required equipment was unavailable which undermined the teacher effectiveness.

The results further showed that majority of the teachers, 59.8% strongly disagreed that students had limited or no opportunities to manipulate data on their own and yet this was a typical learning activity in a learner-cantered Physics lesson. Faced with such a challenge, majority of the teachers (62.9%) strongly disagreed that the students could ably draw conclusions on results which suffocated the learning and mastery of content. In the same vain, majority of the teachers (59.8%) strongly disagreed that the students verified their own predictions of relationships in the learning activities performed. Furthermore, majority of the teachers (72.2%) disagreed that they gave students problem-solving activities on a regular basis which impeded active learning of Physics.

The results in table 4.12 equally showed that majority of the teachers, 55.2% strongly disagreed that the students were engaged in role-play on a

regular basis while an equally big number strongly disagreed that the think-pair-share method was applied in Physics lessons (66.5%). Since role-plays provided an excellent way of introducing new concepts in teaching, the failure to adopt this form of active learning affected the quality of teaching. On the other hand, use of think-pair-share method involved asking multiple-choice questions to engage the students in discussions and to challenge their thinking. For that reason, majority of the Physics teachers (74.7%) strongly disagreed that think-pair-share approach was commonly used in Physics teaching. The HoDs in the two FGDs revealed that they rarely applied the two teaching methods and indeed, this was confirmed during lesson observation with none of the teachers in the 12-lesson observed applying either of the methods.

Table 4. 11

Summary Descriptive statistics on respondents' opinions on Active Learning

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std.**
1.	Students are encouraged to freely express their views	122(62.8)	68(35.1)	2 (1.0)	2(1.0)	0(0.0)	2.33	1.61
2.	**S**tudents freely share their experiences	131(67.5)	20(10.3)	7(3.6)	18(9.2)	18(9.2)	2.21	1.37
3.	**S**tudents derive hypothesis for questions on their own	127(65.5)	42(21.6)	14(7.2)	6(3.1)	5(2.6)	2.40	1.50
4.	**S**tudents explain their findings to the rest of the students	126(64.9)	62(32.0)	3(1.5)	1(0.5)	2(1.0)	2.21	1.61
5.	**S**tudents perform experiments on their own	54(27.8)	129(66.5)	0(0.0)	6(3.1)	5(2.6)	2.26	1.55
6.	Students set apparatus from instructions on their own	36(18.5)	142(73.2)	4(2.1)	5(2.6)	7(3.6)	2.15	1.21
7.	**S**tudents record observations for their own experiments	116(59.8)	74(38.1)	0(0.0)	2(1.0)	2(1.0)	2.37	1.62
8.	**S**tudents manipulate data on their own	122 (62.9)	62(32.0)	3(1.5)	3(1.5)	4(2.1)	2.21	1.42
9.	**S**tudents draw conclusions on results	116(59.8)	74(38.1)	0(0.0)	4(2.1)	0(0.0)	2.29	1.23
10.	**S**tudents verify their own predictions of the performed	49(25.3)	140(72.2)	0(0.0)	2(1.0)	3(1.5)	2.14	1.45
11.	**S**tudents are given problem solving activities regularly	107 (55.2)	64(32.9)	0(0.0)	10(5.2)	13(6.7)	2.20	1.37
12.	Students are engaged in role play	129(66.5)	63(32.5)	0(0.0)	2(1.0)	2(1.0)	2.25	1.41
13.	Think-Pair-Share approach is used in physics lessons	145(74.7)	49(25.3)	0(0.0)	0(0.0)	0(0.0)	2.15	1.24

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data 2022

4.4.2 Application of contextual learning strategies in Physics teaching in Kigezi sub-region

Contextual learning was assessed using 6 items (Table 4.13) and the statements assessed whether the teaching of Physics was localized and contextualised by the teachers to enable the students to relate what was learned theoretically in the classroom and how it applied in the real life. Majority of the teachers (70.6%) strongly disagreed that they encouraged the students to apply new knowledge in real-life situations which deviated from the philosophy of SESEMAT programme. That deficiency in applying contextual teaching was equally manifested by failure of majority of the teachers (57.2%) who disagreed strongly that they gave out exercises and take-home activities on several Physics theory concepts for the students to work them out from home. The failure of the Physics teachers to apply the above contextual learning methods was reasoned out by the HoDs in FGDs who related engaging students in such learning drills as an addition of inconveniencing extra work for marking and discussing with the students, yet they handled bulk teaching and co-curricular work. Through informal conversations with some of the teachers, it was revealed that engaging students in the above contextual learning methods would be sort of additional work that could not be remunerated by management. To that effect, majority of the teachers would apply them only when it was mandatory and supervised by the school leadership. These views were raised by the teachers across the school types and therefore, they clearly showed how SESEMAT pedagogical approaches were least applied by Physics teachers.

The results in table 4.13 also showed that majority of the Physics teachers (72.2%) strongly disagreed that they used group teaching methods whenever they engaged students in contextual learning activities while they equally disagreed that they assigned practical work to the students with questions at the end for the students to answer while they were at home (80.9%). These findings implied that most teaching that ought to be contextualized on the environment outside the school setting was done theoretically or even discussed theoretically in class which undermined critical thinking and encouraged rote learning. When students learnt theoretically, it was difficult to relate it to real life situations thus the headteachers intimated that while they would encourage contextual learning every other day, it was not possible to hold the lessons in the communities or industry settings because the logistical implications at times were divorcing. The same views were expressed by the DEOs who cited the example of lower secondary curriculum that had added an extra line of expenditure on the side of the parents and therefore, their willingness to cost-share for contextualized learning in the STEM subjects such as Physics might not be tenable.

Furthermore, majority of the Physics teachers strongly disagreed that they barely used hands-on and minds-on approaches (75.2%) as well as engaging students in Physics with locally harvested teaching materials (70.1%). The hallmark of contextual learning was tailoring the leaning to the local content and enabling the learners to engage with the local materials for cognitive and affective development. The finding therefore implied that the teachers barely applied contextual learning approaches even when the materials were locally available and cheaper or toll free. The situation in the classrooms

observed during data collection where a negligible number of teachers displayed teaching aids confirmed that contextual learning of Physics was rarely applied. Indeed, in the FGD with the Physics HoDs from the private secondary schools, the tightness of the programmes in their schools could not afford them time to move round the school environment and establish aspects of interest that would allure the contextual learning of Physics. Two outstanding issues emerged from the interviews with teachers first, that the teachers had limited interest in using locally available materials since UNEB focused on conventional apparatus and materials. Secondly, that the teachers were hesitant to use the immediate environment for Physics teaching and learning. *Hedimasita* J in emphasizing the latter point said:

> *"… most teachers in this school as is the case with other schools where I have worked are less innovative in regard to using the locally available materials and the local ground for teaching because of the 'selfish motive'….they are quick to organize study tours away from the school setting because they wind up with some Ka balance to make ends meet…this is quite discriminative because not all the students can afford to contribute the asked for monies….in my opinion, this attitude of teachers to prefer away teaching than close to school grounds dilutes the entire meaning of contextual learning* …"(Hedimasita J, 15 June 2022).

The findings above implied that Physics teaching in both government-aided and private schools in Kigezi sub-region did not reflect the philosophy of the SESEMAT programme which required that teachers contextualized whatever was taught in classroom to the learners' immediate environment.

Table 4. 12

Summary Descriptive statistics on respondents' opinions Contextual Learning (CL)

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std.**
1.	Students apply new knowledge in real life situations	137(70.6)	31(16.0)	2(1.0)	18(9.3)	6(3.1)	2.30	1.29
2.	**S**tudents work out some physics concepts from home	111(57.2)	49(25.3)	9(4.6)	23(11.9)	2(1.0)	2.14	1.66
3.	Students work in groups with their friends	140(72.2)	52(26.8)	0(0.0)	0(0.0)	2(1.0)	2.30	1.33
4.	Students answer practical questions from their homes	34(17.5)	157(80.9)	0(0.0)	3(1.5)	2(1.0)	2.51	1.43
5.	Students are engaged in hands-on and minds-on approaches	146(75.2)	39(20.1)	4(2.1)	2(1.0)	3(1.5)	2.28	1.40
6.	**S**tudents to use local materials in a physics lesson	136(70.1)	45(23.2)	9(4.6)	2(1.0)	2(1.0)	2.41	1.32

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data, 2022

4.4.3 Application of collaborative learning strategies of teaching Physics in Kigezi sub-region

For this case, nine (9) items measured the application of collaborating learning methods in Physics teaching (Table 4.14) where majority of the teachers (61.9%) strongly disagreed that they often paired the students to enable group teaching and learning during Physics lessons. That inhibited critical thinking among the learners and denied them from benefitting from the synergy of groups in which fast learners and average learners would uplift the understanding of the slow learners. Moreover, majority of the teachers (53.6%) strongly disagreed that they grouped the students to enable them complete the Physics assignments together and further disagreed strongly that the students were unable to innovate and produce useful and relevant, artefacts together (57.7%), consequently hindering effective teaching and learning and the results from FGDs with HoDs from both government-aided and private schools never differed from the quantitative responses. From both sides, the respondents decried the difficulty of using collaborative learning methods because they required much time to form, monitor and evaluate therefore, most teachers avoided using those learning approaches to escape from their demands. In relation, the head teachers revealed that some teachers were not skilled in forming functional groups and were never technical in wading off any possible domineering where a few students took over the group activities and relegated the groupmates to academic spectators. Such a scenario could not enable all the group members to benefit from the virtues of group teaching and learning.

Table 4. 14 further showed that majority of the teachers (63.4%) strongly disagreed that the students were rarely engaged in constructive conversations during Physics lessons and this could be largely due to use of inconsistent and coercive methods in forming the students' groups as a further majority of the teachers (70.6%) strongly disagreed that they engaged the students in forming the study groups. That panned out in formation of chaotic groups that spoiled the intentions of group teaching and learning. That assertion was based on the views of majority of the teachers (73.7%) who disagreed that students in the teacher-formed (and usually dictated) groups listened to one another.

Furthermore, confirmation of limited application of collaborative learning was reflected in the views of majority of the teachers (75.8%) who strongly disagreed that the students set rules that were followed by a group during Physics teaching and learning. That provided confirmatory evidence of limited engagement of the students in forming groups which in one way or the other, created a power vacuum, leading to utter disorder. That finding was further confirmed by the views of majority of the teachers (64%) strongly disagreeing that roles were assigned to members of each group. That finding implied that the teachers formed the groups but never observed the dynamics of forming functional groups that were required to keep the members gelled together. A further anomaly reported by the study was that majority of the teachers disagreed that they assigned different tasks to the groups (77.8%) and duplication of information arising from assigning similar tasks to the groups hindered the achievement of many learning goals that would have been so, should the teachers have assigned different tasks to different groups. *Hedimasita* D and F as well as *Offisa* 2 and 4 raised an important issue regarding

the use of teacher-centred approach in curving out learning groups in a class as they reasoned that much as coercion could not be challenged directly, the students joined the groups but with less interest in learning especially where there were members that they did not believe in because of personal and individual differences. During lesson observations, the researcher established that introverts felt out of place when paired with extroverts; moreover, the teachers failed to create conditions that would enable the introverts to fit seamlessly in the groups, hence disadvantaging their learning.

Table 4. 13

Summary Descriptive statistics on respondents' opinions Collaborative Learning

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std**
1.	Students work together in Physics lessons	120(61.9)	68(35.1)	1(0.5)	2(1.0)	3(1.5)	2.27	1.47
2.	Students complete physics tasks together	104(53.6)	87(44.8)	1(0.5)	0(0.0)	2(1.0)	2.31	1.61
3.	Students create innovative products together	112(57.7)	74(38.1)	3(1.5)	2(1.0)	3(1.5)	2.29	1.33
4.	Students engage in constructive conversations	123(63.4)	60(30.9)	3(1.5)	6(3.1)	2(1.0)	2.27	1.45
5.	Students take part in forming groups	137(70.6)	52(26.8)	3(1.5)	0(0.0)	2(1.0)	2.34	1.43
6.	Students listen to one another	56 (67.5)	143(73.7)	0(0.0)	3(1.5)	2(1.0)	2.54	1.29
7.	Students set rules to be followed by a group	147(75.8)	40(20.6)	0(0.0)	5(2.6)	2(1.0)	2.33	1.40
8.	Roles are assigned to members of each group	124(64.0)	65(33.5)	0(0.0)	2(1.0)	3(1.5)	2.26	1.27
9.	Each group is assigned a different task	39(20.1)	151(77.8)	0(0.0)	2(1.0)	2(1.0)	2.65	1.33

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data 2022

4.5 Empirical findings on the School Environment and Physics teaching in Kigezi sub-region

Objective 2 assessed the influence of the school environment on the Physics teachers' effectiveness. The influence of the school environment was assessed along three dimensions, namely: - administrative support, collegiality and professional development. The data for meeting the requirements of the research objective was collected using a questionnaire that was administered to the Physics teachers as well as qualitative data from in-depth interviews with head teachers and DEOs. More data was sourced from FGDs with HoDs and lesson and classroom observation.

4.5.1 Administrative support for Physics teaching and learning

This aspect was assessed using 5 statements (Table 4.15). Regarding the nature of the school administration on the prism of according support to Physics teachers, most teachers strongly disagreed (65.4%). The support that the teachers needed to teach effectively might be financial for, for example, procuring instructional materials and for boosting their vigour and dedication to work diligently. The supportive headteachers were concerned about the social and emotional needs of the teachers. However, lack of supportive administrators was raised by the HoDs in the FGD discussions when they noted that most headteachers in the current work place and even former workplaces attached less value to the needs of the teachers. The HoDs from private schools expressed that the conditions in their schools were even worse since the bottom line of most of the founders was profits and the HoD 3 summarised this condition as follows:

> *"…In most private secondary schools, the conditions of work are crazy……the administrators work to the tune of the founders and they are at times compelled to assign us unacceptably big teaching loads and by doing so, we can barely find rest time to relax and regain composure…. this notwithstanding the fact they consider us as a 'liability' to the school finances since we take away money. For this reason, our socio-emotional needs do not matter and yet to my knowledge, an unstable teacher will always be physically present but emotionally absent…..this has given birth to a new concept; 'Present dodging' implying the presence of a teacher in school and in class at the right time but with 10% work done….."* (HoD 3, FGD Private Schools, 17 August 2022).

The above verbatim provided crystal-clear evidence that teaching effectiveness was greatly hindered by limited administrative support for the Physics teachers. While that could be thought of as a mere claim, the views from all head teachers of private schools vindicated the outcry of HoDs. They indicated that every year in, year out, they face challenges in attempting to meet the emerging needs of the teachers. As a result, some of the felt needs that required the intervention of the school administration were left unresolved as Hedimasita 5 summarised that argument as follows:

> *" ...I have no way I can pin my employers for failing to support the teachers in one way or the other because the school fees that we charge is in the same or at times south of what is charged by government-aided schools, which are tax-exempt, they pay some little PTA allowances and receive*

> *capitation grants from the government….we normally have headteachers' meetings and you hear many of them complaining about how the economy is stinging them hard and stifling the school plans……..when a rich man complains of hunger, what would you expect of a casual worker?.....this simile clearly tells you that often times, some of the supports that teachers need are not in our touching distance….."* (Hedimasita L, 1 June 2022).

