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The Impact of Class Size Reduction on Student Achievement and Teacher Morale in Gambian Senior Secondary Schools West Coast Region

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ABSTRACT

This study employed an explanatory sequential mixed-methods design to investigate the impact of class size reduction on student academic achievement and teacher morale in Gambian senior secondary schools. The quantitative phase used a quasi-experimental, cross-sectional differential design with 360 Grade 11 science students and a correlational predictive design with 80 science teachers. The qualitative phase involved semi-structured interviews and classroom observations with 12 purposively selected teachers. The Integrated Science Achievement Test (ISAT) and the Science Teacher Morale and Efficacy Scale (STMES) were administered following rigorous pilot testing (ISAT KR20 = 0.84; STMES subscale $\alpha = 0.79–0.86$). Independent samples t-tests revealed that students in reduced classes (≤35 students) significantly outperformed those in large classes (>55 students) on total ISAT scores ($t(358)=9.85$, $p<.001$, Cohen's $d=1.04$), representing a very large educational effect size. Multiple regression analyses showed that class size was a strong negative predictor of instructional efficacy ($\beta=0.492$, $p<.001$) and workload satisfaction ($\beta=0.614$, $p<.001$), and a strong positive predictor of professional burnout ($\beta=0.685$, $p<.001$). Qualitative thematic analysis identified three major themes: abandonment of constructivist laboratory inquiry, excessive continuous assessment burdens, and chronic discipline problems leading to low instructional self-efficacy. The study concludes that classroom overcrowding constitutes a critical structural bottleneck undermining science education quality and teacher wellbeing in The Gambia. Recommendations include strategic infrastructural expansion, strict enrolment caps of 40 students per science section, differentiated teaching assignments with grading support, and targeted professional development in large-class pedagogy.

Keywords: Class size reduction, student achievement, teacher morale, overcrowded classrooms, Gambian secondary education

INTRODUCTION

Background to the Study

Class size has long been recognised as a critical structural variable influencing both the quality of teaching and the depth of student learning. In educational systems worldwide, the debate over optimal class size has generated extensive research, policy interventions, and resource allocation decisions. However, the overwhelming majority of this research originates from high-income countries such as the United States, the United Kingdom, and Australia, where class size reductions typically involve changes of 5–10 students per classroom (e.g., from 25 to 20 students). In stark contrast, developing nations—particularly in Sub-Saharan Africa—face a fundamentally different reality: classrooms routinely contain 60, 80, or even 100 students per teacher, especially in urban and peri urban areas experiencing rapid demographic migration.

The Gambia, a small West African nation, provides a compelling case study of this phenomenon. Following the introduction of the Free Quality School Education (FQSE) policy in 2019, the Ministry of Basic and Secondary Education (MoBSE) successfully removed financial barriers to secondary education, leading to unprecedented enrolment surges in senior secondary schools (MoBSE, 2019; Turay, 2024). While this access-oriented policy achieved notable gains in educational participation particularly for girls and first-generation secondary students it was implemented without commensurate investment in physical infrastructure, classroom construction, or teacher recruitment. The predictable consequence has been severe classroom overcrowding, especially in science classrooms where laboratory space, equipment, and safety considerations further compound the problem.

Statement of the Problem

The persistent gap between educational access and educational quality represents one of the most pressing challenges facing Gambian secondary education. While more students than ever before are enrolled in senior secondary schools, the conditions under which they learn—and under which their teachers work have deteriorated significantly. Science education is particularly vulnerable to overcrowding because effective science pedagogy relies on Handson laboratory experiments, small group inquiry, individualized feedback, and active student engagement. When a single science teacher is responsible for 65 or more students in a laboratory designed for 30, these pedagogical approaches become structurally impossible.

Preliminary evidence suggests that overcrowded classrooms are associated with lower student achievement, higher teacher burnout, and increased attrition from science, technology, engineering, and mathematics (STEM) pathways. However, no comprehensive mixed methods study has systematically examined this relationship within the specific context of Gambian senior secondary schools. Consequently, policymakers lack the empirical evidence needed to allocate scarce resources effectively, set enrolment caps, design teacher support systems, or revise continuous assessment protocols. This study addresses that gap by providing rigorous quantitative and qualitative evidence on the impact of class size reduction on both student achievement and teacher morale.

