

Influence of Teachers' Welfare TQM practices on learners' academic achievement in Integrated Science in junior schools in Bomet County, Kenya

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ABSTRACT

Total Quality Management (TQM) holds significant transformative potential for science education, yet academic achievement in Integrated Science among Junior School learners in Bomet County, Kenya, remains well below national expectations. Baseline data from the 2023 KPSEA showed that 59.92% of learners performed at "Approaching" or "Below Expectations" levels, a declining trend that persisted in subsequent School-Based Assessments where 67.3% of Grade Seven and 62.3% of Grade Eight learners failed to achieve standard mastery. Crucially, the 2025 KJSEA recorded a low county mean score of 31.63% in the "Approaching Expectations" category, reflecting only 30% to 40% mastery of core competencies, directly threatening Kenya Vision 2030's target of transitioning 60% of learners into Senior School STEM pathways. Grounded in Deming's TQM Theory and Hattie's Visible Learning Theory, this study investigated the specific influence of Teacher Welfare (TW) on Integrated Science achievement using a pragmatist philosophy and a mixed-methods concurrent triangulation design. From a target population of 21,653 participants across Bomet County, a quantitative sample of 230 Heads of Institutions (HOIs) yielding response rate of 194 (84.53%) was surveyed ($\alpha=.89$). The qualitative phase involved saturation-based interviews with 5 Sub-County Directors of Education and 23 Grade Nine parents' representatives, alongside 36 classroom observations involving 36 facilitators and 2,756 Grade Nine learners, bringing total completed study participation to 3,050 individuals. Procedural dependability was established through a pilot study in 23 Junior Schools in Kericho County. Quantitative analyses in SPSS at $\alpha=.05$ revealed that while the combined four-dimension TQM model accounted for 36.9% of performance variance ($R^2=.369$, $p \leq 0.01$), Teacher Welfare independently explained 13.6% of the variance ($R^2=.136$, $\beta=.369$, $p \leq 0.01$). Qualitative analysis in NVivo 14 highlighted three critical constraints: overcrowded classrooms exceeding 40 learners, an 86.1% ICT integration deficiency, and severe teacher burnout. Realizing Vision 2030 STEM goals requires prioritizing robust teacher welfare frameworks alongside equitable resourcing.

Key-Terms: Total Quality Management (TQM), Teacher Welfare, Academic Achievement, Integrated Science.

INTRODUCTION

Total Quality Management (TQM) is a holistic, human-centric philosophy designed to embed quality into every organizational facet through collaborative teamwork, employee empowerment, and systematic benchmarking (Abimbola et al., 2021;). Historically conceptualized in the early twentieth century and formalized by pioneering theorists such as W. Edwards Deming, Joseph Juran, and Philip Crosby, TQM has increasingly been adapted to the education sector to elevate teaching and learning standards (; Psomas et al., 2025). Within educational institutions, this philosophy serves as a strategic framework that aligns administrative functions and resource distribution directly with classroom instruction (Kakingo & Lekule, 2021). Ultimately, by uniting the entire school community under a shared vision of continuous improvement, TQM fosters a durable culture of excellence that not only optimizes learner outcomes but also drives broader socio-economic development (Alauddin & Yamada, 2022).

The International Organization for Standardization (ISO 9001:2015) identifies the foundational principles of Quality Management as leadership commitment, continuous improvement, customer focus, engagement of people, process management, and evidence-based decision-making. To align these global principles with the localized operational context of Junior Schools in Bomet County, this study synthesizes these constructs into four targeted principles: stakeholder engagement, learner focus, continuous improvement, and process management. Consequently, this study operationalizes these practices at the primary level of administrative accountability: the Head of Institution (HOI) serves as the principal Quality Enabler. Within this administrative quality framework, theoretical constructs are operationalized through four interrelated pillars, with a central empirical focus on Teachers' Welfare (TW) as a key determinant of instructional effectiveness.

Teachers' Welfare (TW) TQM Practices are operationalized by examining the institutional support mechanisms that enhance teachers' motivation, well-being, and professional commitment. Within this pillar, Stakeholder Engagement encourages collaborative welfare initiatives involving school leadership, external partners, and other stakeholders in creating supportive working environments. Customer Focus recognizes that addressing teachers' welfare needs contributes directly to improved instructional quality and learner outcomes. Process Management promotes equitable workload distribution, transparent communication channels, and structured feedback systems that enhance organizational effectiveness. Meanwhile, Continuous Improvement facilitates the ongoing refinement of welfare policies and administrative support systems to strengthen teacher satisfaction, commitment, and instructional performance.

While complementarily linked to Teacher Welfare (TW), Continuous Improvement serves as the overarching TQM principle integrating these pillars. Grounded in Deming's Plan-Do-Study-Act (PDSA) cycle and supported by contemporary quality management practices in education, this principle enables Heads of Institutions to systematically assess academic achievement, identify gaps in instructional delivery, resource utilization, teacher support, and learner welfare, and implement evidence-informed interventions that enhance school performance. Through this iterative process, institutional leadership continuously refines organizational practices, strengthens stakeholder participation, improves teaching quality, and promotes sustained learner achievement in Integrated Science.