Much as the teacher respondents valued fluid and effective communication as a linchpin for effective teaching, the majority (62.9%) strongly disagreed that their school leadership ensured that there was principled communication. The gravity of the matter was expressed by HoD 1, 3 and 5 in the FGD for private schools when they mentioned that communication was sluggish in their schools and that in events when formal communication activities such as meetings were held, the teachers were only involved for formality and basically to rubber stamp and ratify the new school policy developments in which they had played no role. Comporting views from the FGD of HoDs of government-aided schools equally highlighted the laxity in communication between the school managers and the teachers, which obviously, created a power distance and affected the school operations negatively, teaching inclusive. Related sentiments were raised by the *Offisa* 1, and 3 that in the event when school leadership kept communication informal and unstructured, the stakeholders such as teachers were kept in a state of confusion and could even barely find spaces for opinion on improving the operational efficiency; consequently, routine functions such as teaching and learning were choked. Comparing between the two school

types, such problems were prevalent in private secondary schools compared to the government aided ones. Therefore, teaching would be effective in government-aided schools than it was in private -owned ones.

Fading levels of teacher recognition were reported in some of the schools and in others, it was absent altogether. Majority of the teachers (64.9%) disagreed that in their school, all the teaching staff were highly recognized by school leadership implying that the leadership styles adopted by the head teachers were not enabling. Characteristically, in situations where one was hardworking but the administration was not appreciative, the zeal was lost. In informal conversations with some of the teachers especially in private schools, a number of teachers were plying trade to eke a living for meeting the daily needs of their dependents. One teacher even mentioned that some of her colleagues were better than her because they quit teaching and went to Middle East to work as nannies. Consolidating evidence of the low level of teacher recognition was scanned from both FGDs though the magnitude of mention was universal among all the HoDs of private schools and HoD 4 said:

> *"…our conditions of service are not appetizing at all…..ours is a man eat man society where the administration of our schools have never on a single day, organized an event to appreciate the good work that we are doing…….we are like bereft children, the community has nothing much to offer them even when their fallen parents have visible good deeds that are community goods benefitting everyone….I have five students who I brought to our school at the beginning of the year (2021) but I never received even a simple thank you from*

> *management…this is so demotivating……and for academic performance, the proprietors organize brown envelopes for the head teacher to congratulate him upon the good work done ……..can you imagine!* (HoD 4, 17 August, 2022).

The above verbatim showed clearly that there was limited or no recognition of teachers in most private secondary schools. As was the case with other non-educational institutions, the employees who felt not valued could decide to keep the job for survival. They could not innovate and were always craving for better opportunities. At the workplace, they were demotivated and delivered shoddy or substandard results. That assertion was clearly manifested in the views of majority of the teachers (67.5%) who expressed that they were not happy with their workplaces and therefore, as far as they were concerned, the schools were not run in a proper manner, but rather haphazardly as indicated by a further majority (70.1%) and that had to have affected the teaching effectiveness of the Physics teachers.

Table 4. 14

Summary Descriptive Statistics on Respondents opinion on Administrative Support

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std**
1.	I feel I have supportive administration	127(65.4)	25(12.9)	0(0.0)	30(15.5)	12(6.2)	2.34	1.45
2.	Headteacher-teacher communication is valued in my school	122(62.9)	62(32. 0)	3(1.5)	3(1.5)	4(2.1)	2.21	1.22
3.	I feel like the whole staff is recognized	48(24.7)	126(64.9)	5(2.6)	13(6.7)	2(1.0)	2.52	1.23
4.	I feel generally satisfied with the situation	131(67.5)	58(29.9)	0(0.0)	3(1.5)	2(1.0)	2.20	1.46
5.	I see that the school is well run	136(70.1)	39(20.1)	0(0.0)	12(6.2)	7(3.6)	2.29	1.16

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data 2022

4.5.2 Collegiality among Physics teachers in Kigezi sub-region

Collegiality was assessed using 6 statements (Table 4.16) which were boosted by the qualitative findings from FGDs with HoDs and in-depth interviews with head teachers and DEOs. A big proportion of Physics teachers (65.5%) strongly disagreed that they shared common beliefs with regard to improving the teaching and learning as well as the achievement of the grand goals of the school while more teachers (62.9%) strongly disagreed that there was much respect between the teachers. Those findings implied that there was lack of unity among the teachers and where there was lack of unity of purpose in an institution, the job performance was greatly affected. Therefore, it was plausible to infer that Physics teaching was not effective due to poor collegiality. In the latter case, absence of respect among the teachers was indicative of a cold working environment where teachers felt out of place whenever they were interacting with their colleagues. Furthermore, the lack of respect was cursory to workplace conflicts, which undermined employee productivity and performance in relative and absolute terms. Trivial issues such as religion were cited as the greatest cause of divisionism among the teachers by the headteachers and DEOs. The HoDs cited the same aspect of religion during FGDs where one of the participants said:

> *"….the lack of common beliefs and a common stand among teachers in my school is religion….the animosity that was cultivated in our communities by entrenched beliefs of missionaries and competition fights for converts has continued to prevail over us in the 21st century….I have seen this mirror in our school*

> *whenever external students' seminars are organized….Catholic teachers shun seminars of Protestant teachers and the other way round……the same applies to facilitators especially those marking UCE examinations…….religion is determining factor of who should be invited and when…..this has left crevices in the staffrooms and at Departmental level, hence undermining the quality of teaching…" (*Participant, FGD Government-aided schools).

The results in table 4. 16 equally showed that majority of the teachers (64.9%) felt that they were not valued in their department which further signalled to how dissatisfied the teachers were with the workplace in general and their department in particular. That scenario highlighted the possibility of teachers feeling so low in the school environment and those who felt so low about their job could not become effective because they were battling the challenge of identity, which put them out of place socially and emotionally. In the same vain, majority of the teachers (58.8%) disagreed that they cooperated and worked together as colleagues teaching the same discipline. As the old adage goes that unity is strength and combined efforts break the bone, the failure of Physics teachers to work as a team had to have affected the quality of teaching largely because teamwork allowed professionals to work together, to grow professionally and to make discoveries of how to teach erstwhile abstract content for better understanding of learners. That situation was decried by the HoDs that limited cooperation affected the performance of teachers in the department. Furthermore, the HoDs revealed that most schools created a competitive culture at school among the teachers. This reduced the chances of cooperating and planning together and therefore, the teachers missed the

benefits of synergy. Relatedly, *Offisa* B mentioned that most teachers were competing other than collaborating and as a result, it was not possible to improve the quality of teaching since learning for improvement was not possible. The seriousness of that scenario was summed by *Hedimasita* D as follows:

> *"…The power of synergy where 1+1=3 instead of 2, is lost when the teachers are not working as a one force. The acronym TEAM (Together, Each one Achieves More) is lost…and this has to do with attitude……negative attitudes erase the chances of realising the goals of any institution because they undermine performance by -100% while positive attitude propels performance to +100%.....I am choosing to illustrate my submission as follows, A is the first letter of the alphabet and represents 1, T is the 20th and so TT represent 40; I is the 9th representing 9, T is the 20th representing 20, U is the 21st representing 21, D is the 4th representing 4 while E is the 5th letter, representing 5. Mathematically expressed, 1 +40+9+20+21+4+5=100%.... therefore, working in silos is a disservice to effective teaching as it undermines performance by 100%.... this expresses the mathematical implication of absence of good collegiality in a school and how it suffocates the several good intentions that schools are founded to serve…."* (Hedimasita D, 4 June 2021).

The majority of the teachers (67%) disagreed that there was joint planning that involved all the teachers in the department. That affected the quality of teaching largely because collaborating teachers in planning sessions especially those focusing on improving the quality of teaching and learning improved the quality of teaching practice as it provided a forum through which the participating teachers were able to identify the weakness and strengths of their professional

services. On an equally problematic front, majority of the teachers (63.9%) disagreed that the heads of departments advised the teachers on how to go about teaching and how to tie the teaching to school goals. That finding consolidated the earlier observations that there was lack of unity of purpose among the teachers and therefore, lack of good collegiality. That was indicative of lack of organizational citizenship among the Physics teachers in Kigezi sub-region. The findings from interviews with DEOS also showed that when there was lack of joint planning among the teachers, it was not possible to improve the quality of teaching and learning. That became worse when the middle level managers such as HoDs failed to use their positions of responsibility to prioritize the grand goals and objectives of the schools and to emphasize the effect, Offisa B said:

> *"…. Some middle level managers in school settings that I have personally visited are not up to what they were delegated to do by school leadership…I wondered on several occasions, interacting with HoDs on a guided tour of the schools. Many are very green about what projects running in the schools were and their roles as implementers….for instance, a headteacher working with teachers to organize remedial lessons for slow learners but the HoD is not interested in supervising the entire project and failing to work with the said teachers, to me is an indication of a manager becoming a 'damager'….this reminds me of the Systems Theory which upholds that when there is a leakage at one node of the system, the entire system is wrecked……..the situation in schools especially government-aided secondary schools needs some real re-working*…."(Offisa B, 20 June 2021).

Table 4. 15

Summary Descriptive statistics on Collegiality

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std**
1.	Staff share common beliefs	127(65.5)	42(21.6)	14(7.2)	6(3.1)	5(2.6)	2.10	1.80
2.	Teachers respect each other	122(62.9)	62(32.0)	3(1.5)	3(1.5)	4(2.1)	2.31	1.74
3.	I am valued in the Physics department	126(64.9)	62(32.0)	3(1.5)	0(0.0)	3(1.5)	2.24	1.53
4.	Physics teachers work together	69(35.6)	114(58.8)	1(0.5)	5(2.6)	5(2.6)	2.84	1.45
5.	We plan together in my department	30(15.5)	130(67)	0(0.0)	17(8.8)	17(8.8)	2.74	1.64
6.	Head of department advises colleagues about school goals	34(17.5)	124(63.9)	0(0.0)	20(10.3)	16(8.2)	2.39	1.32

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data 2022

4.5.3 Professional Development among Physics teachers in Kigezi sub-region

Teacher professional development and its effect on Physics teaching was assessed using 5 statements. Those findings were corroborated by interview and FGD responses where in table 4.17, majority of the teachers (67.5%) strongly disagreed that school leadership created and organized several opportunities for professional development for teachers. Through informal conversations with the teachers when administering the questionnaires, it was established that professional development was a pipeline dream in private secondary schools as the proprietors of the private schools conceived investment in the professional development of the teachers as a wasting asset. Actually, majority of the teachers still confessed during the informal conversations that the school leadership in private secondary schools was even against any individual initiatives for professional development such as upgrading or self-sponsored attendance of workshops and seminars. In the government-aided schools, the aspect of professional development was almost nearly absent in the rural-based ones. The magnitude of that problem was further reflected by the majority of teachers (72.2%) who disagreed strongly that they attended trainings in work related activities and a further majority (53.6%) strongly disagreed that they participated in workshops on a regular basis.

The above findings were consolidated by the views of the headteachers who indicated that training opportunities for the teachers such as workshops had a cost pegged to organising and facilitating the participants. Therefore, given the squeezed budgets on which government-aided secondary schools were

operating, training opportunities were rare. Their counterparts from private secondary schools admitted that it was rare for school administration to create a vote for capacity building and on their own, the headteachers were powerless and could not dare organize any professional development activities of any sort despite the knowledge about the efficacy of such in boosting the performance levels of the teachers. Relatedly, the DEOs revealed that they put the school administrators at task to provide them with updates about capacity building programmes implemented in the schools from time to time. To their dismay, the DEOs revealed that very few schools had complied while majority were yet to do so, much as their annual plans usually included in passing, statements about the commitment of schools to support professional development of the teachers. Majority of the head teachers that we interviewed expressed that the schools did not have adequate funds to support teachers when opportunities for professional development arose. Actually, some head teachers from the private secondary schools were not sure whether they could convince the school Directors to do so. One of the headteachers summarized the mentality of Directors in relation to this matter as follows:

> *"…In one of the strategic planning meetings, I was forced to swallow any ideas that I had written on my considerations list for sharing with the school Directors. When I raised the issue of refresher training of the teachers in AOB of the meeting, one of the Directors said….just assume that we are in Lake Victoria which is shared by three countries that make up East Africa, if one chose to pour fish feeds in the middle of lake, how sure would they be that they would ever catch such fish for a meal? You are well aware that these teachers are not our property, so in my opinion, we would burn our money 'fattening fish' for either other fishermen, or even for predators like crocodiles….so simplistically, I don't buy*

> *the idea of wasting our money on teachers' capacity building …"* (Hedimasita G, 4 June 2021).

Observably, the above finding showed that the teachers in private secondary schools had not benefitted from capacity building and might not do so in the near future unless that wrong mentality of the school Directors had changed altogether.

At Departmental level, majority of the teachers (65.9%) strongly disagreed that the in-house trainings were organized to boost their teaching efficiency. The in-house trainings, if organized and implemented would provide fertile grounds for the teachers to learn new ways of improving the teaching and learning process. Thus, the failure to organize such had to have seemingly led to knowledge obsolescence, hence leading to ineffective teaching. Further evidence of limited opportunities for professional development was reflected in the inability of the school leadership to organize vestibule-training opportunities for the teachers. Majority (62.9%) strongly disagreed that school leadership organized vestibule training opportunities and yet these would have improved Physics teaching. That weakness was common in both private and government aided schools. The HoDs' revealed that in their districts, there were best-in class or the so-called Ivy-league schools such as *Kalaba* Seminary (not real name), *Ntorerehe School* (not real name), *Nyamiranga Girls School* (not real name) and *Stomata High School* (not real name). The participants revealed that the school leadership had failed to seize opportunities of improving academic performance in their schools by failing to copy and replicate the best practices implemented when teaching and learning in those schools by way of organizing vestibule-training opportunities for the teachers. In a related scenario, the DEOs revealed that if such opportunities were provided to teachers by the school

administration, it would result in qualitative and quantitative improvements in the quality of teaching and learning. Offisa E credited the likely benefits that would accrue from vestibule training as follows:

> "…*I highly believe that if school administrators in most of the schools that trail others in UNEB examinations settled for vestibule trainings, the status of academic performance would improve greatly…. the best practices that teachers and school administrators from best performing schools implement to boost teaching and learning would benefit the teachers from the low-cadre schools whose performance has failed to improve over the last one decade or more. This attribute is administrative related and therefore, unless school administrators show commitment to this cause, the divide between best performing schools and poor performing schools will continue to grow fonder*…."(Offisa E, 23 June 2021).

