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The Role of Teacher knowledge on implementation of Integrated Science in Competency Based Curriculum in Junior Schools: A case Study of Westlands Sub-County

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ABSTRACT

The purpose of the study was to examine the effect of teacher knowledge on implementation of integrated science in Competency Based Curriculum in junior schools in Westlands Sub-County. The social development theory underpinned the study. A descriptive research design was used. The target population were teachers, principals and heads of departments in the 30 junior schools in Westlands Sub County. A census was conducted for the integrated science teachers while 30% of heads of departments and principals were purposively selected. Data were collected through mixed methods. A structured questionnaire was distributed to the teachers in the selected schools. Interviews were conducted with heads of departments and principals. A pilot study was conducted to establish the validity and reliability of the data collection tools. Quantitative data was analyzed using the Statistical Package for Social Sciences version 29, employing correlation and regression analysis techniques. Qualitative data was analysed thematically. Results showed that teacher knowledge positively correlated with implementation of integrated science in the CBC in JSS(r=0.926 p=0.000). This study concludes that, despite teachers' strong understanding of integrated science, they face challenges due to a lack of resources, such as teaching materials and laboratory equipment. There was an increase in teacher workload, yet few received sufficient job training or continuous education opportunities in integrated science. The study concludes that, while the types of resources provided are relevant for instructional teaching, there is inadequacy in the provision of teaching resources. The study recommends that JSS should encourage greater involvement in research activities and professional organizations to promote continuous professional growth.

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Keywords: Competency Based Curriculum, implementation of integrated science , junior schools , teacher knowledge

1. Introduction

The Competency Based Curriculum (CBC) reflects a paradigm shift in teaching methodologies, shifting away from conventional approaches that are teacher-centered to learner-centered approaches. According to Delbert and Jacobs (2021), the primary focus of the CBC is on developing learners' competencies rather than merely imparting content knowledge. In this context, competencies are considered more crucial than the accumulation of information. The evaluation process within CBC is formative and summative. This means that the emphasis is placed on continuous feedback and improvement, fostering the development of learners' skills and abilities throughout the learning journey. The ultimate goal is to prepare students holistically for future challenges. Fitria et al, (2022) define CBC as a curriculum that outlines specific learning outcomes and competencies to be achieved by the learners.

Competency is the proven capacity to use one's knowledge, skills, and abilities in a way that advances their profession. In response to the rapidly changing global landscape, educational reforms have become necessary. CBC emerges as a promising approach to address the evolving needs of learners (Uzule, 2020). This curriculum prioritizes competencies over content, recognizing the importance of practical skills and abilities. It also emphasizes formative evaluation, providing continuous feedback to enhance the learning process. The implementation of the CBC is designed to empower students by equipping them with the vital skills and knowledge required to thrive in a rapidly evolving world. Unlike traditional education systems that often focus on rote memorization and standardized testing, the CBC places a strong emphasis on practical skills, critical thinking, problem-solving, and adaptability. In CBC, students are encouraged to actively engage with the learning process, fostering a deeper understanding of subjects and the ability to apply their knowledge in real-life situations. This learner-centric approach not only prepares students for academic success but also equips them with the skills necessary to navigate complex challenges in their personal and professional lives.

CBC curriculum prepares learners to adapt and thrive in diverse and unpredictable environments. The aim is to equip students with the tools they need for personal and professional growth, ensuring they are well-prepared for the challenges and opportunities that lie ahead (Morrish & Neesam, 2021). In Australia, competence is the explicit description of knowledge, skills, and their practical application to meet the expected performance standards within a professional environment. These essential competencies encompass digital learning, effective communication, and critical thinking (Beneitone & Yarosh, 2022).

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The successful execution of the CBC necessitates proficient and well-informed facilitators, sufficient resources, and appropriately equipped educational institutions. Okoth (2018) underscores the importance of teachers' disposition, preparedness and CBC-focused training. To successfully implement the CBC, instructors must be well-informed and prepared to adopt coaching and facilitation roles instead of merely transmitting knowledge to students. Awili and Begi (2021) acknowledge that a teacher's value and quality are unparalleled, making teacher training a crucial factor in the success of the curriculum. Leadership within educational institutions also assumes a pivotal role in the effective execution of the curriculum, exerting a direct influence on the quality of educators and their efficacy in the classroom.