Parallel to Total Quality Management (TQM), Competency-Based Education (CBE) has emerged as a transformative educational approach that emphasizes learner outcomes and practical skill development (Ainscow, 2020; OECD, 2015). Global implementations in countries such as Finland, Sweden, and Scotland demonstrate that supportive teacher environments and continuous pedagogical support significantly elevate practical skill acquisition. However, the prevailing global challenge remains the "learning crisis," where increased enrollment does not necessarily equate to skill acquisition due to inadequate instructional standards and unmanaged educator stress (World Bank [WDR], 2018; UNESCO, 2024). In Sub-Saharan Africa and regional contexts, comparative studies highlight that persistent barriers, such as inadequate teacher training, limited funding, heavy workloads, and poor working conditions, severely hinder inquiry-based teaching and competency-based assessment execution (Nsengimana et al., 2020; Dusabimana & Leon, 2022; Muchira et al., 2023; Kubai, 2023; Mwangi, Ndanu, & Awino, 2024). Research underscores the pivotal role of science teachers in advancing science education (Maphosa, et al, 2016), emphasizing that educator welfare and physical learning infrastructure are inseparable prerequisites for effective science instruction in junior schools (Inghug, 2020).

In Kenya, the application of TQM practices in education is firmly anchored in the Constitution of Kenya (2010), Sessional Paper No. 1 of 2005, Sessional Paper No. 1 of 2019, the Basic Education Act (2013, amended to 2025), and the Basic Education Curriculum Framework (BECF, 2019). Within this statutory environment, Integrated Science serves as a critical focus due to its role as a strategic gateway under the Competency-Based Education (CBE) model, where approximately 60% of learners are projected to transition into STEM pathways in Senior School to support Kenya's Vision 2030 (Ministry of Education, 2025; KICD, 2024). In Bomet County, while TQM interventions such as leadership training through KEMI, stakeholder sessions at KSG, and retooled teacher support via SBTSS and SMASSE have been deployed (MoE, Bomet County, 2024), learner achievement remains critically low.

According to the Kenya National Examinations Council (KNEC, 2023), national 2023 KPSEA outcomes indicated that only 49.09% of candidates met or exceeded expectations in Science & Technology, while 40.92% performed at "Approaching or Below Expectations" levels. While the national 2025 KJSEA recorded 76.86% of learners meeting or exceeding proficiency thresholds in Integrated Science (KNEC, 2025), Bomet County exhibited a severe localized performance deficit. In Bomet County, the KJSEA mean percentage for Integrated Science was recorded at a depressed 31.63%, reflecting only 30–40% core competency mastery. This underperformance aligns with Bomet's 2023 KPSEA baseline (where 59.92% failed to achieve mastery) and subsequent School-Based Assessments (SBAs), where 67.3% of Grade 7 learners and 62.3% of Grade 8 learners scored at "Approaching or Below Expectations" levels (MoE, 2024).

Comparative data further highlights this administrative and instructional execution gap: while neighboring Kericho County maintained a terminal KJSEA mean score of 41.06% in Integrated Science, Bomet County dropped from a 32.48% KPSEA baseline to a 31.63% KJSEA mean, marking a net decline of 0.85% and a nearly 10 percentage point gap behind Kericho (MoE, 2024). Because both counties share similar physical environments and resource allocations, these persistent disparities indicate that Bomet's science achievement crisis stems from internal school management and administrative execution deficits, specifically regarding how school leaders support, motivate, and manage Teachers' Welfare. Investigating Teachers' Welfare within the TQM framework provides a data-driven, pragmatic pathway to stabilize the instructional environment, alleviate teacher strain, and secure national STEM transition goals under Vision 2030.

Statement of the Problem

Total Quality Management (TQM) provides a strategic framework for driving educational excellence by fostering a culture of continuous improvement, stakeholder collaboration, and accountability. It places learners at the center of decision-making, encourages teamwork among educators, parents, and administrators, and ensures that institutional resources, administrative support structures, and curricula are aligned with clearly defined quality objectives. When effectively implemented, TQM enhances teaching practices, strengthens learner engagement, and promotes a more inclusive and responsive learning environment. Central to this system is the strategic management of human resources, where prioritizing Teacher Welfare (TW) directly stabilizes instructional execution, alleviates educator strain, and cultivates a high-performing pedagogical culture.

