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Reduced Students' Participation and Teacher Motivation, Overpopulation-induced Problem in UN SDGs Implementation

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Abstract

Background and Aims: Classroom overpopulation has emerged as a persistent global challenge that threatens educational quality, teacher wellbeing, and the achievement of the United Nations Sustainable Development Goals (SDGs). Overcrowded learning environments strain instructional capacity, reduce student engagement, and compromise both physical and psychosocial conditions necessary for effective teaching and learning, particularly in relation to SDG 4 (Quality Education) and SDG 3 (Good Health and Well-being). This study examined the effects of overpopulated classrooms on students' active participation and teacher motivation. It assessed how these classroom-level challenges impede the implementation of the United Nations Sustainable Development Goals in education.

Methodology: A quantitative cross-sectional survey design was adopted. Data were collected from 222 teachers and students using a structured questionnaire distributed through academic and professional networks. Descriptive statistics, Pearson correlation analysis, and multiple regression analysis were employed to examine the relationships among classroom overpopulation, students' active participation, teacher motivation, and challenges in implementing the SDGs.

Results: Findings revealed that classroom overpopulation significantly reduces students' active participation and undermines teacher motivation. Pearson correlation analysis showed significant relationships among all study variables. Multiple regression analysis further identified classroom overpopulation as the strongest predictor of SDG implementation challenges, while reduced student participation also significantly predicted poorer SDG outcomes. Teacher motivation, although correlated with SDG challenges, did not emerge as a significant predictor when controlling for structural factors.

Conclusion: The study concludes that classroom overpopulation constitutes a major structural barrier to achieving inclusive, equitable, and sustainable education. Addressing overcrowding through policy reforms, infrastructure expansion, and strategic teacher recruitment is essential for improving classroom conditions and advancing progress toward the United Nations Sustainable Development Goals.

Keywords: Overpopulation, Overpopulated Classroom, Students' Active Participation, Teacher Motivation, United Nations SDG.

Introduction:

The United Nations Sustainable Development Goals (SDGs) emphasize inclusive, equitable, and sustainable development across all sectors, with education positioned as a central driver of societal progress. SDG 4 (Quality Education) and SDG 3 (Good Health and Well-being) specifically require learning environments that are safe, participatory, and adequately resourced. However, the rapid growth of school-age populations across both developed and developing regions has increasingly strained educational systems, resulting in widespread classroom overpopulation.

Overpopulation is a global phenomenon that occurs when the number of individuals exceeds the capacity of available resources to support them sustainably. In the context of education, classroom overpopulation arises when student enrolment surpasses the physical, instructional, and human resource capacity of schools, thereby undermining effective teaching and learning. This challenge poses a direct threat to the attainment of the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), which emphasizes inclusive and equitable learning environments.

Across both developed and developing regions, increasing enrolment, migration, teacher shortages, and inadequate infrastructure have intensified classroom overcrowding. For instance, public schools in

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Edmonton, Canada, are projected to face severe space shortages by 2027, with some schools already operating beyond capacity (Newbigging, 2025). Similarly, reports from China indicate that some classrooms accommodate more than 70 students, demonstrating that classroom overpopulation is not confined to a single region but represents a global educational concern (Yiwen, 2017).

Overpopulation is seen through the lens of an uneven ratio between the number of individuals within a community and the quantity of available resources for use. That is to say that a community of one thousand individuals with enough resources available for their use is said to be less populated compared to a community of fifty individuals with insufficient resources available for their use. Scholarly literature conceptualizes overpopulation not merely as numerical density but as a disproportion between population size and the availability of sustainable resources. (Garg, 2017, p137). Evidently, the moment an area begins to grow beyond its available resources, in terms of food, water, physical land, and other related resources, as the case may be, it is considered overpopulated, and this raises a serious concern in a world striving to achieve sustainability. This is, however, a more stretched and general description of overpopulation.

Meanwhile, taking a closer consideration of the foregoing as it relates to the classroom setting, Chavez (2023) posits that "The consequences of overcrowded classrooms run deeper than too many students in one class. It includes the strain it placed on teachers, the limited access to resources and support for students, and the resulting decline in attendance and motivation."