The preparedness, professionalism and access to resources among teachers relates with students' achievements (Wambua & Samuel, 2019). This link between instructors' competencies and students' success surpasses the effect of various other factors, including financial investments such as salaries. The correlation between teachers' capabilities and students' accomplishments carries greater significance than other variables, underscoring the imperative nature of investing in the professional development and support of educators.

2. Statement of the Problem

The implementation of CBC has generated significant interest among scholars in Kenya due to its novel approach to education. When properly implemented, CBC aims to produce well-rounded learners, with teachers playing a pivotal role in ensuring active and participative learning to make the curriculum successful. Despite its potential benefits, the implementation of integrated science in CBC in junior schools has faced challenges and criticism since its introduction. This is because integrated has three learning subjects in one learning area and the teacher is trained in teaching two subjects. Many education stakeholders have expressed concerns about the lack of teaching experience, poor leadership practices, inadequate training, and insufficient resources. Instructional leadership and teacher knowledge are lacking in integrated science as a learning area for effective implementation of the curriculum. The 8.4.4 system of education teaches two science subjects to graduate teachers, while the CBC curriculum requires that these teachers have knowledge and teach three science subjects. The challenge is that the curriculum is being implemented despite the recommendations from the task force on the retooling process. Thus, there is a gap in knowledge of the third science subject. Additionally, junior schools may not have adequate teachers, resources, and personnel to offer integrated science (Okoth, 2018).

The purpose of the study was to examine the effect of teacher knowledge on implementation of integrated science in CBC in junior schools in Westlands Sub-County.

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In order to measure the relationship between teacher knowledge and curriculum implementation, the study the hypothesis H01: There is no significant relationship between teacher knowledge and implementation of Integrated Science in CBC in junior schools in Westlands Sub-County was tested.

3. LITERATURE REVIEW

Research indicates that in integrated scientific classes, teacher knowledge is critical in determining the caliber of instruction and learning outcomes for students. Proficiency in content knowledge enables teachers to create meaningful links between disparate scientific concepts, improving students' understanding and retention (Nsengimana et al.,2021). Furthermore, by effectively involving students in practical exercises, inquiry-based learning, and real-world applications, teachers who possess a thorough understanding of pedagogical methodologies specifically designed for integrated science can help students develop a deeper understanding of the subject.

Sakib and Obra (2019) investigated teachers' knowledge of teaching secondary science curricula in the city of Isabela, Philippines. They evaluated educators' understanding of the secondary science curriculum, which encompassed not only the subject matter but also the incorporation of scientific process skills, curriculum planning, and various teaching and learning methods. Furthermore, they investigated the obstacles encountered by teachers to the curriculum, teaching techniques, educational resources, classroom atmosphere, and evaluation methods. The study also examined the level of support provided by school principals to teachers in teaching secondary science curriculum, covering aspects such as supervision, professional training, monitoring, and evaluation. A researcher-designed Science Teachers Preparedness Survey questionnaire that was given to 62 respondents in a school division was used to collect the data. The research showed that, on the whole, teachers were well-prepared and knowledgeable of the instructional material combined with science process competencies, curriculum design, and teaching and learning methodologies. However, they had more difficulty with abstract concepts, mathematical calculations and some instructional techniques. Despite the endorsement of school principals, the availability and accessibility of educational technologies were seen as possible concerns in relation to instructional materials. The study recommended continuous training for teachers in areas where understanding was weaker and assistance with obtaining instructional materials. The study presents a contextual gap as it was conducted in Indonesia, with different social, economic and legal regimes from Kenya.

Mutale and Ng’andu (2022) assessed teaching resources and teacher readiness for civic education in secondary schools under Zambia's CBC. Their research adopted a qualitative method approach, utilizing an embedded research design. The study included the participation of

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120 secondary school students and 40 teachers, who were chosen through stratified random sampling. Qualitative data were collected from teachers and school leaders using semi-structured interview guides, while learners provided information through questionnaires. The findings revealed that, despite having received in-service training on CBC, civic education teachers were not effectively implementing recommended teaching methods. Moreover, teaching resources were deficient, and educators demonstrated an incomplete grasp of how to employ these materials effectively within the context of CBC. As a result, the study put forth several recommendations. Firstly, it proposed that the Ministry of Education should prioritize the retraining of teachers to equip them with the essential competencies needed for the successful implementation of CBC. Secondly, it suggested that teachers should undergo training in learner-centered approaches to enhance students' acquisition of skills. A methodological gap emerges as the study was purely qualitative, while the current study used mixed, methods in data collection and analysis.