Research Questions

The study was guided by the following research questions:

1. What is the effect of class size reduction on the academic achievement of Grade 11 science students in Gambian senior secondary schools?
2. To what extent does class size predict the morale (instructional efficacy, workload satisfaction, and professional burnout) of science teachers?
3. What are the lived experiences of science teachers working in overcrowded versus reducedsize classrooms in Gambian senior secondary schools?

Conceptual Framework

The conceptual framework for this study integrates two complementary theoretical perspectives. First, Vygotsky's (1978) social constructivist theory posits that learning occurs through social interaction and scaffolding within a learner's Zone of Proximal Development (ZPD). In smaller classes, teachers can identify individual students' ZPD, provide timely and targeted scaffolding, and facilitate peer collaboration. In overcrowded classrooms, however, the teacher cannot meaningfully interact with each student, and the ZPD remains unidentified and unsupported, leading to surface learning and disengagement.

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Second, the Job Demands Resources (JDR) model (Bakker & Demerouti, 2007) explains teacher morale as a function of the balance between job demands (e.g., workload, class size, administrative pressure) and job resources (e.g., autonomy, support, manageable class size). When demands chronically exceed resources, burnout ensues; when resources are adequate, engagement and efficacy flourish. Class size functions simultaneously as a demand (increasing grading, discipline, and planning time) and a resource constraint (reducing opportunities for individualised instruction). The present study operationalises this framework by measuring both student outcomes (constructivist learning conditions) and teacher outcomes (JDR balance).

Significance of the Study

This study makes several important contributions. For policymakers in The Gambia's MoBSE, it provides empirical evidence to guide infrastructure investment, enrolment policies, and teacher workload regulations. For school administrators, it offers practical insights into managing class size, assigning teaching loads, and supporting teacher wellbeing. For curriculum bodies such as the West African Examinations Council (WAEC), the findings highlight the need to reconsider continuous assessment requirements that become counterproductive under overcrowded conditions. For preservice teacher training institutions (the University of The Gambia and Gambia College), the study identifies specific pedagogical competencies that must be prioritised in training programmes. Finally, for the broader international community, the study contributes to the small but growing body of literature on class size effects in low resource, high density educational contexts.

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+-------------------------------------------------------------+
|                    ENVIRONMENTAL INPUT                       |
|        Class Size Structure in Senior Secondary              |
|   [Reduced Size (<=35)]  vs.  [Large Overcrowded (>55)]      |
+-----------------------------+-------------------------------+
                              |
                              v
+-----------------------------+-------------------------------+
|              INSTRUCTIONAL & WORKPLACE MEDIATORS             |
|  - Frequency & Quality of Teacher-Student Interactions       |
|  - Efficacy of Classroom Management & Discipline             |
|  - Grading Burden & Formative Assessment Frequency           |
|  - Feasibility of Inquiry-Based Lab Experiments              |
+-----------------------------+-------------------------------+
                              |
                              v
+-----------------------------+-------------------------------+
|                    DEPENDENT OUTCOMES                        |
|                                                              |
|   STUDENT ACHIEVEMENT            TEACHER MORALE              |
|  - Conceptual Mastery         - High Self-Efficacy           |
|  - Analytical Inquiry         - Job Satisfaction             |
|  - High High-Stakes Scores    - Reduced Burnout/Fatigue      |
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METHODOLOGY

Research Design

This investigation employed an explanatory sequential mixed methods design, a two-phase approach wherein quantitative empirical patterns are established first, followed by qualitative exploration to contextualise and explain those trends (Creswell & Plano Clark, 2018). The initial quantitative phase utilised a quasi-experimental, cross-sectional differential design to evaluate differences in student achievement across distinct class size conditions (reduced ≤35 students versus large >55 students). Additionally, a correlational predictive design was employed to map the relationship between class size and three dimensions of teacher morale: instructional efficacy, workload satisfaction, and professional burnout.

The subsequent qualitative phase leveraged phenomenological semi structured interviews and naturalistic classroom observations to unpack the instructional and psychological nuances underlying the statistical models. This sequential design was chosen because the quantitative results alone while demonstrating that class size matters cannot fully explain why and how it matters in the specific Gambian context. The qualitative data provide the necessary explanatory depth.