However, despite ongoing training initiatives under the Competency-Based Education (CBE) framework, academic achievement in Integrated Science among junior school learners in Bomet County continues to fall drastically below national expectations. Baseline data from the Kenya Primary School Education Assessment (KPSEA, 2023) indicate that 59.92% of learners performed at the "Approaching Expectations" or "Below Expectations" levels. This regressive trend persisted in subsequent School-Based Assessments (SBAs), where 67.3% of Grade 7 and 62.3% of Grade 8 learners failed to meet established performance benchmarks. Ultimately, by the terminal Grade 9 summative assessment, the Kenya Junior School Education Assessment (KJSEA)—the county mean score for Integrated Science in Bomet County had dropped to a mere 31.63%, leaving local learners heavily anchored in the lower tier of the "Approaching Expectations" band (Ministry of Education, Bomet County Report, 2024). This persistent underperformance presents a significant challenge to the realization of Kenya's Vision 2030, which identifies Science, Technology, and Innovation (STI) as key drivers of economic transformation. With the government targeting a 60% transition rate into STEM pathways at the Senior School level (MoE, 2025), strengthening foundational science education at the junior school level is essential to building a robust and future-ready STEM workforce.

While general school leadership and pedagogical retooling have received attention, a major administrative disconnect persists regarding how institutional leadership addresses the psychological, operational, and physical well-being of science teachers. Unmanaged teacher workloads, large class sizes, insufficient instructional support, and weak institutional recognition systems foster educator burnout and low morale, directly degrading classroom delivery in practical science subjects. This study specifically investigated the influence of Total Quality Management (TQM) practices on learners' academic achievement in Integrated Science in junior schools within Bomet County, placing an empirical focus on evaluating the contribution of Teachers' Welfare. The findings provide critical evidence on the extent to which structured teacher welfare TQM practices explain

variations in learners' academic achievement, offering actionable insights for strengthening science education under the Competency-Based Education framework

Importantly, this study emphasizes that TQM, and specifically Teacher Welfare, is not merely an administrative convenience but an academic imperative. Systematic interventions, particularly in supporting teacher well-being, workload balance, and motivational support, were shown to significantly enhance learners' academic achievement in Integrated Science. By demonstrating the measurable statistical impact of Teacher Welfare within the broader quality management framework, this research provides an evidence-based roadmap for transforming junior secondary schools into centers of scientific excellence and advancing Kenya's technological and educational development goals.

LITERATURE REVIEW

Teachers' Welfare TQM Practices and Learners' Academic Achievements in Integrated Science

Teacher welfare is increasingly recognized as a vital dimension of educational quality and institutional effectiveness, encompassing the physical, psychological, social, and professional conditions that shape educator motivation, job satisfaction, commitment, and instructional capacity. Within a Total Quality Management (TQM) framework, teacher welfare assumes a foundational role because educators constitute the core human resource whose well-being directly dictates the quality, consistency, and execution of institutional processes. Supportive working conditions, formal recognition, social support, appropriate incentives, and accessible psychosocial services foster high teacher motivation, establishing the prerequisite environment for effective classroom instruction. Globally, UNESCO (2024) emphasizes in its *Global Report on Teachers* that empowering, recruiting, training, and supporting educators through improved working conditions and professional support is essential for building resilient education systems, strengthening teacher retention, and boosting instructional effectiveness. This global stance establishes that teacher welfare is not merely an employment condition, but a critical strategic lever for driving broader educational performance and academic quality.

Empirical scholarship consistently associates structured institutional welfare systems with enhanced teacher performance and service delivery across diverse international contexts. Apriliani et al. (2023) demonstrated that institutional professional development and support pathways significantly improved teacher performance, while Ahiruddin et al. (2021) identified a strong positive relationship between structured teacher welfare mechanisms and workplace effectiveness. Expanding on these multidimensional welfare components, Rwigema (2022) examined physical working conditions and institutional benefits across the East African Community, while Ladipo (2020) demonstrated a direct link between welfare structures and organizational effectiveness in Lagos State, Nigeria. Further supporting these findings, Harapan and Wahidy (2021) reported that teacher welfare explained a substantial proportion of variance in educational service quality in Banyuwasin Regency, Indonesia. Similarly, Isong et al. (2023) in Rivers State, Nigeria, and Johnson et al. (2023) in West Akim, Ghana, confirmed that institutional welfare packages, administrative support, and healthy interpersonal relationships significantly elevated basic schoolteacher performance. Collectively, these global and regional studies prove that teacher welfare extends far beyond financial compensation to encompass leadership support, healthy work environments, workload management, and targeted psychosocial care.

In the Kenyan context, empirical attention to educator well-being has grown alongside national curriculum reforms. Otundo (2024) highlighted the positive contribution of mindfulness practices and stress management frameworks to teacher welfare in coastal public junior secondary schools, while Ogari and Orwa (2021) established that structured social support programs significantly enhanced teacher performance in private schools within Bomet County. However, from a TQM perspective, traditional welfare approaches that focus solely on isolated benefits or basic salaries fall short. A true TQM-driven welfare strategy requires institutional leaders, specifically Heads of Institutions, to systematically identify employee needs, establish transparent communication and equitable workload processes, monitor workplace conditions, and continuously refine support policies using Deming's Plan-Do-Study-Act (PDSA) cycle. Recognizing teachers as internal customers

whose morale and engagement directly govern learning outcomes transforms teacher welfare from a passive administrative duty into an active, continuous quality improvement mechanism.