Chemagosi (2020) underscored the critical importance of teachers' knowledge in the successful implementation of CBC in a study carried out in Kilifi and Nandi counties. This focus on teacher readiness aligns with the idea that the effectiveness of any educational reform or curriculum change largely depends on the teachers who are tasked with delivering it. When teachers are well-prepared and equipped with the necessary knowledge and skills, they are more likely to effectively implement the new curriculum, leading to positive outcomes for students. Moreover, the study's emphasis on leadership's role in the CBC implementation process aligns with the broader understanding that effective school leadership is crucial for educational reforms to succeed. Leadership within schools plays a pivotal role in creating an environment conducive to change and innovation. Leaders can set the tone for collaboration, instructional improvement, and pedagogical innovation among their teaching staff.

Mulandi (2019) noted that leadership is not only about administrative functions but also involves providing mentorship and effective planning. This implies that educational leaders need to guide and support teachers in understanding and adapting to new educational paradigms like CBC. Effective planning is crucial to ensure a smooth and well-organized transition Awili and Begi (2021) highlighted the effect of a principal's leadership style on teachers' exploration and performance. This underscores the notion that leadership is not a one-size-fits-all concept. Different leadership styles can have varying effects on teachers' willingness to explore new teaching methods and their overall performance in implementing educational reforms like CBC.

Isaboke et al. (2021) examined the challenges hindering successful CBC implementation in Machakos County, Kenya. The study revealed that teachers were not adequately prepared, and school infrastructures were lacking. The rushed implementation of CBC without addressing issues like understaffing and resource shortages significantly affected the process. The study

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presents conceptual and contextual gaps as the study focused on challenges in CBC implementation and was carried out in Machakos County. Awili and Begi (2021) assessed instructional leadership and CBC implementation. While there was no significant difference in implementation between private and public schools, headteachers tended to prioritize administrative roles over supporting curriculum implementation. Their study, however, focused on early years education, hence a conceptual gap. Okoth (2018) investigated the link between headteachers' instructional leadership and CBC implementation. The study found that instructional leadership was moderate and not significantly influenced by headteachers' characteristics or teaching experience but was dependent on headteachers' qualifications. The study's unit of observation was teachers only, hence a limitation scope in population.

Nsengimana et al. (2021) examined the correlation between a school's adoption of CBC for science education and its ability to foster innovation in Rwanda. Their research encompassed 12 teacher interviews, the observation and documentation of 23 science lessons, and an evaluation of school facilities within three different educational institutions. The investigation uncovered disparities in CBC implementation among teachers and schools, primarily stemming from variations in individual professional development and the school's readiness to embrace innovation. The study identified robust CBC execution in schools. However, it revealed a lower level of implementation

in the domain of science in society. The results showed a clear relationship between a school's capacity for innovation and its science CBC implementation profile, placing particular emphasis on elements like teachers' individual experience, readiness for CBC integration, and accessibility to science teaching and learning resources. The study thus advocated for the development of strong, ongoing training programs that emphasize the implementation of the practical CBC and emphasized the requirement for the availability of suitable resources to support the successful completion of the science CBC. The study used interviews and observations guide to collect data while the current study employed questionnaires and interviews, in data collection.

4. Theoretical Framework

The Social Development Theory attributed to Lev Vygotsky (1896-1934), posits that each task in a child's cultural development manifests itself twice: first, at the societal level, and subsequently, at the personal level. Key principles of the theory involve the notions of the More Knowledgeable Other and the Zone of Proximal Development and scaffolding (MockingJay, 2022). The More Knowledgeable Other refers to an individual possessing greater expertise than the learner in a particular task, such as a teacher, an older adult, or a peer. It is noteworthy that the More Knowledgeable Other need not necessarily be a person; it could also be an entity or resource with additional information on the subject compared to the learner. Effective school

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policies regarding ICT use, proficient head teachers, teachers, and learners act as the More Knowledgeable Others, playing a crucial role in shaping the implementation of digital literacy. The Zone of Proximal Development delineates the cognitive space where the More Knowledgeable Other offers suitable assistance or instructive lessons, facilitating a child's development of skills that they can subsequently apply independently, thereby enhancing advanced mental capabilities. Collaborative learning, particularly within the zone of proximal development, is instrumental in cultivating the skills of pupils (Healy, 2015).