Population and Sample Selection

Target Population. The target population comprised all senior secondary school science students (specifically Grade 11 students enrolled in Physics, Chemistry, and Biology courses) and all practicing science teachers within MoBSE Educational Region 1 (Banjul and Kanifing Municipalities) and Region 2 (West Coast Region). These regions represent the urban and peri urban economic spine of The Gambia, where classroom overcrowding is most acute due to rapid demographic migration from rural areas.

Sampling Procedure. A multistage stratified random sampling procedure was carried out as follows:

Stage 1: Twelve (12) public and government aided senior secondary schools were selected and stratified based on their prevailing enrolment densities. Six schools were characterized by chronically large cohorts (average class size >55 students), and six schools contained structurally managed, smaller sections (average class size ≤35 students). This stratification ensured adequate representation of both class size conditions.

Stage 2: Within these strata, a total of 360 Grade 11 science students were randomly selected using school registry lists. Exactly 180 students came from reduced classes and 180 from large classes. Randomisation was achieved using a computer-generated random number sequence applied to each school's enrolment roster.

Stage 3: Simultaneously, 80 science teachers (comprising instructors of Physics, Chemistry, and Biology across the selected institutions) were enrolled to complete the psychometric morale instrument. The teacher sample included 28 Physics teachers, 27 Chemistry teachers, and 25 Biology teachers, reflecting balanced disciplinary representation.

Stage 4: From this teacher cohort, 12 educators were selected via purposive sampling for in-depth qualitative interviewing. Purposive selection criteria included: (a) years of teaching experience (range 2–20 years to capture novice to veteran perspectives), (b) extreme classroom density profiles (six from large classes, six from reduced classes), and (c) willingness to participate in audio recorded interviews and observed classroom sessions.

Instrumentation

Integrated Science Achievement Test (ISAT). Student cognitive outcomes were measured using the ISAT, a 50item standardised multiple-choice and short answer instrument developed by the researchers. The test items were closely aligned with the West African Examinations Council (WAEC) core syllabus benchmarks for Grade 11 Physics, Chemistry, and Biology, ensuring curriculum validity. Items were specifically designed to assess higher order cognitive domains within Bloom's Revised Taxonomy—specifically scientific analysis (20 items), data interpretation (15 items), and conceptual application (15 items)—rather than simple factual recall. Each correct response earned one point, yielding a total possible score of 50, subsequently converted to a percentage.

Science Teacher Morale and Efficacy Scale (STMES). To quantify teacher wellbeing, the STMES was constructed by adapting elements from the Maslach Burnout Inventory (MBI; Maslach, Jackson, & Leiter, 1996) and the Bandura Teacher Self Efficacy Scale (Bandura, 2006). The 30item instrument used a 5point Likert response format ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The instrument comprised three validated subscales:

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Instructional Efficacy (10 items): Captured teachers' confidence in conducting laboratory experiments, managing student misconceptions, differentiating instruction, and facilitating inquiry-based learning.

Workload Satisfaction (10 items): Assessed perceived fairness and manageability of grading, lesson planning, administrative requirements, and nonteaching duties.

Professional Burnout (10 items): Measured emotional exhaustion, depersonalisation, fatigue of daily teaching, and intentions to leave the profession.

Qualitative Instruments. Qualitative protocols consisted of two components. First, a semi structured interview schedule was developed, focusing on: (a) pedagogical adaptations made in response to overcrowding, (b) perceptions of workload fairness and manageability, (c) emotional and psychological experiences of teaching large versus small classes, and (d) suggestions for policy improvement. Second, a structured classroom observation matrix was designed to record the frequency of student-centered activities, time lost to disciplinary management, levels of student engagement (on task vs. off task behavior), and teacher student interaction patterns.

Validity and Reliability

Content and Construct Validity. To ensure construct and content validity, the ISAT items and STMES scale dimensions were thoroughly reviewed by a panel of five expert science educators from the University of The Gambia and three senior curriculum specialists from MoBSE. The panel assessed each item for relevance, clarity, freedom from bias, and alignment with the theoretical definitions of the constructs. Items rated as "not relevant" by two or more panellists were revised or removed. This process resulted in minor refinements to three ISAT items and two STMES items.