Table 4. 16

Summary Descriptive statistics on respondents' opinion on Professional Development

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std**
1.	There are several opportunities for professional development	131(67.5)	49(25.3)	9(4.6)	3(1.5)	2(1.0)	2.14	1.45
2.	I get training in work related activities	140(72.2)	52(26.8)	0(0.0)	0(0.0)	2(1.0)	2.11	1.53
3.	I regularly participate in workshops	104(53.6)	87(44.8)	1(0.5)	0(0.0)	2(1.0)	2.31	1.61
4.	My department usually organizes in-house trainings	128(65.9)	26(13.4)	4(2.1)	23(11.9)	13(6.7)	2.37	1.54
5.	I have attended several vestibule trainings	122(62.9)	49(25.3)	0(0.0)	14(7.2)	9(4.6)	2.20	1.60

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data 2022

4.5.4 Empirical findings on Teacher Effectiveness

Teacher effectiveness was measured under the dimensions of:- effective communication, subject matter expertise, professional competence, teaching style and classroom management style. The statements measuring these dimensions were based on the Likert's scale ranging from 1 to 5, where 1 represented strongly disagree, 2 for disagree, 3 for not sure, 4 for agree; and 5 representing strongly agree and the results were interpreted using mean values. The quantitative findings were corroborated by the qualitative findings from interviews, observation and FGDs.

4.5.5 Effective communication among Physics teachers in Kigezi sub-region

Five items measured the effectiveness of communication among Physics teachers (Table 4.18). Here, Majority of the Physics teachers (68.5%) disagreed that they gave immediate feedback to students in every Physics lesson. The positive feedback or at least neutral feedback was vital for promoting effective learning among the students. Then, corrective feedback helped in defusing misconceptions, misinformation and disinformation among the students leading to improved learning and mastery of content. That importance was not realised by the students in Kigezi sub-region as majority of the teachers revealed through informal conversations that the feedback normally given to the students was to criticise whatever they said or did wrongly. That finding correlated with the interview responses from the head teachers that some teachers lacked knowledge of providing constructive feedback to students, which would help in correcting any possible misconceptions among the students. Rather, the majority used appalling statements as manifested on the end-of-term reports where some teachers used comments such as "pull-up your socks", "get serious

with your studies", "better wake-up when it's not yet late", and so forth. Such comments were a true reflection of how teachers verily used sarcastic words in providing feedback to the students during the lessons. That exemplar, according to the head teachers, showed that many students performed poorly due to lack of knowledge about how to attempt questions. Scorning students, according to the DEOs was very embarrassing and actually, stressing to the students to the extent that they felt embarrassed and ended up hating the subject in question and obviously, their teacher. The negative perceptions of students about a subject and its teacher provided antecedents of poor academic achievement.

Majority of the teachers (53.6%) were not sure whether they had adequate language to enable them to teach Physics fluently and more teachers (66.5%) expressing split opinion on whether their non-verbal cues as used from time to time in Physics teaching, were clear to the students. Furthermore, majority of the teachers (55.2%) disagreed that Physics teaching did not require detailed explanations for elaborating the content being taught from time to time. That was indicative of problems surrounding the capability of teachers to teach effectively because fluency kept the students focused on what was being taught especially when it was presented in a story form, the non-verbal cues as points of emphasis that helped the students to notice areas of emphasis such as by facial expressions, gestures, postures, touch and eye contact. The findings further painted a bad image about how teachers failed in detailing the taught content therefore, some content was missed especially when it was abstract. For example, in Physics, there was Absolute zero and zero but unless the teacher provided sufficient explanation between the two, the students could barely notice the difference.

Majority of the teachers (56.1%) strongly disagreed that they answered all the questions emerging during and at the end of a lesson. That mentality hampered the teaching effectiveness largely because the students shot questions for clarification and so, the teachers who failed to attend to all questions of the students were ineffective teachers. Equally, the rationale of providing answers to the questions emerging in a lesson was to provide more information that would enrich further understanding to the learners therefore, a teacher who shied away from such is ineffective. That finding surfaced in the interviews with head teachers from both school types. The majority revealed that the information collected from the students in informal conversations indicated that most STEM teachers were not committed to answering the students' questions all the time and castigated that mentality as a 'killer' of curiosity among the students. In connection to the above, the DEOs mentioned that whenever a teacher chose to dodge the questions of students especially during and after the lesson, it raised begging questions about how competent the teacher was, leading to the development of negative attitudes about the subject in question. Consequently, the students performed poorly in both internal and external examinations (District Mock Examinations and UNEB).

Table 4. 17

Summary Descriptive statistics on respondents' opinions on Effective communication

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std**
1.	I give immediate feedback in every lesson taught	133(68.5)	50(25.8)	0(0.0)	8(4.1)	3(1.5)	2.23	1.70
2.	I have language fluency while teaching physics	6(3.1)	58(29.9)	104(53.6)	20(10.3)	6(3.1)	2.61	1.23
3.	My non-verbal clues are clear students	30(15.5)	6(3.1)	122(66.5)	30(15.5)	6(3.1)	2.74	1.23
4.	Physics concepts does not need a lot of explanation	16(8.2)	107(55.2)	4(2.1)	3(1.5)	64(33.0)	2.45	1.30
5.	I answer all the questions of my students	109(56.1)	48(24.7)	0(0.0)	26(13.4)	11(5.7)	2.33	1.17

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data 2022

4.5.6 Subject matter expertise of Physics teachers in Kigezi sub-region

The subject matter expertise was assessed using 4 statements (Table 4.19) and the findings were qualified by interviews with key informants (head teachers and DEOs) and FGDs with HoDs. Majority of the teachers (55.7%) disagreed that they rarely followed schemes of work and lesson plans. The lesson plans specified the methods of teaching for a particular lesson and equally relayed information on how the taught lessons were to be evaluated with regard to the achievement of the learning objectives. The evaluation criteria could specify the topical tests, lesson quiz or fill-in blank spaces marked by the teacher as the lesson progressed. That said, the above finding implied that the Physics teachers who never stuck to the demands of the lesson plans were not effective and so, they lacked the nous of the subject matter experts. In relation, majority of the teachers (75.2%) strongly disagreed that they possessed subject matter knowledge in all components of the Physics syllabus. While that was understandable, efforts should be taken by the teachers to ensure that at least every component of the syllabus was taught so that the learners were prepared for the UNEB examinations.

The HoDs in FGDs revealed that the teachers decided to skip some of the content areas they disliked such as Modern Physics about half-life and the radioactive isotopes. Thus, when the same content was set in Physics Paper Two, the students were bound to fail it. That finding was substantiated by the UNEB Reports on the Students' Work Report, which showed that for successive years, majority of the students had continued to fail some questions totally, because the teachers had provided little or no knowledge about the same. For instance, the UNEB Report on the Students' work for UNEB 2020 examinations

showed that most students understood ‘force’ and reasoned it out in the parlance of military and security than Physics. Such was indicative of the failure of the teachers to provide vivid examples whenever they were teaching some of the content that shared similar wording with other disciplines.

Furthermore, the results showed that the teachers never rated themselves highly (63.4%) regarding the subject matter expertise and that could be associated with the overloading of the teachers by the school leadership with lessons from other disciplines other than Physics. Indeed, majority of the teachers (82.4%) strongly disagreed that they taught Physics only and they minored or majored in Physics alongside Mathematics or Chemistry. Therefore, in the schools with shortage of teachers for any of the two subjects warranted the school administration to allocate the teachers lessons from the two subjects. That had an impact of the subject matter expertise among the Physics teachers by dividing the concentration in two areas and also according to the HoDs, that limited the development of the subject matter expertise. A similar issue was raised by the head teachers who said that the Physics teachers were allocated lessons in their other teaching subject to cut costs of employing a teacher per discipline. However, they recognized losses that accrued concerning the subject matter expertise as summarised by *Hedimasita* K:

> *“…It is so unfortunate that most schools do it that way that Physics teachers should at least be allocated a few lessons from their other teaching subject…in some schools where the teachers are allocated equal lessons in both subjects, the zeal of teachers in becoming subject matter experts is lost…, this is because their mind is divided amongst the two subjects and consequently, they end up becoming jack-of-all-trades but master of none…”* (Hedimasita K, 10 June 2022).

Table 4. 18

Summary Descriptive statistics

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std**
1.	I always follow the prepared lesson	84(43.2)	108(55.7)	0(0.0)	2(1.0)	0(0.0)	2.61	1.63
2.	I know the content of all parts of the Physics syllabus	146(75.2)	32(16.5)	4(2.1)	7(3.6)	5(2.6)	2.14	1.71
3.	I feel I am an expert in my subject	123(63.4)	43(22.1)	8(4.1)	10(5.2)	10(5.2)	2.22	1.54
4.	I teach Physics only	160(82.4)	16(8.2)	0(0.0)	12(6.2)	6(3.1)	2.19	1.62

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data 2022

4.5.7 Professional competences of Physics teachers in Kigezi sub-region

The professional competences of Physics teachers were measured using 5 statements (Table 4.20) whereby the findings on each statement were supported by interview and FGD responses. Majority of the teachers (67.5%) expressed that they were not wholly dedicated to teaching. Through informal conversations, most of the teachers harboured intentions of quitting teaching and craved for employment in non-teaching jobs such as NGO work and in other businesses or enterprises where the conditions of service were friendly and enabling. The lack of contentment with the teaching work compromised the ethical conduct and as reflected by the majority of the teachers (72.2%), the teaching ethics were rarely or even never adhered to, consequently leading to inefficiency and ineffectiveness. That loss of passion in teaching as further indicated by the majority of the teachers (53.6%) clearly showed that the majority of the teachers were chasing opportunities for crossing to other fields and or even starting self-employment ventures so that they could uplift their social status. In relation to the above, the interview responses from the head teachers indicated that the teachers had less interest in carrying on with the teaching profession. Therefore, the head teachers convincingly asserted that teachers with such a mentality could not teach effectively as summarised by Hedimasita B;

> *"…the lowest lows of the teaching profession were clearly shown during the 2020 and 2021 lockdowns that froze opportunities for teachers and mostly of private secondary schools. Their earning potential was seriously eroded by COVID-19 and unlike teachers from government-aided schools who were paid regularly by the government, private school teachers lost it all….the domino effect of this state of restlessness*

> *and hopelessness has continued to manifest in the present time…most teachers in private schools are so desperate that they have lost all the iota of trust in their profession….those who are still plying trade there are just there for formality and chasing better deals because COVID-19 became a reality check and made them learn that they are also survivors and not stable income earners who are able to smooth their consumption and expenditure patterns…. I am not surprised that the very teachers are disgusted with teaching…"* (Hedimasita M, 4 October 2022).

The results in table 4.20 further showed that majority of the teachers (59.8%) declined that they marked the students' work with integrity. In the FGDs with HoDs from both private-owned and government-aided schools, the participants revealed that some teachers were not following the ethics of evaluating the learners' mastery of content and only marked the exercises given to the students in order to fulfil the norms of the school, which specified that the work of students was evaluated from time to time. That provided signals that Physics teaching was not effective and in addition, majority of the teachers (60.3%) disagreed that they role-modelled for students so that they could shape their attitudes towards Physics in their successive academic ventures. It should be remembered that role -modelling was one of the competences that a teacher should exhibit all the time since the students mimicked the role modelling to decide the careers to pursue. A role-model teacher inspired and encouraged their students to strive for greatness so, the teachers who failed to do so were ineffective. That was one of the main points of concern raised during interviews with head teachers and FGDs with HoDs where the head teachers stated that role -modelling was an indicator of great interest that the teacher had in the profession and in the routine work that they did. Failure to do so was a clear manifestation of ineffective teaching and this submission never differed from

the views of HoDs who revealed that most teachers especially in private secondary schools and some government-aided schools were just there for formality. With the fading interest in teaching, they showed no interest in mentoring the students to focus on careers in the STEM fields and merely taught to pass time. That according to the HoDs, partly explained why there was a persistent poor academic performance in Physics year in and year out.

Table 4. 19

Descriptive statistics for professional competencies of Physics teachers

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std.**
1.	I am dedicated to my work	131(67.5)	49(25.3)	9(4.6)	3(1.5)	2(1.0)	2.14	1.623
2.	I am handling my job according to the work ethics	140(72.2)	52(26.8)	0(0.0)	0(0.0)	2(1.0)	2.26	1.554
3.	I am passionate about the work in my profession	104(53.6)	87(44.8)	1(0.5)	0(0.0)	2(1.0)	2.49	1.620
4.	I exhibit integrity when marking students	116(59.8)	69(35.6)	4(2.1)	2(1.0)	3(1.5)	2.27	1.701
5.	I show a positive role model to students	117(60.3)	74(38.1)	1(0.5)	1(0.5)	1(0.5)	2.35	1.581

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data 2022

4.5.8 Classroom management styles applied by Physics Teachers in Kigezi sub-region

The aspect of classroom management styles as an indicator of teacher effectiveness was assessed using 4 statements (Table 4.21). And, more assessments about the viability of the classroom management styles applied by the teachers were made through interviews and FGDs. In that case, majority of the teachers (51.5%) strongly disagreed that they kept the students focused to task behaviours in every lesson which manifested ineffective teaching largely because by ensuring that the students remained focused on the tasks in a lesson, there is effective learning as students are engaged throughout the lesson with no possibility of losing focus. On the other hand, failure by the teachers to keep the students focused on task behaviours was equally reflected in the views of majority of the teachers (56.2%) who disagreed that they always maintained discipline in class. The disruptive students' behaviour could not keep the students focused on learning and in most cases, they poached on the available learning time thereby leading to lost time. The results from FGDs with HoDs revealed that government-aided secondary schools as well as the private-owned secondary schools that were implementing USE under the Public-Private Partnership (PPP) arrangement had more undisciplined students. Thus, the teachers from such schools who lacked the benevolence of handling indiscipline could not teach effectively.

Another manifestation of failure to apply best classroom management styles was indicated by majority of the teachers who strongly disagreed regarding the rewarding of students for good conduct (56.7%). If the teachers

were to use rewards, they would enforce discipline and even encourage the students to become achievement oriented. The physics teachers who failed to use rewards were ineffective as they failed to establish a spirit of healthy competition among the learners. The students were naturally motivated when they were working for rewards and recognition. The same message was raised by the HoDs in the two FGDs who said that the teachers who had tried and tested that approach could testify that it made them better teachers.