Despite these insights, several critical empirical gaps persist in the literature. First, existing research predominantly evaluates teacher welfare in relation to intermediate outcomes—such as teacher job satisfaction, general workplace performance, or overall service quality—rather than direct, measurable learner academic achievement. Second, previous studies routinely analyze isolated welfare elements (e.g., stress management or monetary incentives) rather than conceptualizing Teacher Welfare as an integrated, process-driven TQM pillar. Third, there is a distinct lack of empirical evidence linking teacher welfare to academic achievement in Integrated Science—a subject defined by heavy practical, inquiry-based, and collaborative demands that require sustained pedagogical energy. Fourth, limited research addresses public junior secondary schools navigating Kenya's Competency-Based Education (CBE) framework, where rapid curriculum transitions, new assessment demands, severe ICT deficiencies, and overcrowded classrooms generate acute teacher strain. This study directly addresses these gaps by evaluating the empirical influence of Teacher Welfare TQM practices on learners' academic achievement in Integrated Science within Junior Schools in Bomet County.

MATERIALS AND METHODS

Chapter Three delineates the empirical research design and methodological framework executed to investigate the influence of Total Quality Management (TQM) practices on learners' academic achievement in Integrated Science within Junior Secondary Schools in Bomet County, Kenya. Grounded in a pragmatist research philosophy incorporating hybrid ontology and hybrid epistemology (Burke & Christensen, 2020;), the study adopted a mixed-methods concurrent triangulation design (QUAN + QUAL) based on the framework by Guetterman et al. (2019). This design merged a quantitative cross-sectional survey rooted in positivist epistemology (Creswell & Creswell, 2023;) with a qualitative descriptive phenomenological approach grounded in interpretivist (Watson, 2024). This dialectical pluralism (Johnson, 2017) supported simultaneous data collection and methodological integration (Yuwono & Rachmawati, 2023), enabling quantitative models to establish statistical generalizability while qualitative strands provided deep contextual insights into administrative quality enablers, school-level operational dynamics, and teacher welfare support structures (Mohamed et al., 2021).

The target population comprised 21,653 potential participants across Bomet County's five sub-counties (Bomet Central, Bomet East, Konoin, Sotik, and Chepalungu), including 5 Sub-County Directors of Education (SCDEs), 541 Heads of Institutions (HOIs), 541 Grade Nine parents' representatives, 541 Integrated Science Facilitators (ISFs), and 20,025 Grade Nine learners, aligned with Ministry of Education records (MoE, 2025) and the Basic Education Act (2025). To evaluate macro-level administrative quality enablers, the quantitative sampling frame focused on institutional managers. Using Yamane's formula (Yamane, 1967; Adams & Yamen, 2020) at a 95% confidence level and 5% margin of error ($e = .05$), a quantitative baseline sample size of 230 Heads of Institutions was selected via proportionate stratified random sampling across 31 educational zones (Fraenkel et al., 2019; Kothari & Garg, 2023). A lottery technique was applied for unbiased school selection (Guetterman et al., 2019). The qualitative strand employed a nested sampling design (Burke & Christensen, 2020): saturation sampling included all 5 SCDEs, while purposive sampling engaged 23 Grade Nine parents' representatives (interviewed to data saturation) and 36 classroom observations involving 36 ISFs and 2,756 Grade Nine learners (MoE, 2025), bringing the total completed study participation to 3,050 individuals.

Data collection utilized five complementary research instruments developed under expert supervision (Fraenkel et al., 2019): semi-structured survey questionnaires for HOIs (Saunders et al., 2023), in-depth interview schedules for SCDEs and parents' representatives (Luhmann, 2021), non-participative classroom observation checklists (Lune & Berg, 2017; Mirhosseini, 2020), and document analysis guides evaluating schemes of work, lesson plans, assessment rubrics, and CBA portal logs (Armstrong, 2021). A central empirical focus was placed on measuring Teacher Welfare (TW). Within the HOI questionnaire, Teacher Welfare was operationalized using 5-point Likert scales, dichotomous items, and multiple-choice questions to capture institutional support mechanisms, equitable workload distribution, transparent communication, and continuous refinement of motivational policies (Theodoropoulou et al., 2026).