In such educational environments, students are viewed as unique individuals, and the primary emphasis is on fostering personal meaning rather than solely relying on teacher-imparted knowledge and instructor-directed activities. Through this theory, the implementation of integrated science in CBC diverges from the traditional teacher-centered approach, placing a significant emphasis on empowering students to actively engage in the learning process. The integration of science into the CBC for junior schools necessitates school administrators to allocate adequate resources, that would enhance active learner engagement. Drawing from the social development theory, teacher professional development and teacher knowledge are critical in integrated science integration. Learners are empowered to build on educational foundations based on guidance from teachers, enabling them to develop their own reality and knowledge. This theory emphasizes collaboration, interaction, scaffolding and practical experiences in the learning process.

5. RESEARCH METHODOLOGY

This study used a correlational research design. A correlational research design examines connections between variables without the researcher having control over any of them. A correlation indicates how strong and/or in which direction variables are related. A correlation can have either a positive or negative direction. This design entails observing and examining the study variables as they naturally exist, without any intentional manipulation or alteration. The design was important to the study as it helped to assess the relationship between leadership practices and implementation of integrated science in CBC in junior schools in Westlands Sub County Nairobi county.

The study was conducted in junior schools in Westlands subcounty. It is one of the seventeen sub counties in Nairobi county. The sub county has 5 wards. Westlands Sub County was selected as it has a good distribution of public and private JSS and being an urban centre, it becomes a mirror for the other urban centres in the country.

This study’s target population were teachers, principals and heads of departments (HODs) in the 30 JSS schools in Westlands Sub-County Nairobi City County. Table 3.1 shows the distribution

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of the study population.

Table 1: Target Population

Category	Population
Teachers	94
Head of departments	30
Principals	30
Total	**154**

Source: Ministry of Education, 2023

Sampling procedure

Sample size

The study selected all teachers in the 30 JSS schools in the sub county as the population is small and easily accessible. Mugenda and Mugenda (2003), a sample size of 10%-30% is adequate for analysis. Consequently, this study selected 10 HODs and 10 principals. Table 2 illustrates the sample size: -

Table 2: Sample Size

Category	Population	Sample
Teachers	94	94
Head of departments	30	10
Principals	30	10
Total	**154**	**114**

The study employed a census for all the 30 schools in the sub-county, as the population was small and easily accessible. Five Heads of Departments (HODs) from public schools and five HODs from private schools were also purposively sampled. 5 principals from a public school and 5 principals from private schools were purposively selected for the study.

The data collection procedure commenced with the recruitment and training of one research

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assistant, who was trained on the research objectives. The distribution of questionnaires was conducted in person to ensure an even distribution of respondents, with all schools being visited. The study's objectives were clearly communicated to the participants, and those who agreed to participate were provided with the questionnaires and given ample time to complete them. In cases where participants encountered difficulties in filling out the questionnaires, both the researcher and the research assistant were available to assist. Subsequently, the questionnaires were collected, and their accuracy examined.

The researcher then held interviews with the sampled principals and HoDs. This commenced with booking appointments with the principals one week in advance. The study's objectives were explained to these respondents, and each interview session was timed to take approximately 30 minutes to obtain in-depth information. The interviews were recorded for examination and respondents were informed of the recording, most respondents were not comfortable being recorded but were ready to give the responses.

Data was collected through mixed methods using questionnaires and interviews. The study provided a structured questionnaire to the teachers of integrated science in all the schools, with detailed instructions on how to complete the questionnaires to ensure accuracy and consistency in the responses. The researcher reassured respondents that their participation in the study entailed no risk. Additionally, the study conducted interviews with Heads of Departments (HoDs) and sampled Junior school principals to gather additional information.