The results in table 4.22 further showed that majority of the teachers (55.7%) strongly disagreed that they ensured harmony among the students. That was an indicator of ineffective teachers because by failing to set a right tone for the classroom, a teacher could hardly ensure a harmonious classroom environment and whenever there were unhealthy relationships between students, the teaching effectiveness was crippled. For instance, the classrooms with backstabbing and bickering students could not be taught using teaching strategies such as group learning because of infighting among the students. That affected the coverage of the content planned by the teacher and led to wastage of time while quelling down the conflicts. The same views were raised by the head teachers who noted that whenever there is disharmony in a classroom, the teacher could not form successful groups, they could not share some of the limited learning materials to ensure that every group benefited and they could not foster meaningful discussions because the students were not friendly to each other. In the same vain, the HoDs from private schools and government-aided schools under USE revealed that the teachers found it hard to gel the students together because of the big class numbers. That failure to gel the students

together complicated the use of some teaching strategies such as groups work, debates and role-play.

Table 4. 20: Descriptive statistics for classroom management styles applied by Physics teachers

		Frequency (Percentage)						
		SD	**D**	**NS**	**A**	**SA**	**Mean**	**Std**
1.	I ensure that students are focused on task behaviours	100(51.5)	43(22.2)	0(0.0)	8(4.1)	43(22.2)	2.45	1.80
2.	I always maintain discipline in my class	33(17)	109(56.2)	0(0.0)	13(6.7)	39(20.1)	2.54	0.96
3.	I reward students for good conduct	110(56.7)	60(30.9)	0(0.0)	24(12.4)	0(0.0)	2.39	1.12
4.	I always ensure that there is harmony amongst students	108(55.7)	48(24.7)	0(0.0)	25(12.9)	13(6.7)	2.49	1.05

N=194: SD=Strongly Disagreed, D=Disagreed, NS=Not Sure, A=Agreed SA=Strongly Agreed, Std=Standard Deviation

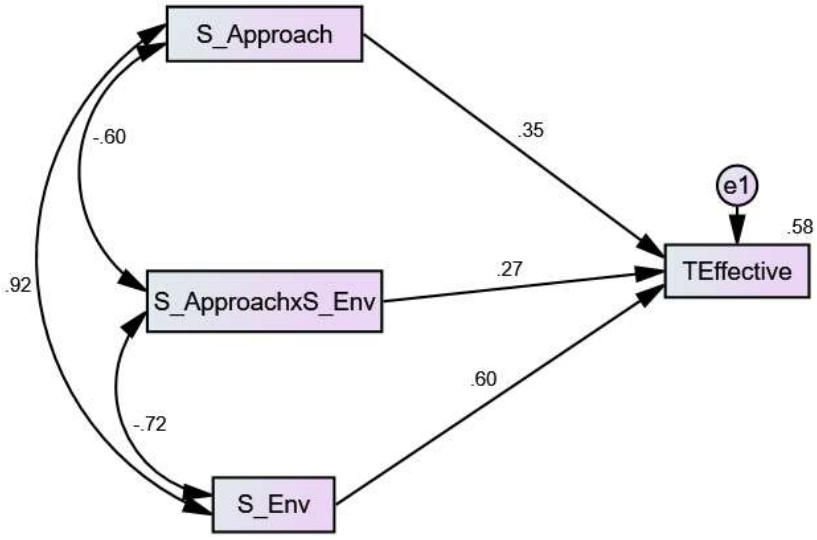
Key for interpreting mean values:1.00-2.49= Disagreed; 2.5-3.49= Not sure; 3.5-5.00=Agreed

Source: Field Data 2022

4.6 Causal relationships between the SESEMAT Pedagogical Approaches, the School Environment and the Teacher Effectiveness

The study investigated the causal relationship between the antecedents of (SESEMAT pedagogical approaches, the school environment) and the teacher effectiveness. To test the three hypotheses that informed the study (H_{01}- H_{03}), structural equation modelling was applied as discussed below:

4.6.1 The Structural Equation Model for Antecedents of Physics teachers' effectiveness



Source: SPSS AMOS 2022

Figure 4. 3: SEM results for antecedents of Physics teachers' effectiveness

To test the three hypotheses, the path coefficients of SEM were examined. As seen in figure 4.4 and table 4.23 the regression weights for the causal paths were found to be statistically significant and relevant. As reflected in Figure 4.4, there was a positive and statistically significant influence of SESEMAT pedagogical approaches on teacher effectiveness (TEffective ←····· S_SESEMAT) β=

0.348, p < 0.001; school environment on teacher effectiveness (TEffective ←·····S_ENV) β= 0.596, p < 0.001 and in the moderation of SESEMAT pedagogical approaches on physics teacher effectiveness by the school environment (TEffective ←····· S_Approach x S_ Env) β= 0.275, p < 0.001. Therefore, all the three null hypotheses (H_{01}- H_{03}) were rejected while the alternative hypotheses were accepted. Figure 4.4 further revealed that 58% of the Physics teachers' effectiveness could be estimated by exogenous constructs of the SESEMAT pedagogical approaches (active learning, contextual learning and collaborative learning), and the moderating effect of the school environment. That finding implied that a teacher's understanding and right application of pedagogy translated into effective teaching.

Table 4. 21: Regression weights (Group number 1 – Default model)

Structural paths	Estimate	S. E	C.R	P	Result
TEffective ←·····S_SESEMAT	.348	.122	2.852	0.000	Significant
TEffective ←···S_Approach × S_Env	.058	.015	4.016	0.000	Significant
TEffective ←·····S_ENV	.596	.140	4.249	0.000	Significant

***(p< 0.001)

4.6.2 The SESEMAT Pedagogical Approaches and the Physics Teachers' Effectiveness

The causal relationship between the SESEMAT pedagogical approaches and the physics teachers' effectiveness (TEffective ←····· S_Approach) was positive and significant with $\beta = 0.35$, p<0.001). Therefore, when the teachers applied the pedagogical approaches rightly, the teaching became effective. For instance, the approaches allowed the learners to participate freely, to be

responsible of their learning process, to apply new skills to real life and to work together as a group. Therefore, it was evidentially clear that the SESEMAT pedagogical approaches had a significant influence on the Physics teachers' effectiveness.

4.6.3 School Environment and Physics Teacher Effectiveness

The causal paths between the school environment and the teacher effectiveness (TEffective ←····· S_Env.) flagged β = .596, p< 0.001 indicated that the school environment had a positive significant influence on the Physics teachers' effectiveness. Thus, in schools with favourable administrative support, good collegiality and several opportunities for teacher professional development, the teacher effectiveness was higher than in their counterparts where such factors were regressive. In schools with favourable school environmental factors, the teacher encouragement was high through support supervision, the teachers received instructional materials on time, the trainings emphasised in form of workshops, conferences and team teaching, as well as the teachers planing lessons together. Therefore, it was right to assert that a favourable school environment had a positive significant influence on the Physics teachers' effectiveness.

4.6.4 The Moderating impact of school Environment on the relationship between the Pedagogical Approaches and the Physics Teachers' Effectiveness

Referring to Figure 4.4 and Table 4.23, the school environment had a positive significant moderating influence on the relationship between the pedagogical approaches and the Physics teachers' effectiveness (TEffective ←····· S_Approach x S_Env) had β = 0.27, p < 0.001). That result implied that the

school environment greatly influenced how the Physics teachers applied the SESEMAT pedagogical approaches for the teaching effectiveness. Thus, the alternative hypothesis which stated that the school environment had positive significant influence on the interplay between the pedagogical approaches and the Physics teachers' effectiveness was retained by this study as a binding answer. The above results were summarised in Table 4.24.

Table 4. 22: Summary of results as per hypotheses

Hypothesis statement	Decision
H_{01} There is no statistically significant effect of pedagogical approaches on Physics teachers' effectiveness	Not supported
H_{02} There is no statistically significant effect of school environment on Physics teachers' effectiveness	Not supported
H_{03} School environment does not have a significant moderate effect on the relationship between pedagogical approaches and Physics teachers' effectiveness.	Not supported

Source: Field data, 2021

4.7 Chapter summary

The descriptive, SEM and qualitative findings presented in the chapter had shown that largely, the pedagogical approaches had potential for improving the teaching effectiveness. On an equal footing, the school environment influenced the teaching effectiveness thus, schools that had favourable conditions in terms of administrative support, collegiality and professional development for teachers determined the propensity with which the teachers would apply the pedagogical approaches for effective teaching. Those results especially the quantitative ones which were analysed from the responses of the Physics teachers as the main respondents passed both the normality, multicollinearity

and linearity tests and were declared fit for analysis and respective interpretation. Ideally, the study's findings were discussed in the next chapter.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Introduction

The chapter was devoted to discussion of the study's findings and the discussion was handled thematically in tandem with the themes under which the findings were presented. The discussion was cross-referenced with the study's literature and strengthened with underpinning theories.

5.1 The Relationship between the Pedagogical Approach antecedents and the Physics Teachers' Effectiveness

The results from the descriptive and the qualitative analyses showed that the Physics teachers were yet to apply the SESEMAT pedagogical approaches in the best manner. That was an unexpected result, given the long period that the teachers had been exposed to the SESEMAT programme. Physics teaching was thus less effective as majority of the teachers were yet to uphold the guidelines that were contained in the pedagogical approaches. The inferential findings from SEM showed that the pedagogical approach antecedents had a predictive potential on the Physics teachers' effectiveness ($\beta = 0.348$, $p < 0.001$). So, that result implied that a unit improvement in the application of the guidelines contained in the pedagogical approaches predicted similar improvement in the Physics teachers' effectiveness by 35 times. Thus, any changes in how the Physics teachers applied the pedagogical approaches would improve the teaching by a greater magnitude. For example, if teachers used active learning approaches such as think-pair-share, debates and role play, they created a favourable ground in which the students were able to develop multiple learning

skills such as critical thinking, high level cognition and development of the decision-making abilities. By doing so, the students would gain more than just knowledge and become wholly immersed in their learning. Consequent to that, the rate at which the students acquired and retained new knowledge would increase, their brains would become receptive to new information, their memories would improve, they would become motivated to learn and would rarely fail to reproduce the learned information; leading to better academic achievement. That finding was in congruence with the Social Constructivism Theory which noted that learners constructed knowledge.

In the construction of new knowledge and information, learners should be involved in thinking, accepting wisdom and making judgement. According to Vygotsky, teachers were supposed to scaffold learning so that learners could construct meaning but when teachers failed to do so, teaching became ineffective. Similarly, Pelley (2014) observed that active learning strategies promoted knowledge construction, acquisition of declarative and procedural knowledge; and integration of knowledge. Moreover, the University of California (2024) reported that the students taught using active learning strategies registered improved academic performance whereas high learner achievement manifested effective teaching. In addition, the use of active learning approaches translated into better learner performance as it involved routine assessment of mastery of content and the elimination of any possible digressions and misinformation (Miller & Metz, 2014).

The application of the specifications of virtues of contextual learning by teachers was an important driver of teacher effectiveness. As indicated, such was yet to become a universal characteristic of the Physics teachers in Kigezi-

sub-region. On the same note, contextualised learning promoted effective teaching in a way that it allowed the learners to introspect and to relate the classroom content to what they saw, touched and used in their everyday life. For the teachers, it provided thorough opportunities of relating the content taught in class to what the students already knew and/or had known for some time. When lessons were framed in that simplest way and were related to everyday life, the students acquired relevant and reproducible knowledge. This assertion rhymed with Utami et al. (2023) who acknowledged that teaching while utilizing the contextual learning approaches enabled the students to REACT; that is to say, they Relate what is learnt with what is known, they gain Experience by translating abstract information into their scope of understanding, they Apply the information in the daily happenings, they Cooperate with fellow students to refine the information for better understanding and eventually, they Transfer that refined information to the long-term memory.

Vygotsky contended that knowledge was experience-based and by that, he meant that learners underwent numerous experiences in life and therefore, they should be assisted to connect the theoretical knowledge learned in the classroom with what took place in their environment. More light was shed by Pedroso et al. (2023) who noted that the teaching strategies such as work-integrated learning connected or integrated the classroom learning (theoretical or academic content) with the surrounding environment or workplace contexts leading to holistic learning. However, Lotulung et al. (2018) advised that a teacher would succeed with contextual learning strategies when he/she considered the learners diversity. That was important for instilling harmony among the learner and paved way for empowering them to learn on their own

as well as to learn through collaboration with their fellow students. Besides, Lotulung et al. (2018) recommended that teachers using this approach should endeavour to develop an authentic scoring system to enable them to ascertain that contextualized and integrated learning had taken place.

It is an age-old adage that unity is strength and combined efforts break the bone. That adage underscored how beneficial, collaborative learning strategies that were prescribed by SESEMAT were, to the teaching and learning of Physics. The descriptive results and observations made revealed that the teacher minimally applied the collaborative teaching strategies. When correctly applied, the teachers would expose the students to group learning from where they would appreciate diverse perspective, develop oral communication skills, boost the confidence of learners, and improve the problem-solving skills and abilities of learners; consequently, classroom learning results would be achieved. Vygotsky noted that learning was a social activity and therefore, learners were able to learn multiple things and develop viewpoints when they became social. That enabled them to be aware of the diverse areas in the environments hitherto unknown which implied that when teachers applied collaborative learning strategies, teaching and learning became effective.

The findings of this study were in consonance with Salma (2020) who espoused that collaborative learning was built on the principle of cooperation and that enhanced the attainment of mutual benefits by the group members. On the same note, Salma (2020) argued that when students were placed in heterogeneous groups, the diverse experiences increased the learning experiences leading to better achievements; moreover, the positive interdependence led to group and individual learner excellence. That was

occurring, because of individual accountability, simultaneous interactions and responsibility taking (Salma, 2020). The findings were equally amplified by the University at Buffalo (2024) which noted that collaborative learning enabled learners to assimilate and accommodate knowledge; assimilation, denoting taking in new information by a learner and fitting it into the existing schema; and accommodation, entailing using the newly acquired information to revise and redevelop an existing schema.

5.2 The Relationship between the School Environment antecedent and the Physics Teachers' Effectiveness

The influence of the school environment was assessed under the prism of administrative support, collegiality and professional development. The descriptive results and findings from the qualitative analyses revealed that each of the three dimensions was not largely favourable in all the sampled schools. The conditions were suboptimal in the private rural secondary schools and the government-aided secondary schools especially those implementing USE programme. It was surmised that schools with a favourable school environment supported the effective Physics teaching compared to where it was moderately favourable and unfavourable respectively. Similarly, the SEM results showed a positive statistically significant influence (β = .596, p< 0.001) implying that a unit change in administrative support, collegiality and professional development predicted a similar improvement in the teaching effectiveness by approximately, 57 times. That outcome signified how critical, the school environment was to the teaching and learning of Physics in particular and possibly other disciplines in general.

The administrative support, for example, determined the psychological well-being of the teachers and also determined their degree of satisfaction and level of commitment to the teaching and learning activities. In schools where teachers were shown empathy and recognised for the work done, among others, the zeal for teaching was higher than where such were absent. Those characteristics determined the extent to which a teacher would feel a sense of belongingness and when they developed a high degree of trust in the school leadership, stakes were high that their organizational citizenship behaviour (OCB) would improve greatly; as a result, they would become effective teachers.