Instrument validity was established through face, content, construct, and criterion validity (DeVellis, 2017;), with content validity quantified using Lawshe's Content Validity Ratio (CVR) formula across expert panel assessments (Lawshe, 1975). Instrument reliability was confirmed through a preliminary pilot study across 23 Junior Secondary Schools in neighboring Kericho County, yielding a high internal consistency score (Cronbach's $\alpha = .853$) for the primary HOI questionnaire. Quantitative data were processed and analyzed using SPSS Version 27 at a significance threshold of $\alpha = .05$. Descriptive statistics (frequencies, percentages, means, and standard deviations) summarized demographic profiles and TQM indicator scores, while multiple linear regression analysis was executed to evaluate the predictive power of the four TQM dimensions on Grade Nine KJSEA Integrated Science scores. Qualitative transcripts were transcribed, organized, and analyzed thematically using NVivo Version 14 following Braun and Clarke's reflexive workflow. Methodological triangulation integrated quantitative regression parameters (beta coefficients, R^2 values, ANOVA F-tests) with qualitative themes, verifying how administrative teacher welfare provisions directly condition classroom pedagogical execution, educator commitment, and student competency acquisition in Integrated Science.

RESULTS AND DISCUSSIONS

Influence of TQM practices on Teachers' Welfare TQM practices in junior schools, in Bomet County, Kenya

The following objective sought to ascertain TW TQM practices in junior schools in Bomet County, Kenya. The findings are presented in this section

Regression analysis and hypothesis testing on the relationship between Teacher Welfare TQM Practices and Learners academic achievements in Integrated Science (ACIS).

Hypothesis testing were conducted to evaluate the predictive influence of Teacher Welfare (TW) TQM practices on academic achievement in Integrated Science. Utilising an aggregate mean score of 3.912 from the 2025 KJSEA as the performance benchmark, regression analyses were executed on Head of Institution (HOI). The study adhered to a strict decision rule, rejecting the null hypotheses where the computed p-values fell below the significance threshold of $\alpha = .05$. The study further triangulated quantitative findings with qualitative insights from key informant interviews, document analysis, and classroom observation checklists.

H_{03} : stated that *'of Teachers' Welfare TQM practices have no significant effect on learners' academic achievements in integrated science at junior schools in Bomet County, Kenya.*

Table 1 HOIs Model Summary on TQM practices on TW and ACIS

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.369	.136	.132	.36445

The regression analysis model summary presented in Table 1 indicates a moderate positive relationship between Teachers' Welfare (TW) TQM practices and academic achievements in Integrated Science, yielding a correlation coefficient of $r = .369$. The coefficient of determination ($R^2 = .136$) reveals that TW explains 13.6% of the variance in student achievement, which adjusts to an Adjusted R^2 of .132 (13.2%) after accounting for sample size and the single predictor structure. This demonstrates a stable model fit for a single-predictor institutional welfare framework. The standard error of the estimate stands at .36445, reflecting an acceptable and strong level of prediction accuracy across the sampled junior schools.

While the findings confirm that TW is a relevant and statistically viable predictor of academic success, approximately 86.4% of the variation in the dependent variable remains unexplained, driven by external, non-instructional factors omitted from this specific single-variable model. This substantial unexplained variance is common in educational regression models, as a large portion of a student's academic performance is independently driven by non-instructional variables such as home socio-economic environment, physical school infrastructure, and institutional resource constraints.

Table 2 HOIs ANOVA on TW TQM practices and ACIS

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.025	1	4.025	30.300	.000
	Residual	25.502	192	.133		
	Total	29.526	193			
a. Dependent Variable: ACIS						
b. Predictors: (Constant), TW						

 $\alpha = .05$

The ANOVA results presented in Table 2 confirm that the linear regression model utilizing Teachers' Welfare (TW) TQM practices to predict Academic Achievements in Integrated Science is statistically significant and highly reliable. The model yielded a substantial F-statistic of 30.300 with 1 regression degree of freedom and 192 residual degrees of freedom ($df = 1, 192$). The associated significance value is reported as $p < .001$ (indicated by .000) , demonstrating that the probability of these experimental results occurring by chance is virtually non-existent, falling well below the established alpha threshold ($\alpha = .05$) .

Out of a total sum of squares ($SS\ Total = 29.526$) , the regression model accounts for a mathematically meaningful portion of the variance ($SS\ Regression = 4.025$) , leaving a residual sum of squares ($SS\ Residual$) of 25.502 . Additionally, the model demonstrates a reasonable fit to the data, as evidenced by a residual mean square error (MSE) of .133, which minimizes the variance of the error terms. Collectively, these findings confirm that the regression model is highly appropriate for explaining variations in student achievement, resulting in the formal rejection of the null hypothesis stating that TQM practices in teacher welfare management have no significant influence on academic achievement in Integrated Science. This validates the predictive power of the TW framework within the junior schools of Bomet County.

Table 3 Regression analysis; on Relationship between Teacher Welfare TQM practices and Learners academic achievements in Integrated Science.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.527	.251		10.053	.000
	TW	.354	.064	.369	5.505	.000

The regression analysis results presented in Table 3 demonstrate that Teachers' Welfare (TW) TQM practices exert a statistically significant and positive influence on Academic Achievements in Integrated Science (ACIS). This relationship is supported by an unstandardized coefficient of $B = 0.354$ (with a standard error of .064) and a standardized coefficient of $\beta = 0.369$. These metrics indicate that a single-unit increase in TW scores yields a corresponding 0.354-unit increase in academic achievements. The model generated a high-test statistic ($t = 5.505$) and an associated significance value of $p < .001$ (indicated by .000), falling securely below the conventional $\alpha = .05$ threshold. This confirms that TW is a strong, mathematically meaningful predictor of academic success. Consequently, the null hypothesis is rejected, establishing that the effective management of teacher welfare significantly drives student outcomes.