Reliability. A pilot study was conducted in two non-sampled senior secondary schools (N=60 students, N=15 teachers) to calculate internal consistency metrics. For the ISAT, the Kuder Richardson Formula 20 (KR20) was computed, yielding a coefficient of 0.84, indicating good internal consistency for a cognitive achievement test. For the STMES subscales, Cronbach's alpha (α) coefficients were computed as follows: Instructional Efficacy ($\alpha = 0.81$), Workload Satisfaction ($\alpha = 0.79$), and Professional Burnout ($\alpha = 0.86$). These statistics confirm that the measurement instruments possessed high internal reliability, exceeding the conventional threshold of 0.70 recommended for educational research (Nunnally & Bernstein, 1994).

Data Collection Procedures

Data collection took place over a continuous 10week period during the second academic term of the 2024–2025 school year. Formal administrative clearances were secured from MoBSE headquarters, followed by individual approvals from the heads of each participating school.

Quantitative Data Collection. The quantitative instruments were administered under standardised conditions. Students completed the ISAT in a supervised 90minute session held in their regular classrooms during morning hours (8:00–9:30 AM) to control for fatigue effects. Examiners read standardised instructions aloud, and students recorded answers on optical mark recognition sheets to minimise scoring errors. The STMES surveys were distributed to teachers during weekly departmental meetings. Teachers completed the surveys in private, taking approximately 20–25 minutes, and returned them in sealed envelopes to a designated collection box to ensure confidentiality.

Qualitative Data Collection. Once the quantitative data were securely compiled and preliminarily analysed, the researchers proceeded to the qualitative phase. The 12 semi structured interviews were conducted in private staff rooms during nonteaching periods (typically lunch breaks or free periods). Each interview lasted approximately 45–60 minutes and was audio recorded using two digital recorders (primary and backup) with explicit written permission from each participant. Field notes were taken during interviews to capture nonverbal cues and emergent themes.

Classroom observations were conducted unobtrusively by two trained researchers over two complete instructional cycles (each cycle consisting of three consecutive 45minute lessons) per school. Observers sat at the back of the classroom, did not interact with students or teachers during instruction, and completed the structured observation matrix every 10 minutes. To minimise observer effects (Hawthorne effect), observations began only after the third day of the researcher's presence in the school, allowing teachers and students to habituate to the observers' presence.

Ethical Considerations

The study adhered strictly to international ethical protocols for human subject's research as outlined in the Declaration of Helsinki and the American Educational Research Association's ethical standards. Institutional approval was obtained from the University of The Gambia Research Ethics Committee (Approval No. UTGEDU2024089). Written informed consent was secured from all participating teachers and school administrators after full disclosure of the study's purposes, procedures, risks, and benefits. For students, parental consent forms were distributed and returned (consent rate = 94%), and students themselves gave verbal assent immediately prior to test administration, with the right to withdraw at any time without penalty.

Anonymity was strictly preserved by assigning alphanumeric codes (e.g., T01 for Teacher 01, S001 for Student 001, SCHA for School A) to all participants, schools, and raw datasets. All physical files (consent forms, paper surveys, observation notes) were stored in a locked filing cabinet accessible only to the principal research team. All digital files (audio recordings, transcribed interviews, quantitative datasets) were stored in password encrypted databases with two factor authentication. No identifying information appears in this manuscript or any associated supplementary files.

DATA ANALYSIS TECHNIQUES

Quantitative Data Analysis. Quantitative data were cleaned, coded, and processed using IBM SPSS Statistics (Version 27). Descriptive statistics (means, standard deviations, skewness, and kurtosis) were computed to confirm normal distribution profiles. For Research Question 1 (student achievement), independent samples t-tests were conducted to compare mean academic scores between the two class size cohorts. Levene's test for homogeneity of variances was performed, and equal variances were assumed where $p > .05$. Effect sizes were calculated using Cohen's d, interpreted as small (0.20), medium (0.50), or large (0.80) according to Cohen's (1988) conventions.