Similar arguments were traceable in the works of Watson (2021) who argued that school heads were supposed to render maximum support to the teachers on emotional grounds, to meet the teachers' environmental needs; and to provide instructional and technical support. In the absence of such support, for example emotional, the teachers could suffer from work stressors and eventually, they would burn out (Watson, 2021). Relatedly, Tran et al. (2023), Crosby (2015) and Martinez and McAbee (2020) noted that when there was lack of teacher recognition, the teachers felt worthless and lost interest in the job. Comparably, the teachers who were happy with their job, developed organizational citizenship behaviours such as trusting relationships and a desire to work hand in hand with their colleagues and the school leadership for goal attainment. The findings also resonated the assumption of the Social Ecological Systems Theory that interrelationships between the facets of the environment helped an individual to thrive sustainably by coping and adjusting to changes that happened from time to time.

Furthermore, good collegiality was a mother of worth feelings among teachers. The situation in Kigezi sub-region was found wanting as the descriptive results showed absence of the 'feel good factor' among the Physics teachers since there was individualism and lack of collective action among the teachers. Generally, when teachers planned together, they shared insights, created cohesive plans and worked together effectively. That improved the teaching as the best practices that were shared strengthened the teaching and, as well, enabled the teachers to look at the students' work together, plan the curriculum and lessons together but the reverse was true when there was absence of good collegiality. This result concurred with the observations of Teasly (2017) that the schools characterized by healthy behaviours and collaborative decision-making, displayed high professional standards and consistently holding teachers to high standards were craved for because they had ideal conditions that enabled them to thrive and the teachers from such schools reported high levels of job satisfaction.

More credence to this result was provided by Nordgren et al. (2021) who observed that schools with good collegiality had more effective teachers than their counterparts since the good collegiality instilled pride among the employees. They became confident that even when they faced trouble, they could be rescued. In the same vain, when a teacher felt that, they were supported and more so, in instances when they were struggling and or was congratulated for their accomplishments, the sense of belonging to the school would improve (Peacock & Cowan, 2019; Pesonen et al., 2021; Skaalvik & Skaalvik, 2019). Thus, in Kigezi sub-region where the Physics teachers were working in schools with poor collegiality, their zeal for teaching was hampered. That observation

was mirrored in the Social Ecological Systems Theory by Urie Bronfenbrenner who emphasized the reciprocity between an individual and the environment. In that case, the individual influenced the environment while the environment equally influenced the individual. Therefore, an unconducive environment where teachers were not feeling at ease could be demotivating, consequently leading to ineffective teaching.

Knowledge is not static and grows with time; so, are the skills and competencies. Incidentally, the secondary schools in Kigezi sub-region as shown by the descriptive and qualitative findings were yet to observe these nuances and their relevance to the teaching effectiveness. This study emphasized the credibility of professional development as a pathway to the upgrading of knowledge, skills and competences. The professional development initiatives provided innumerable opportunities for teachers to learn, relearn and unlearn several things and consequently leading to professional growth and development, with teaching effectiveness as the ultimate outcome. The case in point was that, if the school leadership chose to support the vestibule training of the Physics teachers in the Ivy-league schools that had remarkable results in the stellar performance of students in Physics, the teachers would benchmark the best practices, and, on return to their duty stations, they would cross-pollinate the practices across the department thereby leading to fundamental departmental improvements.

Equally, regular refresher training courses were capable of improving the work performance of the Physics teachers as long as it was preceded with a training needs assessment (TNA). The foregoing assertions underscored the professional development and highly showed the inclination of the researcher

in professing that if well handled, professional training had the potential of midwifing greater changes that engendered teacher effectiveness. That argument cohered to the observations of Sims et al. (2023) that professional development programmes unlocked hidden potentials of teachers thereby promoting the teaching effectiveness. Specifically, the programmes enabled the teachers to gain a deeper understanding of how teaching and learning were supposed to be conducted that made them innovative and adept to change.

5.3 The Moderating impact of the School Environment on the relationship between the Pedagogical Approaches and the Physics Teachers' Effectiveness

Effective teaching is a function of the prevailing environmental conditions in the school setting. Indeed, the findings from descriptive and qualitative analyses revealed that the school environment was a marker of how schools where there was effective teaching, were isolated from those where it was lacking. The SEM results also showed that the change in pedagogical approaches ought to be accompanied with similar or related changes in the school environment, lest no notable results could be realised with regard to effective teaching. The results further showed that the interplay between the SESEMAT pedagogical approach antecedents and the Physics teachers' effectiveness could potentially improve by 27 times whenever there was a similar unit improvement in the quality of the school environment (β = 0.27, p < 0.001). That confirmed that the school environment buttressed every teaching and learning improvement programmes such as SESEMAT. Indeed, that was true because a school environment that was managed by a leadership that showed little concern to the students' misbehaviour impeded the application of the SESEMAT pedagogical

approaches such as collaborative learning. No teacher could ever succeed in teaching through groups unless there was a code of order in the classroom. Related to that, while active learning involved role play and use of games, an administration that was not committed to investing money in the procurement of games and the media in which they would play, could not allure active learning. On the contextual learning perspective, school leadership that showed less or no commitment to facilitating field-tours stifled any efforts made by teachers to hold excursion studies.

The school leaders also had the responsibility of availing instructional materials for teachers and in the absence of such material, the SESEMAT pedagogical approaches could not be effective. For instance, in a Physics practical lesson about refractive index where a glass prism had to be used, the teacher could barely improvise because it had no substitute. In addition, when there were a few meter rules, the teacher could not organize individual experiment sites because of the limited equipment. The teachers were at times compelled to teach practical lessons theoretically because there was no equipment to use at that time. That finding was in consonance with Licorish et al. (2018) and Winarto (2020) who observed that responsive school leadership were supposed to create a conducive teaching and learning environment by for example, availing the requisite teaching and learning materials. Those determined the teaching methods used and the extent to which the teaching could become learner-centred.

The school leaders should plan for the teaching and learning process to ensure that the teachers worked in a suitable and favourable environment. For instance, allocating big numbers of students to a less spacious classroom

impeded effective teaching as the teaching strategies such as group work could not be implemented. In a similar tone, Urie Bronfenbrenner noted that when the environment became unfavourable, the individual would develop negative coping strategies. Thus, when the school leadership failed to create an enabling environment for teachers to apply the teaching strategies specified by the SESEMAT pedagogical approaches, the teaching could not become effective. For instance, much as active learning specified the use of quizzes, these were supposed to be marked by the teachers as the lesson was ongoing. So, applying such a strategy could not be possible in the squeezed classrooms where there were no spaces to enable the teacher to move round the class which impeded the use of active and collaborative learning activities.

The finding was also in agreement with Akon-Yamga et al. (2024) and Hang et al. (2024) who noted that in most developing counties, teaching and learning of STEM subjects faced the challenge of inadequate instructional materials especially for the practical sessions. That observation was not strange with regard to Uganda because it comported with Kakuba et al. (2021) and Twinomuhwezi and Herman (2020) who noted that USE had led to the skyrocketing of student numbers, making it difficult to apply learner-centred teaching strategies.

5.4 Chapter Summary

The foregoing discussion provided a back-up evidence that the gaps in the application of the SESEMAT approaches in Physics teaching and its effect on the teacher effectiveness, the school environment and the teacher effectiveness; and the moderating influence of the school environment on the SESEMAT pedagogical approaches and the teacher effectiveness were related to the

existing practitioner experiences and the theoretical predispositions. Thus, what was observed related to what the related studies had established before and why the established gaps needed remedy as soon as possible. In the next chapter, a summary of the said findings was presented which was followed by conclusions that were drawn in respect to the findings as well as the recommendations that were proposed to turnaround the present state of events in Kigezi sub-region and possibly, other parts of Uganda.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

The chapter covered the summary of the major findings, the emerging conclusions and the recommendations made. The implications of the study and pointers for future research were equally included in this chapter.

6.1 Summary of the Findings

The study assessed the antecedents for improving on the Physics teachers' effectiveness in Kigezi sub-region in Southwestern Uganda. The study was informed by the Social Constructivism Theory by Lev Vygotsky and the Social Ecological Systems Theory (SEST) by Urie Bronfenbrenner. It was guided by three specific objectives:- To establish the relationship between SESEMAT pedagogical approach antecedents and Physics teachers' effectiveness in Kigezi sub-region; To find out the relationship between the school environment and Physics teachers' effectiveness in Kigezi sub-region; and, To ascertain if the school environment moderates the influence of the SESEMAT pedagogical approach antecedents and Physics teachers' effectiveness in Kigezi sub-region. Whereby, both quantitative and qualitative data was collected and analysed by the study. Generally, the study objectives were achieved as shown below in a summary of the findings:

6.1.1 The SESEMAT pedagogical approaches and the teacher effectiveness

Results showed that the SESEMAT pedagogical approaches had a positive significant effect on the teacher effectiveness. In addition, the SEM results showed that any improvements in the application of the specifications of the

SESEMAT pedagogical approaches had a potential of improving the teaching effectiveness. When the teachers applied active, contextual and collaborative learning strategies, the student-centred learning was realised which was the philosophy behind the formulation of the SESEMAT programme. The headteachers needed to emphasize the use of the SESEMAT pedagogical approaches by the Physics teachers through regular supervision.

6.1.2 The School environment and the Physics teachers' effectiveness

The results showed gaps in the administrative support, collegiality and the professional development of the Physics teachers across the school type. These dimensions were negated by most private secondary schools and rural-based secondary schools in Kigezi sub-region. The SEM results showed that the nature of the school environment affected the teacher effectiveness greatly. In the same way, the beta value (0.596) meant that a unit improvement in the elements of the school environment predicted 57% improvement in the teaching effectiveness. That finding provided critical information to the headteachers and the Inspectors of Schools about the need to take efforts for making the environment to become conducive for teaching and learning.

6.1.3 The Moderating Impact of the School Environment on the Relationship between the SESEMAT Pedagogical Approaches and the Physics Teachers' Effectiveness

The SESEMAT pedagogical approaches improved the Physics teachers' effectiveness when the guidelines recommended by the pedagogical approaches were followed. However, the potential effects of the SESEMAT pedagogical approaches were felt in the schools with favourable environments. For instance, the supportive school leadership motivated the teachers and inspired them to

higher levels of achievement. Among others, when the school leadership availed instructional materials for use, created a conducive environment for improved psychological well-being of the teachers and worked hand-in-hand with the teachers in enforcing discipline, the teaching effectiveness was realised. While in the schools where there was a debilitating school environment, the teaching became ineffective. And so, the SEM results confirmed that assertion. Thus the beta value (0.27) implied that the influence of the SESEMAT pedagogical approaches on the teacher effectiveness was catalysed by improvements in the dimensions of the school environment by 27 times. That finding buttressed the critical influence that the school environment had on the teaching and learning process and provided insights to the school leadership and the education practitioners that educational the interventions that were aiming at improving the teaching effectiveness had to be implemented in tandem with the school environment improvement strategies if the anticipated objectives were to be realised.

6.2 Conclusions

The study assessed the antecedents for improving the Physics teachers' effectiveness in Uganda. Specifically, the study investigated the relationship between SESEMAT pedagogical approach antecedents and Physics teachers' effectiveness; the relationship between the school environment and the Physics teachers' effectiveness; and, the moderating effect of the school environment on the relationship between the pedagogical approaches and the Physics teachers' effectiveness; whereby Kigezi Sub-region in Southwestern Uganda was the context of the study. Basing on the study findings, the following conclusions were made.

Regarding the objective 1 and hypothesis 1, the SESEMAT pedagogical approach antecedents had a positive and statistically significant impact on the Physics teachers' effectiveness. The study hypothesised that there was a statistically significant influence of the SESEMAT pedagogical approaches on the physics teacher effectiveness. It was thus concluded that the right selection and application of the prescriptions and guidelines that were recommended for each of the pedagogical approaches was important if the teaching effectiveness was to be improved.

Objective 2 and hypothesis 2 were about the impact of the school environment on the teacher effectiveness. This study established that the schools with favourable environmental conditions such as responsive administration, adequate learning materials, respectful administration, good collegiality and opportunities for professional growth and development of teachers sustained and supported the effective teaching and learning. This study thus concluded that the school environment affected the teacher effectiveness when it was favourable and it inhibited when it was debilitating. Indeed, however committed the teachers were to implementing the prescriptions of curriculum development interventions such as SESEMAT, in the absence of a favourable school environment, no significant gains could be realised. For instance, inadequate or lack of equipment for Physics practical impeded the use of active learning strategies such as individual experiments. Basing on that scenario, the study thus concluded that no meaningful improvements could be realised from any teaching improvement intervention unless fundamental efforts were taken to improve the school environment.

Then objective 3 and hypothesis 3 were about the moderating effect of the school environment on the relationship between the pedagogical approaches and the Physics teachers' effectiveness. The study established that schools with a comparatively a fair environment performed better than those where the environment was poor. Basing on that observation, the study thus concluded that efforts to implement the curriculum interventions should factor in the dimensions of the school environment since the former could not translate into the desired results in the absence of a better and improved school environment.

6.3 The Study's Contribution to Knowledge

No study had ever related the SESEMAT pedagogical approach antecedents to the teaching effectiveness in Uganda. Therefore, the study's findings contributed vital information to the existing knowledge base on the curriculum interventions in Uganda. Thus, the study produced documented evidence of the impact of the curriculum interventions in Uganda as antecedents of the teacher effectiveness. Another credible contribution of the study to the academia was a holistic approach to understanding the influence of the curriculum innovations and /or interventions through the prism of the mixed methods approach. The existing studies on SESEMAT and other curriculum interventions and their influence on school outcomes had largely taken the quantitative approach, hence reporting findings that lacked rigour. This study thus added flavour to the knowledge base on the curriculum development studies by reporting results from both the qualitative and quantitative world of research.

The findings of the study were therefore beneficial to the future researchers and scholars in curriculum, educational policy, planning and management among others about the efficacy of adopting the mixed methods

approach in their studies for purposes of reporting holistic findings. To policy, the study contributed a multidimensional impact of the curriculum interventions and the school environment on the school performance. The policy makers could use the study findings to devise short-term and long-range strategies for an effective curriculum implementation and improvement of the school environment. To the students in secondary schools, the study explored and exposed the inequities in the implementation of interventions for improving the STEM education in Uganda. The reported deficits were likely to attract that immediate attention of policy planners from Ministry of Education and Sports, HEIs as well as the National Curriculum Development Centre leading to improvements in teacher education and consequently, improvements in teaching and learning of Physics and other STEM subjects. To the theory, the study had proven that the curriculum interventions could barely deliver anticipated outcomes in isolation of the school environment. That theoretical observation thus, provided insightful information about the influence of the school environment as a bedrock of any efforts geared towards school improvement.