The regression equation $Y = \beta_0 + \beta_1 X_1 + \varepsilon$ with the constant= β_0 being 2.527 the coefficient can be plugged into the formula to predict learners' academic achievements in integrated science of junior schools using TW

$$ACIS = 2.527 + 0.354(TW) + \varepsilon$$

The constant ($\beta_0 = 2.527$) indicates that when resource mobilization is at a baseline zero level (text RM = 0), the predicted baseline score for learners' academic achievement in Integrated Science is 2.527 units. The unstandardized regression coefficient ($\beta_1 = 0.354$) reflects a positive and direct relationship between Teacher Welfare and academic outcomes. Specifically, for every single-unit increase in Teacher Welfare TQM practices, learners' academic achievement in Integrated Science is predicted to increase by 0.354 units, holding all other unmeasured factors constant in the residual error term. This demonstrates that effective Teacher Welfare significantly and positively enhances learner academic achievements in junior school Integrated Science.

Content and Thematic analysis on Teachers Welfare TQM practices and learners academic Achievements in Integrated Science in juniors schools in Bomet County, Kenya

This study employed content analysis, thematic analysis, and phenomenological reflection to effectively organize and interpret qualitative data in line with the research question: What is the influence of Teacher Welfare (TW) TQM practices on learners' academic achievements in Integrated Science in junior schools in Bomet County, Kenya?

Divergent perceptions emerged from parents' representatives regarding teacher welfare management in junior schools, highlighting a direct link between teacher morale and instructional quality in Integrated Science. *One parent observed, "Teachers appear overworked and sometimes demotivated..."* (PR11), indicating that despite the existence of formal welfare policies, teachers' lived experiences do not always reflect the intended institutional support. Another parent added, *"Some teachers seem stressed and lack the necessary resources to perform effectively"* (PR18), while a third noted, *"Occasionally, teachers complain about delayed allowances, which affects their enthusiasm"* (PR13). A fourth parent commented, *"Some teachers work long hours without adequate support, which impacts lesson delivery"* (PR19), and a fifth observed, *"Even with incentives in place, teachers often feel undervalued"* (PR20).

These collected perspectives suggest that Teacher Welfare practices under a Total Quality Management framework are inconsistently operationalized, directly compromising teacher enthusiasm during practical science lessons. In Integrated Science—a subject demanding intensive practical demonstrations, apparatus setup, and individual student guidance—teacher burnout and demotivation directly diminish classroom engagement, thereby constraining students' conceptual understanding and academic performance. The findings emphasize that formal welfare policies remain insufficient without systematic oversight, equitable resource allocation, and robust feedback mechanisms. Misalignment between policy provision and teachers' actual working conditions erodes professional commitment and classroom performance (Toropova et al., 2022). To sustain high morale and foster optimal science learning outcomes, core TQM principles, such as employee involvement, continuous improvement, and equitable support must be meaningfully integrated into everyday school operations.

Similarly, Sub-County Directors of Education (SCDEs) expressed varying perspectives on the enforcement of teacher welfare policies, revealing structural inconsistencies across junior schools. One SCDE observed, *"Policies exist, but enforcement depends on individual school leadership"* (SCDE4), suggesting that the realization of welfare provisions is largely contingent on administrative discretion. Another SCDE noted, *"Some schools are making efforts to support teachers through incentives and better working conditions"* (SCDE3), indicating pockets of exemplary practice where proactive leadership boosts teacher satisfaction. A third respondent highlighted that *"welfare policies are implemented differently depending on the head teacher's experience and motivation"* (SCDE1), reflecting the influence of leadership capacity on policy implementation. Conversely, another SCDE pointed out that *"in some cases, welfare policies are not fully implemented due to resource constraints"* (SCDE5), underscoring financial limitations that hinder consistent application. Additionally, an SCDE observed that *"monitoring of welfare implementation is irregular, and follow-up is often weak"* (SCDE2), exposing critical gaps in supervisory oversight.

These differing administrative perspectives reveal a persistent execution gap between formal welfare guidelines and their practical enforcement. In the context of TQM, uneven teacher support creates disparities in instructional delivery, ultimately affecting educational quality across schools. Empirical evidence emphasizes that leadership accountability, consistent monitoring, and institutionalized enforcement mechanisms are essential for translating

welfare policies into meaningful teacher support and improved student achievement (Skaalvik & Skaalvik, 2023).