The accuracy and consistency of the questionnaires were carefully assessed. Quantitative data was analyzed using the Statistical Package for Social Sciences, employing correlation and regression analysis techniques. Descriptive analysis was conducted to examine the data. Each independent variable was compared to the dependent variable using inferential statistics. The Pearson correlation coefficient was used to assess the relationship between the variables. Regression analysis was also carried out to examine the cumulative effect of the factors. The study variables were tested at a significance level of 5%. The research adopted the multiple regression model for analysis: -

$$Y=\beta_0+\beta_1 X_{1+}\ \varepsilon$$

Where: -

Y implementation of Integrated Science in CBC, β_0 is a constant, β_1 is the Beta coefficient, X_1 is teacher knowledge and ε is the error term

Qualitative data was categorized into themes to facilitate analysis. Graphs, tables, and narrations were used to present findings.

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6. RESULTS AND DISCUSSIONS

6.1. Demographic information and response rate

The study issued 90 questionnaires to the teachers of integrated science in all the schools, out of which 87 were completed and returned; this was a response rate of 97%. Additionally, the researcher successfully interviewed the 8 out of 10 principals, hence 80% responses rate. Likewise, 8 HODs out of 10 were successfully interviewed. Mugenda and Mugenda (2003) recommend a response rate of 50% or higher for data analysis, with a 60% and 70% rate being considered very good and excellent. Consequently, the study's response rate of 97% is excellent.

Out of 87 respondents, 50 (57%) were male and 37(43%) were female. This showed that 50(57%) had the highest frequency distribution as illustrated in the table above. Fourteen respondents (16%) were between the age of 18-25 years, 50(57%) were 26-35 years, 20 (23%) were 36-45 years and 3(3%) were 46-55 years of age. This showed that 50(57%) had the highest frequency. Nineteen respondents (22%) had diploma education, 53(61%) had bachelors' education and 15(17%) had masters' education. Twenty-three (26%) had 1-5 years of experience, 35 (40%) had 6-10 years, 26 (30%) had 11-15 years and 3 (3%) had 16-20 years of experience. This showed that 35 (40%) had the highest frequency.

6.2. Descriptive Analysis

6.2.1. Teacher Knowledge on the Implementation of Integrated Science in JSS

Table 3 indicates that out of 87 responses, 7% strongly agreed that teachers in the school were well aware of the pedagogical content in integrated science, 18% agreed, 18% were not sure of that, 44% disagreed and 13% strongly disagreed (Mean=2.63; SD=1.132). Additionally, 7% strongly agreed that instructional goals for Integrated science were clear to the teachers, 28% agreed, 7% were not sure, 49% disagreed and 9% strongly disagreed (Mean=2.74; SD=1.166). Nine percent strongly agreed that there was coherence of instruction from the teachers in the school to the learners, 16% agreed, 21% were not sure, 22% disagreed and 32% strongly disagreed (Mean=2.48; SD=1.337). Moreover, 7% strongly agreed that teachers in the school had knowledge on integrated science content outcomes, 30% agreed, 2% were not sure, 36% disagreed and 25% strongly disagreed (Mean=2.57; SD=1.335). Furthermore, fifteen percent strongly agreed that teachers in the school were well aware of the curriculum content for integrated science, 14% agreed, 20% were not sure 36% disagreed and 15% strongly disagreed (Mean=2.80; SD=1.310). Moreover, 9% strongly agreed that educational contexts were well known by JSS integrated science teachers in the school, 23% agreed, 14% were not sure, 32% disagreed and 22% strongly disagreed (Mean=2.66; SD=1.301). The study participants' responses are summarized and presented in Table 3: -

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Table 3: Teacher Knowledge on the Implementation of Integrated Science in CBC

Statements	N	Mean	Std. Dev.	SA	A	N	D	SD
Teachers in the school are well aware of the pedagogical content in integrated science.	87	2.63	1.132	7	18	18	44	13
Instructional goals for Integrated science are clear to the teachers.	87	2.74	1.166	7	28	7	49	9
There is coherence of instruction from the teachers in the school to the learners	87	2.48	1.337	9	16	21	22	32
Teachers in the school have knowledge on integrated science content outcomes.	87	2.57	1.335	7	30	2	36	25
Teachers in the school are well aware of the curriculum content for integrated science.	87	2.80	1.310	15	14	20	36	15
Educational contexts are well known by JSS integrated science teachers in the school	87	2.66	1.301	9	23	14	32	22