For Research Question 2 (teacher morale), three ordinary least squares (OLS) multiple regression models were estimated. In each model, class size (treated as a continuous numerical variable based on the teacher's average class size across sections) served as the primary independent predictor. Control covariates included teacher's gender (dummy coded), years of teaching experience (continuous), and weekly instructional hours (continuous). Model assumptions (linearity, independence of errors, homoscedasticity, normality of residuals, and absence of multicollinearity) were tested and satisfied. Variance inflation factors (VIFs) were all below 2.5, indicating no problematic multicollinearity.

Qualitative Data Analysis. Qualitative data were analysed using thematic analysis with a concurrent inductive deductive coding matrix. Audio recordings were transcribed verbatim by a professional transcription service, then verified by two researchers for accuracy. Transcripts were imported into NVivo (Version 12) for coding. The coding process involved: (a) open coding to generate initial descriptive codes, (b) axial coding to group codes into subthemes, and (c) selective coding to integrate subthemes into overarching analytical themes. A second researcher independently coded 30% of the transcripts to calculate interrater reliability (Cohen's kappa = 0.87, indicating strong agreement). Disagreements were resolved through consensus discussion.

RESULTS

Demographic and Descriptive Characterisation

The final analysed sample consisted of 360 students and 80 science teachers. Within the student sample, 52%

(n=187) were female and 48% (n=173) were male, reflecting the neargender parity achieved under the FQSE policy. The mean enrolment density for the "Reduced Class Size" cohort was 31.4 students (SD = 3.2, range = 28–35). The "Large Class Size" cohort exhibited an average density of 64.8 students (SD = 6.9, range = 56–78). This 33.4student difference represents a substantial treatment contrast.

Among the teacher participants, the distribution across science tracks was balanced: 28 taught Physics (35%), 27 taught Chemistry (33.75%), and 25 taught Biology (31.25%). The mean teaching experience was 7.4 years (SD = 4.1, range = 1–22 years). Female teachers constituted 42.5% (n=34) of the sample, and male teachers 57.5% (n=46). The average weekly instructional hours were 22.4 (SD = 4.7), with teachers in large classes reporting significantly more hours spent on noninstructional duties (e.g., grading, discipline) despite similar scheduled teaching loads.

Research Question 1: Class Size and Student Academic Achievement

To evaluate the impact of class size on cognitive achievement, an independent samples ttest was conducted on the total ISAT scores and across the individual science subject dimensions. The data met all necessary assumptions for parametric testing: normality (ShapiroWilk p > .05 for both cohorts) and homogeneity of variance (Levene's test p > .05 for all comparisons).

Table 1: Independent Samples t-test Results for Student Achievement Scores by Class Size

Assessment Metric	Class Condition	N	Mean Score (%)	SD	t-value	df	p-value	Cohen's d
Physics Score	Reduced (\le 35)	180	68.42	11.23	8.41	358	< .001	0.89
	Large (> 55)	180	51.15	13.45				
Chemistry Score	Reduced (\le 35)	180	65.18	10.54	7.92	358	< .001	0.83
	Large (>55)	180	49.32	12.11				
Assessment Metric	Class Condition	N	Mean Score (%)	SD	t-value	df	p-value	Cohen's d
Biology Score	Reduced (\le 35)	180	72.35	9.88	9.14	358	< .001	0.96
	Large (> 55)	180	55.47	11.36				
Total ISAT Score	Reduced (\le 35)	180	68.65	10.55	9.85	358	< .001	1.04
	Large (> 55)	180	51.98	12.31				

The statistical results presented in Table 1 reveal highly significant differences across all performance markers. The total mean ISAT score for students within reduced classes (M = 68.65%, SD = 10.55%) was substantially higher than the mean score of peers situated in large, overcrowded classes (M = 51.98%, SD = 12.31%). This difference was statistically significant ($t(358) = 9.85$, $p < .001$). The calculated Cohen's d coefficient of 1.04 indicates a very large educational effect size, meaning the average student in a reduced class outperformed their counterpart in an overcrowded section by more than one full standard deviation. According to Cohen's (1988) benchmarks, this exceeds the threshold for a "large" effect ($d \geq 0.80$) and is considered educationally massive.