6.4 Recommendations

Following the conclusions, the study recommended to different stakeholders, a number of strategies that should be undertaken for improving the teaching and learning of Physics.

The study established that if the teachers of physics in Kigezi sub region were able to use the pedagogical approaches (active learning, contextual learning, motivation of students and collaborative learning), then they would be more effective and performance of learners would improve. The physics

teachers should therefore employ the SESEMAT pedagogical approaches (active learning, contextual learning and collaborative learning) when conducting physics lessons.

Secondly, the government policies should try to intensify support supervision, regular workshops for in-service training in the pedagogical approaches by involving all the relevant bodies in the schools to set goals for improving the performance of learners, to become a resource, to hold the staff accountable, and to train in assessment criteria. The training programmes should not only be on in-service teachers but should also be emphasised to pre-service teachers as well, so that as they left colleges/universities, they were aware of the best practices to apply in physics lessons.

Furthermore, there was need for improving the communication and information sharing channels between the school leadership and the teachers. For thoroughness, this study recommended a need for creation of both formal and informal channels through the headteachers and the teachers to exchange information on a regular basis as that was linked to teacher well-being, organization citizenship and commitment to work.

In addition, the school leadership should make efforts to create opportunities for continuous training of the teachers. That was necessary because knowledge could become obsolete when no meaningful refresher trainings, workshops and seminars among others, were organized for the teachers. That need was even imperative in the present time especially with the adoption of the computer mediated teaching and learning. The training opportunities would also empower the novices on ICT use with substantial skills of using it while the luddite would acquire opportunities for transforming their

teaching gear from chalkboard to e-learning, given the pace at which Artificial Intelligence was influencing the education sector.

Further still, there was need for the school leadership to champion the cause of staff development schemes where they were non-existent and boosting of those already running. Those schemes could provide ground for the teachers to commiserate, share and adopt common beliefs which would strengthen the bonding between the teachers, and consequently, good collegiality.

Then, the headteachers should provide both instructional support and supervision to the teachers in order to enforce the observance of the prescriptions of the SESEMAT programme in every lesson taught in Physics and other science fields. Where anomalies were detected, corrective feedback should be provided.

To the Directorate of Education Standards in the Ministry of Education and Sports, they should work hand-in-hand with the District Education Offices in Kigezi sub-region and other parts of Uganda to set minimum standards which had to be maintained by the schools, especially the private-owned where there was laxity among the proprietors who were after meeting the licencing and the UNEB centre requirements; and, lacked the zeal of improving the teaching facilities in particular and the school plant in general.

6.5 Recommendations for Further Research

This study explored on the SESEMAT pedagogical practices, the school environment and the teacher effectiveness in the physics subject. However, while several gaps had been identified in the implementation of the SESEMAT pedagogical approaches, the school environment and the Physics teachers' effectiveness, no actionable solution had been provided by this study. The

researcher therefore recommended that future studies should benchmark this study and formulate related research questions. Those studies should focus on designing a framework or model that could minimise the identified gaps. The designed framework or model should be evaluated in a naturalistic setting involving the real users and all the affected stakeholders and for thoroughness, the evaluation should be analytical. In addition, cognitive walkthroughs should be used and suggestions should be sought from the real users on how the designed framework could be improved. In summary, the researcher recommended that future studies should adopt the Design Science Research Methodology (DSRM) because it addressed the above needs immensely.

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APPENDICES

Appendix 1: Self-administered Questionnaire for Teachers

My name is Tukamuhabwa Evaristo, a PhD student at Kyambogo University. I am conducting a study titled "*SESEMAT Pedagogical Approaches, School Environment and Physics Teacher Effectiveness in Kigezi Sub-Region, Uganda."* You have been selected to participate. This questionnaire is not an examination. There are no wrong or correct answers. Feel free to provide your opinion to the statements contained herein. Respond to the questions as honestly as possible. Your honesty and cooperation will assist in the success of this study. All the information you give will be used for academic purposes only and will be treated with utmost confidentiality. Do not write your name. You are free to participate or leave at whatever stage of the study.

Section A: Background Information: Characteristics of Teachers. Answer by writing 1, 2, 3, 4, 5 in the brackets

A1. Sex of the respondent

1. Male ( )

2. Female ( )

A2. Age

1. Below 25 years ( )

2. 25-34 years ( )

3. 35-44 years ( )

4. Above 45 years ( )

A3. Marital status

1. Married ( )

2. Single ( )

3. Divorced ( )

4. Widowed ( )

5. Separated ( )

A.4. How many years have you been working as a physics teacher?

1. Less than 5 years ( )

2. 5-9 years ( )

3. 10-14 years ( )

4. 15-19 years ( )

A5. Current position as a teacher

1. Regional Physics Trainer ( )

2. Senior physics teacher ( )

3. Head of Department ( )

A6. Type of school

1. Mixed day ( )

2. Single day ( )

3. Mixed boarding ( )

4.Single boarding ( )

A7. Category of school.

1. Government Aided. ( )

2. Private. ( )

A9. Are you a qualified physics teacher?

1. Yes ( )

3. No ( )

A10. Status of a school

1. Rural . 2. Urban ( )

Section B: Independent Variable SESEMAT Pedagogical approaches.

Answer by writing 1, 2, 3, 4 ,5 on the relevant responses

IT1. According to your observation, does your school have a teacher in charge of SESEMAT -in-service training

1. No. 2. Yes. 3. Not observant ( )

IT2. Do you have any SESEMAT in-service Training Certificate?

1. No 2. Yes ( )

IT3. How many SESEMAT in-service training cycles have you ever attended?

1.None 2. One 3 Two. 4. Three and More. ( )

1 = Strongly Disagree (SD), 2 = Disagree (D), 3= Not Sure(NT),

4=Agree(A) 5 =Strongly Agree(SA)

	SESEMAT Pedagogical Approaches					
	Active learning	**SD**	**D**	**NS**	**A**	**SA**
AL1	Students are encouraged students to freely express their views					
AL2	**S**tudents freely share their experiences					
AL3	**S**tudents derive hypothesis for questions on their own					
AL4	**S**tudents explain their findings to the rest of the students					
AL5	**S**tudents perform experiments on their own					

AL6	Students set apparatus from instructions on their own					
AL7	**S**tudents record observations for their own experiments					
AL8	**S**tudents manipulate data on their own					
AL9	**S**tudents draw conclusions on results					
AL10	**S**tudents verify their own predictions of the performed					
AL11	**S**tudents are given problem solving activities regularly					
AL12	Students are engaged in role play					
AL13	Think-Pair-Share approach is used in physics lessons					
	Contextual Learning	**SD**	**D**	**NS**	**A**	**SA**
CL1	Students apply new knowledge in real life situations					
CL2	**S**tudents work out some physics concepts from home					
CL3	Students work in groups with their friends					
CL4	Students answer practical questions from their homes					
CL5	Students apply hands-on and minds-on approaches					

CL6	**S**tudents to use local materials in a physics lesson					
	Collaborative Learning	**SD**	**D**	**NS**	**A**	**SA**
CO1	Students work together in Physics lessons					
CO2	Students complete physics tasks together					
CO3	Students create innovative products together					
CO4	Students engage in constructive conversations					
CO5	Students take part in forming groups					
CO6	Students listen to one another					
CO7	Students set rules to be followed by a group					
CO8	Roles are assigned to members of each group					
CO9	Each group is assigned a different task					

Section C: Dependent Variable Teacher Effectiveness

	TEACHER EFFECTIVENESS	**SD**	**D**	**NS**	**A**	**SA**
	Effective Communication					
EC1	I give immediate feedback in every lesson taught					

EC2	I have language fluency while teaching physics					
EC3	My non-verbal clues are clear students when teaching					
EC4	Physics concepts need a lot of explanation					
EC5	I answer all the questions of my students					
	Subject Matter expertise	**SD**	**D**	**NS**	**A**	**SA**
SM1	I always follow the prepared lesson					
SM2	I know the content of all parts of the Physics syllabus					
SM3	I feel I am an expert in my subject					
SM4	I teach Physics only					
	Professional Competence					
PC1	I am dedicated to my work					
PC2	I am handling my job according to the work ethics					
PC3	I am passionate about the work in my profession					
PC4	I exhibit integrity when marking students					
PC5	I show a positive role model to students					

	Teaching Style					
ST1	I vary the teaching methods					
ST2	Student-centred methods are best for teaching Physics					
ST3	I use teaching aids in every Physics lesson					
ST4	I integrate values in Physics lessons					
ST5	I make research before lessons and refer students to such sources					

	Classroom management	**SD**	**D**	**NS**	**A**	**SA**
CM1	I ensure that students are focused on task behaviours					
CM2	I always maintain discipline in my class					
CM3	I reward good conduct among students					
CM4	I always ensure that there is harmony amongst students					

Section D: Moderating Variable School Environment

	Administrative Support	**SD**	**D**	**NS**	**A**	**SA**
AS1	I feel I have supportive administration					
AS2	Principal communication is valued in my school					
AS3	I feel like the whole staff is recognized					
AS4	I feel generally satisfied with the situation					

AS5	I see that the school is well run					
	Collegiality					
CO1	Staff share common beliefs					
CO2	Teachers respect each other					
CO3	I am valued in the Physics department					
CO4	Physics teachers work together					
CO5	We plan together in my department					
CO6	Head of department advises colleagues about school goals					
	Professional Development	**SD**	**D**	**NS**	**A**	**SA**
Pi1	There are several opportunities for professional development					
Pi2	I get training in work related activities					
Pi3	I regularly participate in workshops					
Pi4	My department usually organizes in-house trainings					
Pi5	I have attended several vestibule trainings					

Thank you for participating

Appendix 2: Interview Guide for Head teachers

1. Are your physics teachers effectively communicating while in class teaching?
2. Are your teachers of Physics well equipped with subject matter?
3. Are physics teachers professionally competent?
4. How are the physics teachers at your school managing to use a variety of teaching style?
5. How is class management handled at your school by the Physics teacher?
6. How do physics teacher apply active learning approach while teaching a class?
7. Do you think physics teachers apply contextual learning approach while teaching? Explain your answer
8. How do you find physics teachers' willingness to apply motivation of students as a learning approach?
9. Are your teachers enjoying collaborative learning approach while teaching physics?
10. How are physics teachers been supported by any administrator from your office for support?
11. How do your physics teachers utilise their time to advise each other while planning for lessons?
12. Does the school facilitate teachers to go for professional development?

Thank you for participating

Appendix 3: Interview Guide for Inspectors of Schools

1. How are physics teachers been supported by school to attend SESEMAT trainings?
2. How do you find teachers applying SESEMAT pedagogical approaches?
3. How is the performance of Physics results in schools in your District?
4. How often do you visit secondary schools in your District?

Thank you for participating

Appendix 4: Focus Group Discussion for Heads of Department

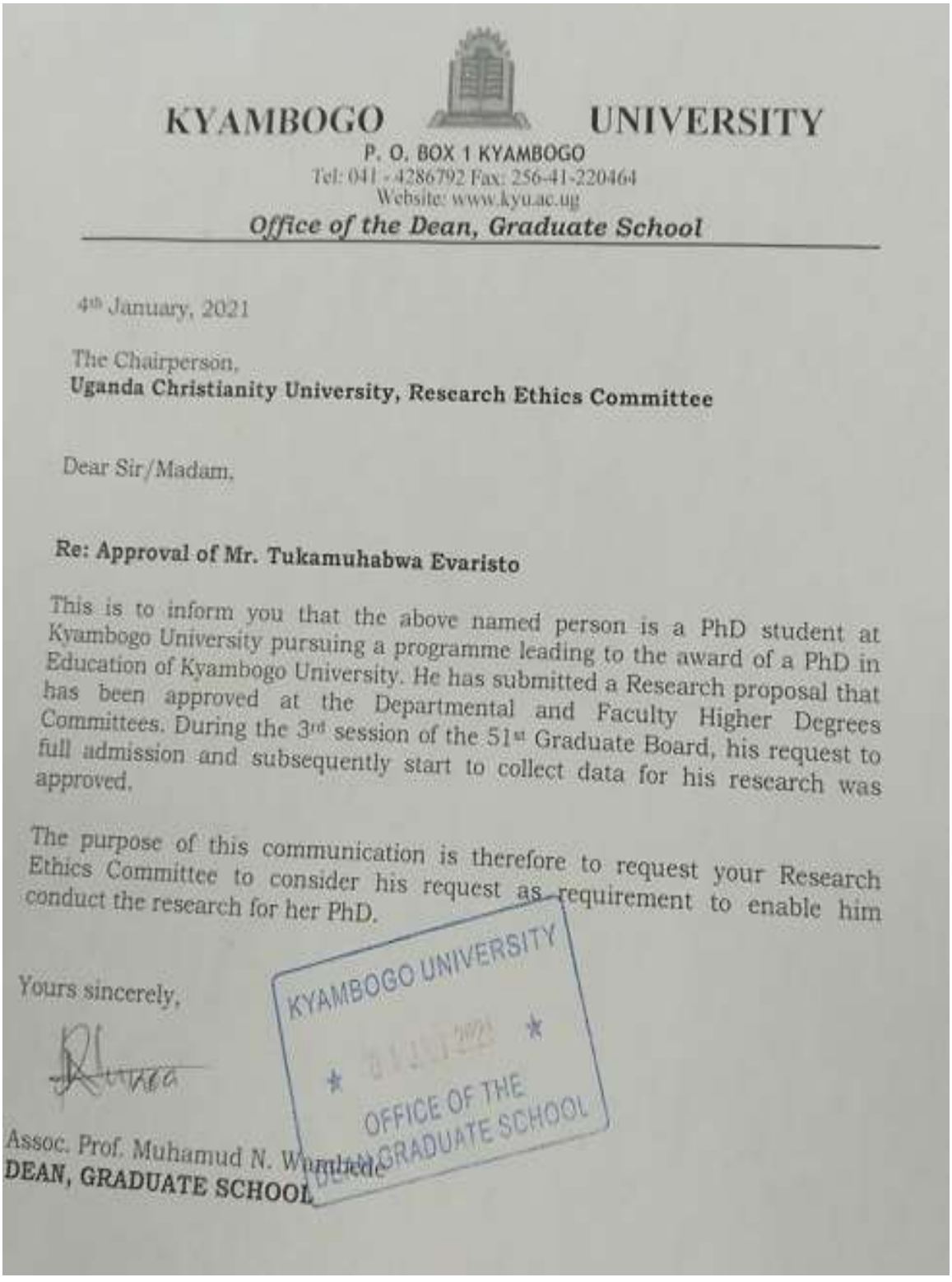
1. How do you find teachers applying SESEMAT pedagogical approaches?
2. How have schools been assisting teachers during lesson preparation?
3. Have schools been arranging time for meeting as a department. Yes/No. Explain?
4. How does the schools' environment influence their effectiveness?