Source: Research Data

The study sought to know how their school supported teacher knowledge on the implementation of Integrated Science. HOD1 noted, "The school has challenges in supporting teacher knowledge on the implementation of Integrated Science. Although the school makes effort in enhancing teacher knowledge, there is the issue of insufficiency of resources. Integrating various scientific disciplines into one cohesive curriculum requires access to a wide range of teaching materials, textbooks and laboratory equipment, which may not always be readily available. Additionally, ensuring that teachers have the necessary expertise in all areas of Integrated Science is challenging. Therefore, the school continuously work towards sourcing and developing comprehensive resources and providing targeted training to bridge any knowledge gaps among our teaching staff."

The study inquired from the principals how their schools supported teacher knowledge on implementation of Integrated Science in CBC. Principal 4 noted, "The school has established a comprehensive professional development program that specifically addresses the interdisciplinary nature of Integrated Science. This program includes workshops, seminars and peer mentoring sessions focused on equipping teachers with the necessary knowledge and skills to effectively integrate multiple scientific disciplines into their instruction. Additionally, we provide access to a wide range of resources, including textbooks, online databases, and teaching materials, to support teachers in staying updated with the latest advancements in Integrated Science. Furthermore, we encourage collaborative lesson planning and sharing of best practices among our teaching staff to foster a culture of continuous improvement."

Principal 5 indicated, "The school offers regular workshops and training sessions specifically

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tailored to Integrated Science instruction, where teachers can learn about effective teaching strategies, assessment techniques and curriculum alignment. Additionally, we provide opportunities for teachers to collaborate with colleagues, share resources and engage in peer learning communities focused on Integrated Science education. Moreover, we encourage teachers to pursue further education and training through external courses, conferences, and online resources."

6.2.2. Implementation of Integrated Science in the CBC

Out of 87 responses, 14% strongly agreed that the syllabus for integrated sciences was covered in time in the school, 32 % agreed, 53% disagreed and 1% strongly disagreed (Mean=3.05; SD=1.210). Additionally, 9% strongly agreed that there was improved pedagogical approach in integrated science courses in the school, 21% agreed, 16% were not sure, 34% disagreed and 20% strongly disagreed (Mean=2.66; SD=1.265). Five percent strongly agreed that students in the school achieved set outcomes in integrated science, 25% agreed, 11% were not sure, 31% disagreed and 28% strongly disagreed (Mean=2.48; SD=1.265). Additionally, 7% strongly agreed that teaching and learning activities in the school runs effectively in the laboratory, 20% agreed, 14% were not sure, 45% disagreed and 14% strongly disagreed (Mean=2.62; SD=1.164). Eleven percent strongly agreed that teaching and learning activities in the school were efficient, 16% agreed, 15% were not sure, 30% disagreed and 28% strongly disagreed (Mean=2.54; SD=1.354). Moreover, 8% strongly agreed that there was improvement for integrated science performance among students in the school, 30% agreed, 3% were not sure, 45% disagreed and 14% strongly disagreed (Mean=2.74; SD=1.253).

Table 4 Implementation of Integrated Science in the CBC

Statements	N	Mean	Std. Deviation	SA	A	N	D	SD
The syllabus for integrated sciences is covered in time in the school.	87	3.05	1.210	14	32	0	53	1
There is improved pedagogical approach in integrated science courses in the school	87	2.66	1.265	9	21	16	34	20
Students in the school achieve set outcomes in integrated science.	87	2.48	1.265	5	25	11	31	28
Teaching and learning activities in the school run effectively in the laboratory.	87	2.62	1.164	7	20	14	45	14
Teaching and learning activities in the school are efficient.	87	2.54	1.354	11	16	15	30	28
There is improvement for integrated science performance among students in the school.	87	2.74	1.253	8	30	3	45	14

Source: Research Data

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The study sought from the HODs their department's status on the implementation of Integrated Science. HOD4 noted, "The department has not made significant progress in implementing Integrated Science in its curriculum. Teachers have barely undergone any training to understand the principles and methodologies of Integrated Science instruction. The program is continually refined and improved to meet student needs and prepare them for success in the ever-changing world. Limited resources are a huge barrier to full implementation of integrated science in CBC"

The study sought from the principals their schools' status on the implementation of Integrated Science. Principal 7 noted, "The school has not made significant progress in implementing Integrated Science in curriculum due to a lack of teaching staff and resources. There are inadequate financial resources and equipped laboratories to support implementation of integrated Science. Innovative instructional approaches like inquiry-based learning and project-based assessments have not been implemented. The school is however committed to ensure success of the program."