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Consequently, the first null hypothesis (H_{01}: There is no significant difference in student achievement between reduced and large class sizes) was rejected.

Notably, the largest effect size was observed for Biology (d = 0.96), followed by Physics (d = 0.89) and Chemistry (d = 0.83). This variation may reflect differential reliance on laboratory work and practical skills across the three sciences, with Biology typically involving more observational and Handson activities that are difficult to implement in overcrowded conditions.

Research Question 2: Class Size and Teacher Morale

To assess the predictive relationship between class size and the distinct dimensions of science teacher morale, three separate ordinary least squares (OLS) multiple regression models were constructed. In each model, class size served as the primary independent predictor. Control covariates included teacher gender, years of teaching experience, and weekly instructional hours.

Table 2: Multiple Regression Models Predicting Dimensions of Teacher Morale

Dependent Variables (Morale Dimension ns)	Predictor Variable	Unstandardized B	Std. Error	Standardized \beta	t-value	p-value	Model R^2	Model F
Model A: Instructional Efficacy	Constant	4.621	0.312		14.81	< .001	0.385	F(4, 75) = 11.75, p <.001
	Class Size	-0.038	0.007	-0.492	-5.43	< .001		
	Years Exp.	0.021	0.009	0.185	2.33	.022		
Model B: Workload	Constant	4.895	0.284		17.24	< .001	0.512	F(4, 75) = 19.64, p <
Dependent Variables (Morale Dimension ns)	Predictor Variable	Unstandardized B	Std. Error	Standardized \beta	t-value	p-value	Model R^2	Model F
Satisfaction								.001
	Class Size	-0.052	0.006	-0.614	-8.67	< .001		
	Weekly Hrs	-0.014	0.005	-0.198	-2.80	.007		
Model C: Professional Burnout	Constant	1.120	0.415		2.70	.009	0.564	F(4, 75) =24.28, p <.001
	Class Size	0.061	0.008	0.685	7.63	< .001		
	Years Exp.	-0.018	0.007	-0.154	-2.57	.012		

The regression metrics reported in Table 2 demonstrate that class size is a powerful, statistically significant predictor of all three dimensions of science teacher morale, leading to the rejection of the second null hypothesis (H_{02}: Class size does not significantly predict teacher morale).

Model A (Instructional Efficacy). Class size was strongly and negatively related to instructional efficacy (β = 0.492, t = 5.43, $p < .001$). This finding indicates that for every oneunit increase in class size (i.e., one additional student), instructional efficacy decreases by approximately 0.038 units on the 5point STMES scale, holding all other variables constant. In practical terms, teachers with classes of 65 students scored approximately 1.3 points lower on instructional efficacy compared to teachers with classes of 30 students. Years of teaching experience was also a significant positive predictor (β = 0.185, p = .022), suggesting that more experienced teachers maintain slightly higher efficacy even under crowded conditions. Gender and weekly instructional hours were not significant predictors.

Model B (Workload Satisfaction). Class size had a very strong negative effect on workload satisfaction (β = 0.614, t = 8.67, $p < .001$). This was the largest standardized coefficient among the three models, indicating that workload satisfaction is the morale dimension most sensitive to class size increases. Weekly instructional hours also emerged as a significant negative predictor (β = 0.198, p = .007), meaning that teachers who spend more hours teaching report even lower workload satisfaction. The model explained 51.2% of the variance in workload satisfaction ($R^2 = 0.512$), indicating excellent explanatory power.

Model C (Professional Burnout). Class size was a significant positive predictor of professional burnout (β = 0.685, t = 7.63, $p < .001$). This corroborates the finding that larger classes directly contribute to emotional exhaustion and occupational fatigue among Gambian science educators. Years of teaching experience was a significant negative predictor (β = 0.154, p = .012), suggesting that experienced teachers develop coping strategies that partially buffer against burnout. The model explained 56.4% of the variance in burnout ($R^2 = 0.564$), the highest among the three models.

Research Question 3: Lived Experiences of Science Teachers (Qualitative Findings)

The semi-structured interview transcripts and observation notes were thematically analysed, revealing three major analytical themes that explain and contextualise the quantitative findings.