Overall, the findings demonstrate that while teacher welfare policies exist within the county's educational framework, their potential to drive student success in Integrated Science is constrained by inconsistent enforcement, leadership variability, resource bottlenecks, and irregular oversight. Addressing these systemic bottlenecks will require strengthening supervisory frameworks, ensuring equitable welfare funding, and enforcing leadership accountability. Such measures are vital for ensuring that TQM teacher welfare practices effectively foster sustained teacher motivation, superior instructional effectiveness, and enhanced academic achievement among Integrated Science learners across junior schools in Bomet County (Darling-Hammond et al., 2022).

Table 4 Evidence of Teacher Welfare (TW) TQM practices

Evidence of TW documents;	Available & used(3)	Available & not used (2)	Not available (1)
1. Policy documents on welfare initiatives	15(45.5%)	11(33.3%)	7(21.2%)
2. Staff feedback records	12(36.4%)	10(30.3%)	11(33.3%)
3. Counselling records	11(33.3%)	9(27.3%)	13(39.4%)
4. Staff meeting minutes	19(57.6%)	8(24.2%)	6(18.2%)
5. Recognition program documentation	10(30.3%)	10(30.3%)	14(42.4%)
6. Incentive records	9(27.3%)	10(30.3%)	14(42.4%)

Source Field data, 2026

Document analysis in Table 4 reveals that Teacher Welfare (TW) in Bomet County is largely informal and reactive, lacking the institutional structure necessary for a robust support system. While staff meeting minutes are common (57.6%), they suggest that welfare is treated as a routine administrative task rather than a specialized well-being priority (OECD, 2023; UNESCO, 2024). Although 45.5% of schools have formal welfare policies, the majority either lack or fail to implement them, creating a gap that undermines the motivation needed for CBE reforms (World Bank, 2024).

The most critical weaknesses involve psychosocial support and recognition. Low rates of staff feedback (36.4%) and counselling documentation (33.3%) point to a lack of preventive care, which increases the risk of professional burnout (Hascher & Waber, 2022). Furthermore, over 42% of schools lack formal incentive or recognition programs. This institutional neglect is reflected in classroom observations: while 83.3% of teachers are professionally prepared, 72.2% show signs of stress or disengagement. Ultimately, relying on individual resilience rather than institutional support threatens the long-term stability and delivery of the Integrated Science curriculum (Skaalvik & Skaalvik, 2023).

Table 5 Teacher welfare TQM practices

Observed domains	Yes	partially	No
Teacher enthusiasm and motivation during instruction	24(66.7%)	8(22.2%)	4(11.1%)
Signs of stress and burnout/ disengagement	10(27.8%)	26(72.2%)	
Professional demeanour and preparedness	30(83.3%)	6(16.7%)	

Source Field data, 2026

The findings in Table 5 indicate a critical tension between professional standards and teacher well-being in Bomet County. While Total Quality Management (TQM) practices successfully maintain high professional standards with 83.3% of teachers demonstrating strong preparedness and 66.7% showing instructional

enthusiasm .Despite this high level of preparedness, psychosocial challenges remain pervasive: field data revealed that 27.8% of sampled teachers showed clear indicators of severe burnout, while the remaining 72.2% exhibited moderate stress-related signs. These empirical observations align with growing evidence on teacher stress and burnout under systemic curriculum shifts (Muchira et al., 2023; Skaalvik & Skaalvik, 2023). This suggests that the current workforce is under significant pressure, which threatens the long-term sustainability of the Competency-Based Education (CBE) framework. Ultimately, to safeguard Integrated Science instruction, school management must pivot from mere administrative oversight toward proactive emotional support and systematic workload monitoring.

Triangulation of Findings on Teacher Welfare (TW) TQM practices on learners academic achievements in Integrated Science

Triangulating the quantitative models, stakeholder interviews, document audits, and direct classroom observations reveals a structural dynamic best defined as a resilience-stress paradox, wherein high instructional output is maintained by individual teacher effort despite under-resourced institutional welfare frameworks. A comparison of quantitative data sources highlights a significant perceptual divergence between school administrators and classroom teachers. While regression models based on responses from Heads of Institutions indicated that Teacher Welfare significantly predicts academic achievement ($R^2 = .136$, $\beta = .369$, $p < .001$), This gap demonstrates that administrators interpret the existence of formal welfare policies as evidence of institutional support, classroom teachers experience these frameworks as largely disconnected from their daily instructional challenges and resource deficits. .

Qualitative reports from parents and Sub-County Directors partially converge with the document analysis, confirming that while overarching welfare guidelines exist, their practical application is reactive and fragmented. Parents consistently noted that science educators appear fatigued and under-resourced, an observation directly corroborated by document audits showing that over 42% of institutions lack functional recognition schemes or incentive records, and nearly 40% lack formal counseling support systems. Although routine administrative tasks such as staff meetings are documented in over half of the sampled schools, proactive mental health support, structured workload management, and formal wellness programs remain largely absent.