The study sought to comprehend challenges in the implementation of Integrated Science in JSS in their schools. Principal 1 indicated, "The implementation of Integrated Science in our school faces challenges such as coordinating the integration of scientific disciplines into a cohesive curriculum, maintaining teacher alignment, and maintaining a broad range of knowledge and skills. Assessment and evaluation also present challenges, as traditional methods may not capture students' understanding. Addressing these requires collaboration, professional development, and adaptation of instructional strategies to meet student needs effectively."

The researcher inquired from principals on what could be done to address challenges in the implementation of Integrated Science in JSS in their schools. Principal 3 noted, "It is important to provide continuous professional development opportunities, enhance teacher collaboration and allocate adequate resources for implementation of integrated science in the CBC. This would enhance student engagement and achievement in CBC."

6.3. Inferential Analysis

6.3.1. Correlation Analysis

Pearson correlation analysis was carried out and results illustrated in Table 5

Table 5: Correlation Analysis

		Implementation
Implementation	Pearson Correlation	1
	Sig. (2-tailed)	
	N	87

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Teacher Knowledge	Pearson Correlation	.926**
	Sig. (2-tailed)	0.000
	N	87

**. Correlation is significant at the 0.05 level (2-tailed).

Source: Research Data

The research findings highlight correlations between variables. The significance of these correlations is determined by p-values. Results showed that teacher knowledge positively correlated with implementation of integrated science in the CBC in JSS(r=0.926 p=0.000).

6.3.2. Hypothesis Testing

The study hypothesis was; H01 : There is no significant relationship between teacher knowledge and implementation of Integrated Science in junior schools in Westlands Sub-County. Results indicate t=22.611; p=0.000 shows that teacher knowledge is a significant determinant of implementation of Integrated Science in junior schools in Westlands Sub-County. The null hypothesis that there is no significant relationship between teacher knowledge and implementation of Integrated Science in junior schools in Westlands Sub-County is rejected. Results of this study's first hypothesis is indicated in Table 6.

Table 6 : Hypothesis H_{01} Testing

Model	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
(Constant)	0.249	0.118		2.116	0.037
teacher knowledge	0.918	0.041	0.926	22.611	0.000

a. Dependent Variable: implementation

Source: Research Data

6.3.3. Linear regression model

A regression analysis was done to explore how the independent variables effect the dependent variable. An overview of the linear regression model is shown in Table 7

Table 7: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.746[a]	0.673	0.593	0.00859

a. Predictors: (Constant), teacher knowledge

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b. Dependent Variable: implementation of integrated science in CBC

Source: Research Data

Results reveal that the coefficient of determination, r squared is 0.673 that is, 67.3%. This means that implementation of integrated science in the CBC in junior schools would vary by 67.3% due to changes in teacher knowledge, at 95% confidence level. Only 32.7 % of the variations in implementation of integrated science in the CBC in junior schools can be ascribed to other factors. The correlation coefficient, denoted , R, is a measure for assessing the relationship between variables. Findings revealed a significant and positive correlation between the variables, evident by a correlation coefficient of 0.746.

Table 8: ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	109.219	3	36.406	82.429	.000[b]
Residual	7.904	83	0.095		
Total	117.123	86			

a. Dependent Variable: implementation

b. Predictors: (Constant) teacher knowledge

Source: Research Data

ANOVA results showed a level of significance at p=0.000, highlighting the significant link between the dependent and independent variables. This finding reveals that there exists a significant relationship between variables. Moreover, the calculated F-value was observed to be greater than the critical F-value (82.429> 2.719). The model employed in the study is thus reliable and consequently, the results are considered adequate to formulate conclusive findings and offer credible recommendations.

Table 9: Coefficients

	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
(Constant)	-0.175	0.093		-1.882	0.063
teacher knowledge	0.355	0.066	0.358	5.369	0.000

a. Dependent Variable: implementation of integrated science in JSS CBC.