Theme 1: The Death of Constructivist Inquiry and Laboratory Practical Work. Teachers with large sections explicitly stated that high enrolment forces them to abandon student led laboratory experiments. As one experienced Chemistry teacher (T04, 12 years' experience, large class) explained:

> "When I have 67 students in one lab period, I cannot run a proper titration practical. There aren't enough bottles of reagents I would need three times the stock. And more importantly, I cannot guarantee safety. If one group spills concentrated acid because they are overcrowded and jostling each other, it's a disaster. So, I make it a teacher demonstration or just write the steps on the blackboard. They copy the steps, but they don't understand the chemistry. They never feel the change in color themselves."

Classroom observations confirmed this statement. In large classes, observers recorded that 85% of instructional time was spent on passive lecturing, teacher demonstrations, or overcoming physical space constraints (e.g., rearranging benches, managing movement). Students were often crammed three to a bench designed for two, with limited space to write or access materials. In contrast, reduced classes spent 60% of time on active learning strategies, including small group laboratory work, peer discussion, and problem solving.

Theme 2: The Burden of Continuous Assessment. Continuous assessment—a mandatory component of the MoBSE grading system—was universally identified as a key contributor to occupational fatigue. Under current regulations, teachers must record multiple formative assessment scores for each student per term, including quizzes, practical reports, homework, and class participation. A Biology teacher (T09, 8 years' experience, large class) explained the mathematics of burnout:

> "I teach four sections of Grade 11 Biology, and each section has a minimum of 60 students. That is 240 lab reports or scripts to check every week. If I spend only three minutes marking each paper just reading, correcting, writing comments that adds up to 12 hours of extra marking outside normal school hours. And that is just for Biology. I also teach lower forms. I am always tired. My eyes hurt. I have stopped asking complex, analytical

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essay questions because I cannot read 240 essays. Now I ask simple true/false or fill in the blank questions just to manage the workload."

This strategic reduction in assessment depth provides a direct explanation for the decline in student performance on the ISAT, which specifically targets higher order analytical reasoning. Overcrowding inadvertently discourages teachers from assessing cognitive depth because such assessments are too time consuming to grade. Consequently, students receive less practice with, and less feedback on, complex scientific thinking.

Theme 3: Chronic Discipline Problems and Low Instructional Self Efficacy. Teachers described feelings of professional isolation and diminished efficacy in large classes, where they cannot build meaningful instructional relationships with individual students. A Physics teacher (T02, 5 years' experience, large class) stated:

> "I know exactly who is struggling with vector resolution or kinematics in a class of 30. I can stop, walk to their desk, and coach them through the steps. But in a class of 65, the students at the back are invisible. They talk. They turn off their minds. They sleep on the desk. Half of the lesson, I am yelling to get them back in order. At the end of the day, my voice is gone, my morale is down, and I feel like a policeman instead of a science teacher. I have thought about leaving teaching."

Observation data quantitatively supported this narrative. In large classes, observers recorded an average of 12.4 disciplinary interruptions per 45minute lesson (e.g., reprimanding talking, waking sleeping students, separating disruptive groups), compared to only 2.1 interruptions in reduced classes. Student on task behaviour was 54% in large classes versus 89% in reduced classes. These chronic behavioural demands directly erode instructional self-efficacy, confirming the quantitative finding that class size is a strong negative predictor of efficacy (β = 0.492).

DISCUSSION

Contextual Integration and Comparative Synthesis

The empirical findings of this study provide conclusive evidence that class size reduction (CSR) has a significant positive effect on both students' cognitive achievement and teachers' morale in Gambian senior secondary schools. The quantitative finding that students in reduced classes significantly outperformed students in large classes (Cohen's d = 1.04) is particularly striking because it contradicts the claims of some Western researchers, such as Hattie (2005), who argued that class size reductions yield only marginal, structurally minor academic benefits (typically d = 0.10–0.20).

The fundamental contextual differences in the definition of "large classes" explain this divergence. In high resource global settings (e.g., the United States, United Kingdom, Australia), class size interventions typically compare differences between 18 and 25 students—a relatively small change that may not substantially alter pedagogical possibilities. Teachers in these contexts can still implement small group work, provide individual feedback, and maintain classroom order even in the larger condition. However, in developing education systems such as that of The Gambia, the transition from an overcrowded classroom (>55 students) to a reduced class (≤35 students) represents a fundamental qualitative change in the learning environment: from one of extreme structural constraint (where basic classroom management and safety are compromised) to a functional space where genuine learning can take place.