This structural shortfall aligns directly with classroom observation findings, which recorded high professional preparedness alongside widespread indicators of teacher stress and burnout. In practice, educators continue to deliver lessons professionally, but they do so under substantial psychological strain caused by heavy teaching loads and large class sizes. Within Total Quality Management theory, particularly the human-centric quality management frameworks articulated by Juran and Crosby, employees function as an organization's primary internal customers. When internal customer satisfaction and well-being are neglected, operational processes inevitably degrade, ultimately compromising product quality.

This internal human resource strain provides critical context for the county's overall academic performance in Integrated Science, where the mean score of 3.912 remains constrained within the basic "Approaching Expectation" performance tier. Exhausted educators operating under continuous work stress are more likely to deliver standard curriculum content without engaging in the intensive, individualized coaching required to move learners into advanced competency bands. While the statistical null hypothesis (H_{03}) was rejected on administrative grounds, the holistic triangulation of empirical data confirms that current teacher welfare practices are reactively managed and under-resourced. Securing sustained improvements in Integrated Science learning outcomes will require junior secondary school management to transition from passive policy compliance toward proactive well-being systems that actively address workload balance, mental health support, and meaningful professional recognition.

Summary of Findings on Influence of Teacher Welfare TQM Practices on learners' academic achievement in Integrated Science

The objective evaluated the influence of Teachers' Welfare (TW) Total Quality Management practices on learners' academic achievement in Integrated Science within Junior Secondary Schools in Bomet County .

Simple linear regression modeling isolating Teacher Welfare as an independent predictor demonstrated a statistically significant, positive relationship with student outcomes ($r = .369$).

From the perspective of Heads of Institutions (HOIs), Teacher Welfare independently accounted for 13.6% of the variance in academic achievement ($R^2 = .136$, Adjusted $R^2 = .132$), a finding structurally validated by the overall analysis of variance ($F(1, 192) = 30.300$, $p < .001$). Qualitative findings contextualized a significant Perception-Execution Gap between administrative expectations and frontline operational realities. Interviews with Sub-County Directors of Education (SCDEs) and parents' representatives revealed that while administrators view formal welfare policies as proof of institutional support, enforcement remains reactive and heavily dependent on individual head teacher initiative.

Document audits ($N = 33$) confirmed severe institutional neglect: 42.4% of schools lacked formal recognition or incentive allocation frameworks, 39.4% lacked counseling logs, and 33.3% lacked staff feedback records, with welfare management largely reduced to routine staff meeting minutes (57.6%).

Classroom observations ($N = 36$) revealed that while 83.3% of teachers maintained high professional preparation, 72.2% displayed partial stress or disengagement and 27.8% exhibited overt burnout. This strain is severely exacerbated by an acute overcrowding crisis where 83.3% of audited classrooms exceeded recommended capacities, swamping facilitator energy during practical science sessions.

Conclusion: Teacher Welfare TQM Practices on learners academic achievements in Intergrated Science

The study concludes that Teacher Welfare TQM practices are constrained by an operational and econometric paradox in Junior Secondary Schools. While institutional managers view teacher welfare as a primary driver of academic achievement ($R^2 = .136$, $\beta = .369$, $p < .001$), frontline execution is undermined by unmediated operational strains that depress teacher morale and instructional enthusiasm. Junior schools have reduced welfare management to a passive compliance exercise, relying on routine staff meetings rather than proactive wellness mechanisms.

The widespread absence of formal incentive systems (42.4% deficit) and psychosocial counseling structures (39.4% deficit), combined with severe classroom overcrowding (83.3% exceeding standard capacities), leaves educators overworked and intrinsically demotivated. Exhausted facilitators operating under chronic stress are unable to sustain the intensive, individualized guidance required to move students beyond basic competency thresholds. Therefore, without proactive well-being systems that actively manage workload balance, mental health, and professional recognition, teacher welfare initiatives will remain functionally neutralized on the ground.

Recommendations for Practice: Teacher Welfare TQM Practices

To close the gap between administrative policy design and teachers' operational realities, the study provides the following targeted, policy-driven recommendations:

1. **Establish Transparent Incentive & Recognition Systems:** School Boards of Management (BOMs) and Heads of Institutions must move beyond basic administrative measures like general staff meetings (57.6%). Institutions should formalize transparent, performance-based incentive frameworks to close the current 42.4% non-existence gap and systematically recognize teaching excellence in science education.
2. **Institutionalize Psychosocial & Wellness Support:** School leadership must introduce confidential staff counseling logs and structured wellness programs to address the 39.4% institutional gap, providing preventative mental health support to mitigate educator burnout.
3. **Mitigate Instructional Workload & Overcrowding Strain:** To relieve the acute physical strain on facilitators caused by large class sizes (83.3% exceeding 60 learners), school administrators and the Ministry of Education should rationalize teaching loads, deploy assistant facilitators during practical

laboratory sessions, and enforce recommended CBC teacher-learner ratios to restore instructional energy and lesson delivery in Integrated Science.

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