Source: Research Data

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Table 4.15 shows the model equation to be:

$Y = -0.175 + 0.355 X_1 + \varepsilon$

Findings reveal that teacher knowledge positively and significantly affects implementation of integrated science in the CBC in junior schools ($\beta = 0.355$, $p = 0.000$). A unit increase in teacher knowledge leads to 0.355 unit increase in implementation of integrated science in the CBC in junior schools.

7. Findings of the Study

Teacher knowledge positively and significantly relates with implementation of integrated science in the CBC in JSS. Indeed, social development theory proposes that learning occurs through social interaction and collaboration. Teachers who possess comprehensive knowledge of integrated science and pedagogical strategies can effectively scaffold students' understanding and facilitate meaningful learning experiences (Healy, 2015). Teachers can create collaborative learning environments where students engage in inquiry-based activities, problem-solving tasks and hands- on experiments. Through active participation and interaction with peers, students construct their knowledge of integrated scientific concepts, fostering deeper understanding and skills development (Law, 2022). Therefore, teacher knowledge, informed by social development theory, significantly relates with the successful implementation of integrated science in CBC.\

Study findings corroborate those of Sakib and Obra (2019) who assessed teachers' knowledge of teaching secondary science curricula in Isabela, Philippines. They evaluated teachers' understanding of subject matter, scientific process skills, curriculum planning, and methods. They also assessed challenges, teaching techniques, resources and evaluation methods. The study found teachers were well-prepared, but had difficulty with abstract concepts and mathematical calculations. Accessibility of educational technologies was an issue. Additionally, Chemagosi (2020) highlighted the importance of teachers' knowledge in implementing CBC in Kilifi and Nandi counties. The study emphasized the role of effective school leadership in implementing CBC, highlighting the need for teachers to be well-prepared and equipped with necessary knowledge. Likewise, Isaboke et al. (2021) found challenges in CBC implementation in Machakos County, Kenya, including inadequate teacher preparation, lack of school infrastructure, understaffing, and resource shortages. Awili and Begi (2021) found head teachers prioritized administrative roles over curriculum implementation, while Okoth (2018) found instructional leadership was moderate and dependent on teacher qualifications.

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8. CONCLUSIONS AND RECOMMENDATIONS

8.1. Conclusions of the Study

This study concludes that majority of teachers in JSS lack awareness of the pedagogical content related to integrated science. There is no clear understanding of the instructional goals for integrated science, leading to a lack of coherent instruction from teachers to learners. Additionally, most JSS teachers are unfamiliar with the content outcomes of integrated science, revealing a significant gap in their knowledge of the curriculum. This lack of awareness extends to the educational contexts within which integrated science should be taught, indicating that JSS integrated science teachers are generally not well-versed in the curriculum content and its instructional framework.

8.2. Recommendations of the Study

The management of JSS should leverage technological advancements and provide internet access, which plays a crucial role in keeping teachers updated on teaching methodologies and advancements in integrated science education. Online resources, webinars and professional development platforms should be availed to teachers to enhance their implementation of CBC.

The Teachers Service Commission should employ and post more teachers with competence in each of the science subjects. This would ensure teacher workload management and promote teaching and learning in integrated science. In the same vein, the management of JSS should implement strategies to manage workload pressures, streamline administrative processes and offer incentives for participation in professional development activities. Continuous education opportunities ensure that teachers remain updated on best practices and innovations in integrated science education.

The CUE and universities should collaborate on a curriculum for integrated science teachers in physics, chemistry and biology, that incorporate interdisciplinary approaches, pedagogical techniques and practical experiences for effective instruction in the CBC.

Teacher training workshops should expand the scope and depth of professional development opportunities to cover a broader range of topics, including assessment strategies, interdisciplinary teaching approaches, and technology integration. This ensures that teachers receive comprehensive training that addresses their diverse needs and challenges.

The management of JSS should enhance collaborative learning communities among teachers to facilitate knowledge sharing, peer support and collaborative problem solving. Structured meetings, online forums and professional learning communities can provide avenues for teachers

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to collaborate, share resources and exchange ideas for improving integrated science instruction.

The boards of management of JSS should provide leadership training, mentorship and resources to equip HODs and principals with the necessary skills and knowledge to support implementation of integrated science in CBC. Collaboration between school leadership, HODs and principals is critical for enhancing change and improvement in integrated science.

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