Thank you for participating

Appendix 5: Classroom environment Checklist

1. Neatness of Classroom, whether organised to qualify as an organised learning environment.
2. Whether the classroom will allow a teacher to exercise all the approaches when handling a lesson.
3. The enrolment number of learners per class visited.
4. To establish a conducive environment for teaching and learning,

Appendix 6: Introductory Letter to UCU REC



KYAMBOGO UNIVERSITY

P. O. BOX 1 KYAMBOGO
Tel: 041 - 4286792 Fax: 256-41-220464
Website: www.kyu.ac.ug

Office of the Dean, Graduate School

4th January, 2021

The Chairperson,
Uganda Christianity University, Research Ethics Committee

Dear Sir/Madam,

Re: Approval of Mr. Tukamuhabwa Evaristo

This is to inform you that the above named person is a PhD student at Kyambogo University pursuing a programme leading to the award of a PhD in Education of Kyambogo University. He has submitted a Research proposal that has been approved at the Departmental and Faculty Higher Degrees Committees. During the 3rd session of the 51st Graduate Board, his request to full admission and subsequently start to collect data for his research was approved.

The purpose of this communication is therefore to request your Research Ethics Committee to consider his request as requirement to enable him conduct the research for her PhD.

Yours sincerely,

KYAMBOGO UNIVERSITY
OFFICE OF THE DEAN GRADUATE SCHOOL

Assoc. Prof. Muhamud N. Wumbede
DEAN, GRADUATE SCHOOL

Appendix 7: Clearance Letter from UNCST

Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

Our Ref: SS837ES **2 August 2021**

TUKAMUHABWA EVARISTO
UGANDA NATIONAL EXAMINATIONS BOARD
Kampala

Re: Research Approval: **Curriculum innovation, school environment and physics teacher effectiveness. The case of\r\nthe SESEMAT program in Kabale Municipality, Uganda\r\n**

I am pleased to inform you that on **02/08/2021**, 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 **02/08/2021** to **02/08/2022**.

Your research registration number with the UNCST is **SS837ES**. 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 participants 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	FGD	English		28 July 2021
2	informed consent forms	English		28 July 2021
3	Assent forms	English		30 July 2021
4	approved Covid 19 Risk Mitigation Plan	English		30 July 2021
5	Project Proposal	English	APHD RESEARCH PROPOSAL	
6	Approval Letter	English	APHD RESEARCH PROPOSAL	0000-00-00
7	Administrative Clearance	English	APHD RESEARCH PROPOSAL	0000-00-00

Yours sincerely,

Hellen Opolot
For: Executive Secretary
UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

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	FGD	English		28 July 2021
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6	Approval Letter	English	APHD RESEARCH PROPOSAL	0000-00-00
7	Administrative Clearance	English	APHD RESEARCH PROPOSAL	0000-00-00

Yours sincerely,

Hellen Opolot
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 8: Informed Consent Form for Physics teachers

KYAMBOGO UNIVERSITY P. O BOX 1, Kyambogo, Kampala

INFORMED CONSENT FORM FOR:

Physics Teachers

My name is Evaristo Tukamuhabwa I am a PhD student at Kyambogo University, Faculty of Education. I am inviting you to participate in a research study about **SESEMAT in-service training, school environment and physics teacher effectiveness in Kabale Municipality.** This form will tell you about the study to help you decide whether or not you want to take part in it.

What is the key information about this research study?
The following is a short summary of this study to help you decide whether you want to be a part of this study. Information that is more detailed is listed later on in this form.

The purpose of this study is to investigate the relationship between SESEMAT in-service training, school environment and the physics teacher effectiveness in Kabale Municipality .You will be asked to join an interview, with your fellow colleague(s) both males and females. We expect that you will be in this research study for 10 minutes. The main benefit is that at the end there will be an improvement in the system.

Why is this study being done?
The purpose of the study is to investigate the relationship between SESEMAT in-service training, school environment and the physics teacher effectiveness in Kabale Municipality. You are being asked to take part in the study because you have benefited out of SESEMAT activities for some time directly or indirectly. You cannot take part in this study if you are mentally disorganized or not disciplined.

What do I need to do?
If you decide to be in the study, I will ask you to feel free and be open, be attentive and participate actively. Then one person to speak at a time. You need to know that no right or wrong answers.

What are the benefits to me?
If you take part in this study, you might improve on the recurring challenges in physics scores for a class or get to know more on the loopholes in the system and learn more on the proper planning.

Are there any risks to me if I decide to be involved in this study?
There are no foreseeable risks however some participants may get fatigued or tired. In such circumstances you will request for a break.

How will my information be protected?
Your responses will be confidential and be put in a lockable facility for some time, up to 3 years. And no unauthorized person will be allowed to read it. The results of this study may be used in academic reports, presentations in conferences, or publications but your name will not be used. Results will only be shared in aggregate form.

Do I have to be in the study?
No, you don't. The choice is yours. Your participation in this study is completely voluntary. No one will get angry or upset if you don't want to do this. And you can change your mind anytime if you decide you do not want to be in the study anymore.

For Research Ethics Issue
It was approved by Uganda Christian University Research Ethics Committee. For any concern contact UCU REC Chairperson: Prof. Waiswa Mob. No. 0772405357 or Secretariat, Mr Osborn Ahimbisibwae, Mob No. 0775737627

If you agree to take part, please sign here:

Signature of participant Date

....

Signature of Researcher

....

Appendix 9: Informed Consent Form for Education Officers

KYAMBOGO UNIVERSITY P. O BOX 1, Kyambogo, Kampala

INFORMED CONSENT FORM FOR:

Municipal Education officials

My name is Evaristo Tukamuhabwa I am a PhD student at Kyambogo University, Faculty of Education. I am inviting you to participate in a research study about **SESEMAT in-service training, school environment and physics teacher effectiveness in Kabale Municipality.** This form will tell you about the study to help you decide whether or not you want to take part in it.

What is the key information about this research study?
The following is a short summary of this study to help you decide whether you want to be a part of this study. Information that is more detailed is listed later on in this form.

The purpose of this study is to investigate the relationship between SESEMAT in-service training, school environment and the physics teacher effectiveness in Kabale Municipality .You will be asked to join an interview, with your fellow colleague(s) both males and females. We expect that you will be in this research study for 10 minutes. The main benefit is that at the end there will be an improvement in the system.

Why is this study being done?
The purpose of the study is to investigate the relationship between SESEMAT in-service training, school environment and the physics teacher effectiveness in Kabale Municipality. You are being asked to take part in the study because you have benefited out of SESEMAT activities for some time directly or indirectly. You cannot take part in this study if you are mentally disorganized or not disciplined.

What do I need to do?
If you decide to be in the study, I will ask you to feel free and be open, be attentive and participate actively. Then one person to speak at a time. You need to know that no right or wrong answers.

What are the benefits to me?
If you take part in this study, you might improve on the recurring challenges in physics scores for a class or get to know more on the loopholes in the system and learn more on the proper plannining.

Are there any risks to me if I decide to be involved in this study?
There are no foreseeable risks however some participants may get fatigued or tired. In such sucumstance you will request for a break.

How will my information be protected?
Your responses will be confidential and be put in a lockable facility for some time, up to 3 years. And no unauthorized person will be allowed to read it. The results of this study may be used in academic reports, presentations in conferences, or publications but your name will not be used. Results will only be shared in aggregate form.

Do I have to be in the study?
No, you don't. The choice is yours. Your participation in this study is completely voluntary. No one will get angry or upset if you don't want to do this. And you can change your mind anytime if you decide you do not want to be in the study anymore.

For Research Ethics Issue
It was approved by Uganda Christian University Research Ethics Committee. For any concern contact UCU REC Chairperson : Prof. Waiswa Mob. No. 0772405357 or Secretariat, Mr Osborn Ahimbisibwae, Mob No. 0775737627

If you agree to take part, please sign here:

Signature of participant Date

....

Signature of Researcher

....

Appendix 10: UCU REC Clearance Letter

UGANDA CHRISTIAN UNIVERSITY
A Centre of Excellence in the Heart of Africa

03/02/2022

To: TUKAMUHABWA EVARISTO

KYAMBOGO UNIVERSITY
0782304091
Type: Protocol Amendment

Re: Curriculum innovation, school environment and physics teacher effectiveness. The case of the sesemat programme in Kabale Municipality, Uganda

I am pleased to inform you that at the convened meeting on **03/02/2022**, the **Uganda Christian University REC** voted to approve the changes to the study titled **Curriculum innovation, school environment and physics teacher effectiveness. The case of the sesemat programme in Kabale Municipality, Uganda** reference Number **UCUREC-2021-67**.

Please note that the approval of the research is valid until **03/02/2023**. The approved changes to the study include;

Amendments Approved.

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 participants 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 participants. All consent forms signed by participants 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 **03/02/2023** 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 notify 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 reviewed in this application by **Uganda Christian University REC**:

No.	Document Title	Language	Version Number	Version Date
1	Payment			
2	SESEMAT Pedagogical Approaches, School Environment and Physics Teacher Effectiveness in Kigezi Sub-Region, Uganda	ENGLISH	NOVEMBER 2021	2021-11-22

Yours Sincerely

Peter Waiswa
For: Uganda Christian University REC

Appendix 11: Transmittal Letter for Field Data Collection

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

15th February, 2022

TO WHOM IT MAY CONCERN

RE: MR. EVARISTO TUKAMUHEBWA

Dear Sir/Madam,

This is to introduce to you the above named student Reg: No **17/U/14382/GDED/PD** pursuing a PhD in Education, Department of Educational Planning and Management, Kyambogo University.

He intends to carry out research on **"Sesemat Pedagogical Approaches, School Environment and Physics Teacher Effectiveness in Kigezi Sub-Region, Uganda"**in partial fulfillment of the requirements for the award of Doctor of Philosophy in Education.

The purpose of this letter therefore is to request you to grant him permission to carry out his study in your institution.

Any assistance rendered to him will be highly appreciated.

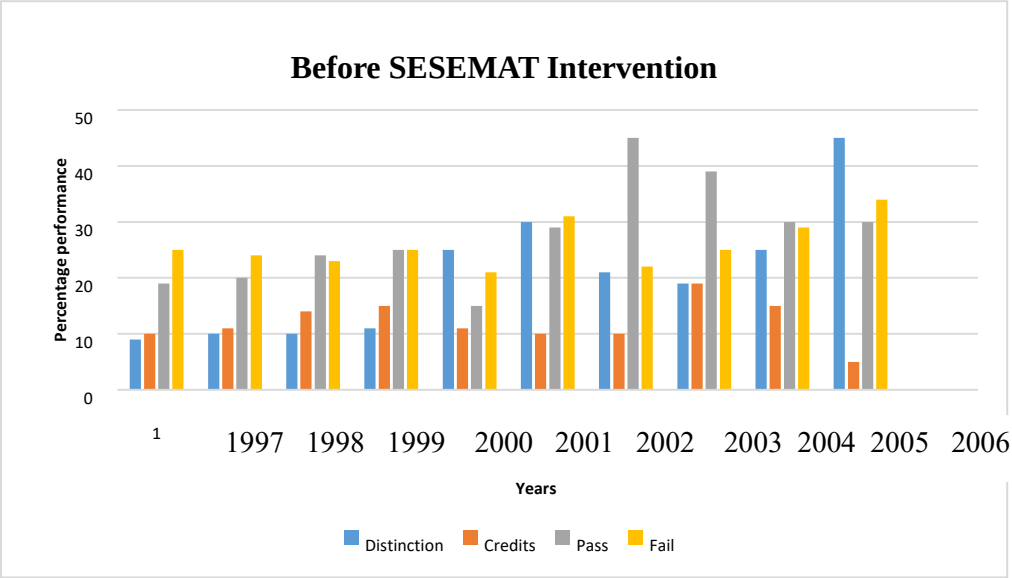
Yours sincerely,

Prof. Bosco Bua
AG. DIRECTOR

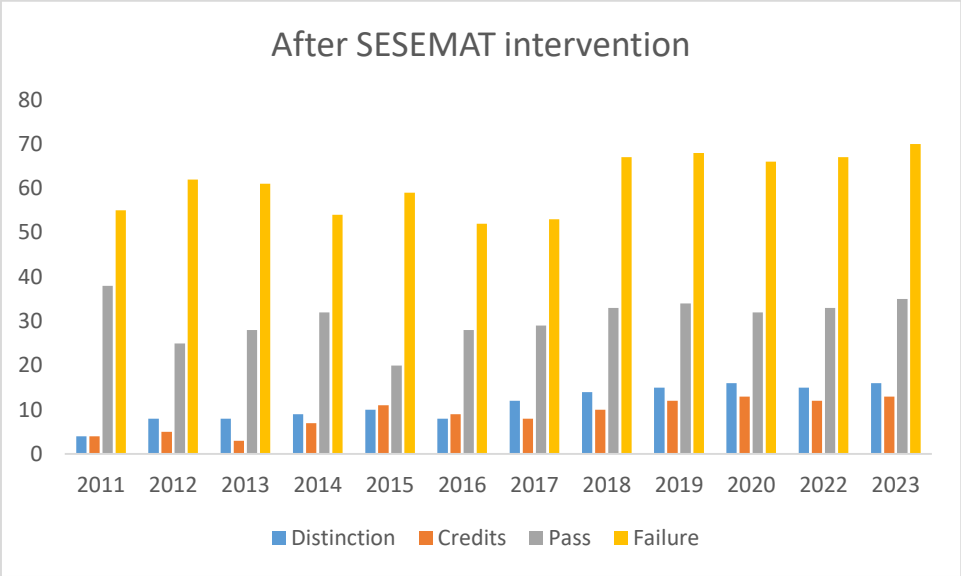
KYAMBOGO UNIVERSITY
★ 15 FEB 2022 ★
OFFICE OF THE
DEAN GRADUATE SCHOOL

Appendix 12: Performance in selected Schools in Physics at UCE in Kigezi sub- region

Panel A



Panel B



** 2021 is excluded because UNEB never held PLE, UCE and UACE examinations

Source: UNEB Archives

Appendix 13: Univariate statistics for assessment of Missing Data

	N	Missing	
		Count	Percent
A1	194	0	.0
A2	194	0	.0
A3	194	0	.0
A4	194	0	.0
A5	194	0	.0
A6	194	0	.0
A7	194	0	.0
A8	194	0	.0
A9	194	0	.0
IT1	194	0	.0
IT2	194	0	.0
IT3	194	0	.0
AL1	194	0	.0
AL2	194	0	.0
AL3	194	0	.0
AL4	194	0	.0
AL5	194	0	.0
AL6	194	0	.0
AL7	194	0	.0
AL8	194	0	.0
AL9	194	0	.0
AL10	194	0	.0
AL11	194	0	.0
AL12	194	0	.0
AL13	194	0	.0
CL1	194	0	.0
CL2	194	0	.0
CL3	194	0	.0
CL4	194	0	.0
CL5	194	0	.0
CL6	194	0	.0
COL1	194	0	.0
COL2	194	0	.0
COL3	194	0	.0
COL4	194	0	.0
COL5	194	0	.0
COL6	194	0	.0
COL7	194	0	.0
COL8	194	0	.0