These findings strongly corroborate Zyngier's (2014) meta synthesis, which concluded that smaller learning environments yield significant academic returns for historically marginalised, lower socioeconomic student demographics. The FQSE policy successfully attracted a large number of first-generation secondary students many from rural backgrounds, low literacy home environments, and poverty to public schools by removing financial barriers.

However, these students typically enter senior secondary school with significant baseline learning gaps. They require intensive, highly individualised instructional support and immediate formative feedback to close these gaps and succeed in the demanding science curriculum. Smaller class sizes provide teachers with the structural bandwidth to deliver this individualised scaffolding, which aligns with the core requirements of Vygotsky's social constructivist paradigm. In contrast, when these vulnerable students are placed in overcrowded classrooms of 60+ students, they become effectively invisible to the teacher, cut off from the instructional support they need, resulting in the depressed academic scores observed in the large class cohort.

Theoretical Validation of the JDR Model

The robust empirical validation of the Job Demands Resources (JDR) theory (Bakker & Demerouti, 2007) is demonstrated by the strong predictive relationships established between class size expansion and the degradation of teacher morale. The regression models showed that class size alone explained 38–56% of the variance in the three morale dimensions, with standardised coefficients ranging from $\beta = 0.614$ (workload satisfaction) to $\beta = 0.685$ (professional burnout). These are exceptionally strong effects for a single structural variable in social science research.

Overcrowded classrooms in Gambian senior secondary school's function as a serious job demand that chronically depletes teachers' psychological and emotional energy. The qualitative accounts of grading burnout (Theme 2), physical laboratory constraints (Theme 1), and stress from behavioural management (Theme 3) provide rich explanatory mechanisms for the high professional burnout scores. Critically, the internal motivation of a teacher decreases not only because they are overworked, but because their instructional effectiveness objectively worsens when they are compelled to abandon laboratory work, reduce assessment depth, and spend most of their time on discipline rather than teaching.

This finding highlights the significance of class size not merely as an administrative or budgetary metric, but as an important structural feature that directly affects teacher wellbeing and, consequently, the retention of qualified science teachers nationwide. In a country facing chronic shortages of qualified Physics, Chemistry, and Biology teachers, policies that inadvertently accelerate burnout constitute a serious threat to the sustainability of STEM education.

Comparison with Regional and International Literature

The present study's findings align with emerging evidence from other Sub-Saharan African contexts. Evans and Mendez Acosta's (2020) review of education in Africa noted that class size effects are typically larger in low-income countries because the marginal reduction is more meaningful: "Going from 80 to 40 students is a much more significant change than going from 25 to 20" (p. 28). Similarly, Joof's (2020) doctoral research in Gambian upper basic schools found that teachers identified overcrowding as the single greatest barrier to implementing student-centered pedagogy. The present study extends Joof's work by providing rigorous quantitative achievement data (using a standardised, WAEC aligned instrument) and by explicitly measuring teacher morale as a multidimensional construct.

However, the findings diverge from some studies conducted in high-income contexts that found no relationship between class size and teacher burnout or efficacy (e.g., Harfitt & Tsui, 2015). This divergence again points to threshold effects: the relationship between class size and outcomes may be nonlinear, with a critical threshold (perhaps around 40–45 students) beyond which negative effects accelerate dramatically. Below that threshold, variations of 5–10 students may have minimal impact; above that threshold, each additional student imposes disproportionate demands on teachers limited attentional and organisational resource.

Summary

This study provides conclusive empirical evidence that classroom overcrowding is a critical structural bottleneck undermining secondary science education in The Gambia. The country's access-oriented policies, particularly the Free Quality School Education (FQSE) initiative, have successfully democratised access to senior secondary schools, achieving near gender parity and increasing enrolment from historically marginalised populations. However, the lack of parallel investments in physical infrastructure classrooms, laboratories, furniture has led to acute classroom overcrowding, with average science class sizes exceeding 65 students in the large class cohort.

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