COL9	194	0	.0
EC1	194	0	.0
EC2	194	0	.0
EC3	194	0	.0
EC4	194	0	.0
EC5	194	0	.0
SM1	194	0	.0
SM2	194	0	.0
SM3	194	0	.0
SM4	194	0	.0
PC1	194	0	.0
PC2	194	0	.0
PC3	194	0	.0
PC4	194	0	.0
PC5	194	0	.0
ST1	194	0	.0
ST2	194	0	.0
ST3	194	0	.0
ST4	194	0	.0
CM1	194	0	.0
CM2	194	0	.0
CM3	194	0	.0
CM4	194	0	.0
AS1	194	0	.0
AS2	194	0	.0
AS3	194	0	.0
AS4	194	0	.0
AS5	194	0	.0
CO1	194	0	.0
CO2	194	0	.0
CO3	194	0	.0
CO4	194	0	.0
CO5	194	0	.0
CO6	194	0	.0
PD1	194	0	.0
PD2	194	0	.0
PD3	194	0	.0
PD4	194	0	.0
PD5	194	0	.0

Appendix 14: Detection of multivariate outliers using Mahalanobis Distance

MHA_1	Probability_ MD	Outlier
99.57769	.60653	.00
65.41943	.60653	.00
12.83152	.60653	.00
11.06284	.60653	.00
10.26309	.60653	.00
9.75105	.60653	.00
9.60570	.60653	.00
9.03037	.60653	.00
8.97766	.60653	.00
7.84910	.60653	.00
7.80391	.60653	.00
7.69358	.60653	.00
7.55810	.60653	.00
7.44356	.60653	.00
7.33640	.60653	.00
7.25905	.60653	.00
7.20989	.60653	.00
7.18438	.60653	.00
7.08965	.60653	.00
7.06269	.60653	.00
6.99306	.60653	.00
6.72521	.60653	.00
6.67071	.60653	.00
6.56917	.60653	.00
6.54464	.60653	.00
6.49689	.60653	.00
6.38088	.60653	.00
6.35917	.60653	.00
6.24378	.60653	.00
6.22013	.60653	.00
6.03923	.60653	.00
5.89167	.60653	.00
5.83682	.60653	.00
5.73036	.60653	.00
5.19171	.60653	.00
5.10713	.60653	.00
4.96354	.60653	.00
4.83259	.60653	.00
4.83259	.60653	.00
4.78846	.60653	.00
4.76005	.60653	.00
4.50375	.60653	.00
4.49903	.60653	.00
4.46193	.60653	.00

MHA_1	Probability_ MD	Outlier
4.35355	.60653	.00
4.32930	.60653	.00
4.32930	.60653	.00
4.27093	.60653	.00
4.18038	.60653	.00
4.13866	.60653	.00
4.06671	.60653	.00
4.02501	.60653	.00
4.01875	.60653	.00
4.00065	.60653	.00
3.95328	.60653	.00
3.93134	.60653	.00
3.92111	.60653	.00
3.91854	.60653	.00
3.84026	.60653	.00
3.83932	.60653	.00
3.83932	.60653	.00
3.83932	.60653	.00
3.83932	.60653	.00
3.77616	.60653	.00
3.77616	.60653	.00
3.76123	.60653	.00
3.70880	.60653	.00
3.61602	.60653	.00
3.55558	.60653	.00
3.53289	.60653	.00
3.46052	.60653	.00
3.41110	.60653	.00
3.27442	.60653	.00
3.18533	.60653	.00
3.11133	.60653	.00
3.03700	.60653	.00
3.03700	.60653	.00
3.02620	.60653	.00
2.99004	.60653	.00
2.99004	.60653	.00
2.96072	.60653	.00
2.90814	.60653	.00
2.88853	.60653	.00
2.87085	.60653	.00
2.82691	.60653	.00
2.81146	.60653	.00
2.80275	.60653	.00
2.76548	.60653	.00
2.75939	.60653	.00
2.74763	.60653	.00
2.73969	.60653	.00

MHA_1	Probability_ MD	Outlier
2.70646	.60653	.00
2.67358	.60653	.00
2.66251	.60653	.00
2.66220	.60653	.00
2.65932	.60653	.00
2.60636	.60653	.00
2.58432	.60653	.00
2.56991	.60653	.00
2.56132	.60653	.00
2.54876	.60653	.00
2.52796	.60653	.00
2.48908	.60653	.00
2.45490	.60653	.00
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2.41939	.60653	.00
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2.30384	.60653	.00
2.26964	.60653	.00
2.26893	.60653	.00
2.26322	.60653	.00
2.21011	.60653	.00
2.19359	.60653	.00
2.17444	.60653	.00
2.13563	.60653	.00
2.10621	.60653	.00
2.10427	.60653	.00
2.08918	.60653	.00
2.08910	.60653	.00
2.06054	.60653	.00
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2.04690	.60653	.00
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2.03731	.60653	.00
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2.00274	.60653	.00
1.97499	.60653	.00
1.94200	.60653	.00
1.89145	.60653	.00
1.88663	.60653	.00
1.86235	.60653	.00
1.84025	.60653	.00
1.83706	.60653	.00
1.81608	.60653	.00
1.77505	.60653	.00
1.75651	.60653	.00
1.73612	.60653	.00
1.73283	.60653	.00

MHA_1	Probability_ MD	Outlier
1.62019	.60653	.00
1.59636	.60653	.00
1.54660	.60653	.00
1.53702	.60653	.00
1.46048	.60653	.00
1.45077	.60653	.00
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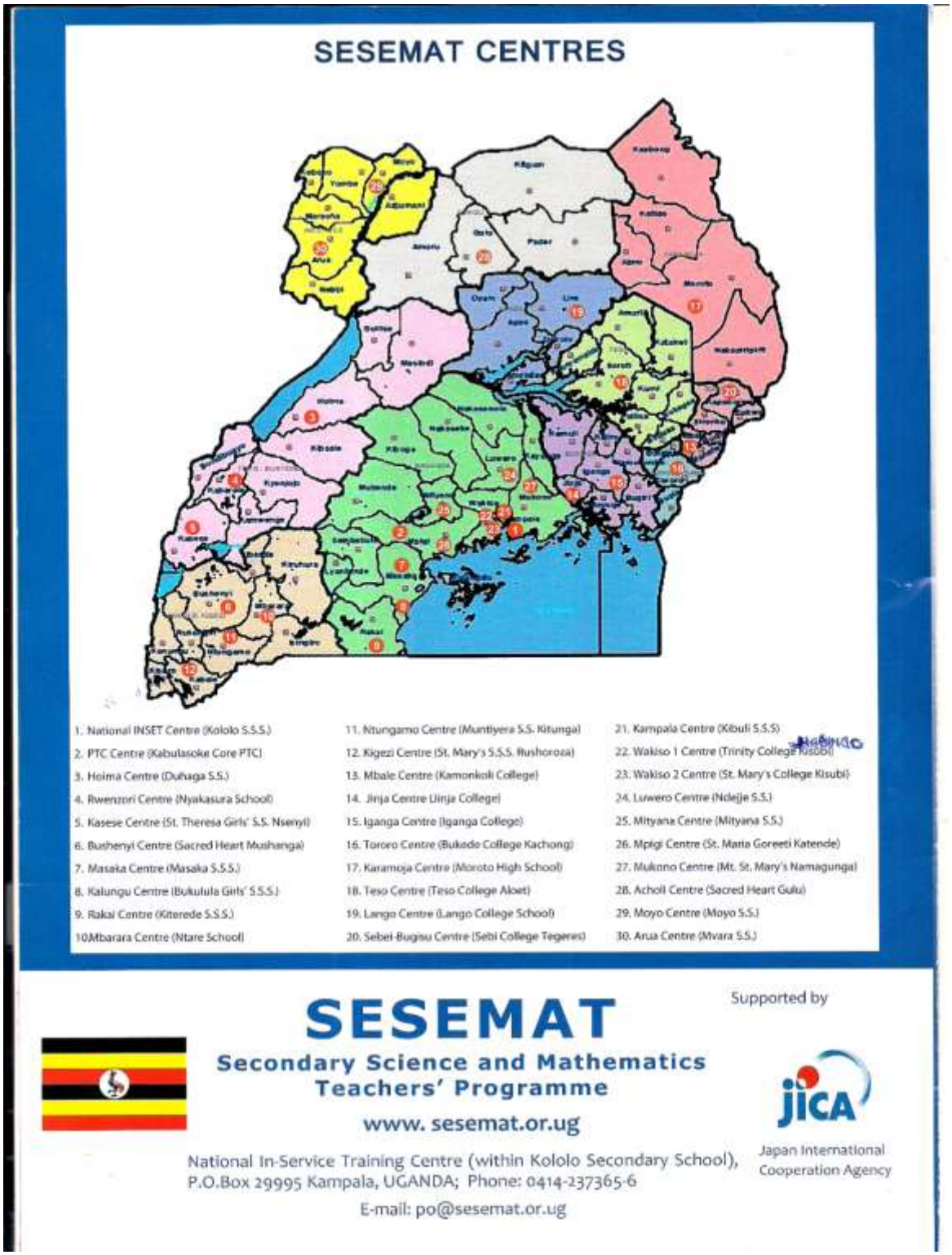
1.39894	.60653	.00
1.39894	.60653	.00
1.39894	.60653	.00
1.36999	.60653	.00
1.34753	.60653	.00
1.32792	.60653	.00
1.30472	.60653	.00
1.30031	.60653	.00
1.26656	.60653	.00
1.26522	.60653	.00
1.22047	.60653	.00
1.07401	.60653	.00
1.04825	.60653	.00
1.02574	.60653	.00
1.02574	.60653	.00

Appendix 15: Map of Uganda showing SESEMAT Centres



Appendix 16: Certificate of Editing

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Kampala

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Email: sekagya64@yahoo.com

RE: CERTIFICATE OF EDITING

This is to certify that I, Ssekagya Eric W. K., have carried out the language editing of Mr. Tukamuhabwa Evaristo's Thesis Entitled: **ANTECEDENTS FOR IMPROVING THE PHYSICS TEACHERS' EFFECTIVENESS IN UGANDA: A CASE OF KIGEZI SUB-REGION**

The editing was carried out between 12th to 19th September 2024 and all the possible noted language errors in the work were adequately adjusted positively.

Signed

SSEKAGYA ERIC WILLY KASIRYE

ENGLISH LANGUAGE with LITERATURE EDUCATION EXPERT

Appendix 17: Similarity Index

ANTECEDENTS FOR IMPROVING PHYSICS TEACHERS' EFFECTIVENESS IN UGANDA: A CASE OF KIGEZI SUB-REGION

ORIGINALITY REPORT

13%	12%	7%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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2	journals.eanso.org Internet Source	1%
3	ir.mu.ac.ke:8080 Internet Source	<1%
4	www.coursehero.com Internet Source	<1%
5	erepository.uonbi.ac.ke Internet Source	<1%
6	ir.uew.edu.gh:8080 Internet Source	<1%
279	Yin Cheong Cheng. "Paradigm Shift in Education - Towards the Third Wave of Effectiveness", Routledge, 2019 Publication	<1%
280	scholarscompass.vcu.edu Internet Source	<1%
281	journals.physiology.org Internet Source	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		

Appendix 18: Article Publications

Blueprint Academic Publishers

Journal of Research in Education and Technology
2(1)
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Accepted: January 24, 2024
Published: January 27, 2024

SESEMAT Pedagogical Approaches and Physics Teacher Effectiveness in Kigezi Sub-Region, Uganda

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Abstract

Effective physics teachers in secondary schools in Kigezi Sub-Region are a focus to improve the scientific skills, competences and students' academic knowledge to the required content. There are however, increasing concerns among stake holders about teacher ineffectiveness which has caused dismal performance of students in science subjects particularly physics. The study investigated the influence of Secondary Science and Mathematics Teachers (SESEMAT) pedagogical approaches on physics teacher effectiveness in secondary schools in Kigezi Sub Region, Uganda. Guided by Cognitive Constructivist theory, the study adopts a perspective that views learning as an active process, where contexts of learners are fully considered and learners being motivated and then collaborative learning takes place. Out of a population of 620, a sample of 234 Physics teachers was drawn from secondary schools of Kigezi Sub-Region. Data collection tool comprised of a questionnaire. Collected data was analysed descriptively using statistical software programs SPSS and SPSS AMOS. The findings showed that physics teacher effectiveness is highly influenced by SESEMAT pedagogical approaches in all aspects. The analysis results of structural equation model (SEM)/path analysis showed that SESEMAT pedagogical approaches influenced teacher effectiveness. Hence the causal relationship between SESEMAT pedagogical approaches and teacher effectiveness was positive and significant. The tested hypotheses state that there is a significant influence of SESEMAT pedagogical approaches on physics teacher effectiveness. It was concluded that SESEMAT Pedagogical approaches (active learning, motivation of students, contextual learning, and collaborative learning) are important to physics teacher effectiveness. Therefore, it was recommended that Physics teachers in Kigezi Sub-Region should apply SESEMAT pedagogical approaches while teaching in a good environment for better performance of learners and skills acquisition.

Keywords: Active, motivation, contextual, collaborative, poor performance.

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Influence of School Environment on Physics Teacher Effectiveness in Kigezi Sub-Region, Uganda

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ABSTRACT

This study investigated the influence of school environment on physics teacher effectiveness in secondary schools in Kigezi Sub-region, Uganda. The focus of the study was to establish the influence of administrative support on physics teacher effectiveness; to establish the influence of collegiality of teachers on physics teacher effectiveness and to find out the influence of professional development like workshops, seminars on physics teacher effectiveness. This study employed both quantitative and qualitative techniques to collect and sequentially analyse the data. The study adopted a mixed research design on a sample of 234 physics teachers, fourteen (14) head teachers and six (06) education officials. Data were collected using a self-administered questionnaire, interview guide, focus group discussions and classroom environment checklist. Quantitative data was analysed through the statistical software programs SPSS and SPSS AMOS while qualitative data was analysed using content analysis and verbatim quotations. Descriptive analysis showed that the school environment highly influences physics teacher effectiveness in all aspects. The results of structural equation model (SEM) showed that the school environment influences teacher effectiveness. The findings showed that the school environment as conceptualised as administrative support, collegiality and professional development had a strong positive influence on teacher effectiveness. It was concluded that teachers should create appropriate environment to present new thoughts by creating standards of administrative support, exercise companionship and cooperation between colleagues. Finally, develop professionally and remain relevant with current skills by participating in activities like educational seminars, workshops, and conferences.