Moving further, A 2021 article for The Tech Edvocate listed classroom overcrowding as one of "20 reasons why the American education system is failing." Lynch (2021). Classroom overcrowding is defined as "when the number of students enrolled in the school is larger than the number of students the school is designed to accommodate," and notes that a classroom is considered overcrowded when it exceeds 5% of the building's designed capacity. Factors such as teacher shortages, increased enrollment, and decreased funding have, unfortunately, made overcrowded classrooms a common feature of American schools." (National Center for Education Statistics [NCES], 2000).

The work of Kozol (1991) and others suggests that in some public schools, overcrowding and crumbling buildings go hand in hand. According to this view, schools overburdened by too many students are likely to experience more wear and tear to their facilities. To examine the relationship between overcrowding and school condition, schools in this study were classified as being under-enrolled, within 5 percent of their capacity, or overcrowded.

According to a post by Clark (2014), the NEA, representing teachers and other education professionals, is a strong advocate for small class size and is very active politically in support of this approach. The ideal classroom should have between 13 and 17 students, for an optimal average class size of 15 individuals. The average classroom size in 2023 was 24 students, or about 60 percent above NEA recommendations. Public schools have a 16 to 1 student-to-teacher ratio, while research indicates that ratios of 15 to 1 or better can significantly improve student performance, particularly among younger students and students enduring socio-economic challenges. It should be noted that the student-teacher ratio does not always correlate with class size — certain classrooms may require multiple full-time teachers.

Notably, migration contributes to the increasing classroom overpopulation, according to Xinhua News Agency (2018), the vice president of 21st Century Education Research Institute, "Since education resources tend to go to urban areas, many rural students move to county seats or city schools for a better education. However, as more students flock in, many schools have to expand their classes because there aren't enough teachers and classrooms."

Although existing studies have extensively documented the negative effects of classroom overcrowding on learning outcomes and teacher wellbeing, there remains a significant empirical gap regarding how these classroom-level conditions directly undermine progress toward the 2030 United Nations Sustainable Development Goals. In particular, limited quantitative evidence links classroom overpopulation to SDG implementation outcomes such as quality education (SDG 4), health and wellbeing (SDG 3), and reduced inequalities (SDG 10). This study addresses this gap by empirically examining the

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interrelationships among classroom overpopulation, students' active participation, teacher motivation, and SDG implementation challenges.

Research Questions

What is the impact of overpopulated classrooms on students' active participation?

How does an overpopulated classroom affect teacher motivation?

What are the implications of overpopulated classrooms on the implementation of the UN Sustainable Development Goals (SDGs)?

Research Objectives

To examine the impact of overpopulated classrooms on students' active participation.

To examine how overpopulated classrooms affect teacher motivation.

To examine the implications of overpopulated classrooms for the implementation of the United Nations Sustainable Development Goals (SDGs).

Literature Review:

Effects of Overpopulation on Students' Active Participation

Research consistently demonstrates that overpopulation in the classroom yields more distractions, poor performance in exams, reduces inclusivity/ increasing less personalized instruction, and it also leads to increased chances of health hazards, which adversely affect the learner's active engagement in class in the long term.

Recent literature indicates that overcrowded classrooms contribute to poor learning conditions due to limited space, inadequate ventilation, high noise levels, and increased psychological stress among learners (West & Meier, 2020; Van Wyk, 2008). These conditions reduce learners' attention spans and negatively affect academic engagement and performance, as evidenced in large-scale international assessments such as PIRLS (Mullis et al., 2012).

"Empirical evidence from large-scale school settings in China illustrates how extreme class sizes, often exceeding 70 students, reduce opportunities for student participation and discourage interactive teaching practices, thereby weakening instructional quality (Yiwen, 2017).

Learners in overcrowded classes are more likely to feel disconnected from the learning process and less motivated to actively participate in class discussions and activities (Marais, 2016).

Effects of Overpopulation on Teacher Motivation

Teacher motivation is significantly compromised in overpopulated classrooms due to excessive workload, heightened stress, limited instructional control, and diminished capacity for individualized feedback. This probably brings about a feeling of dissatisfaction in lesson delivery, longer time, or even failure to cover the course syllabus, inability to carry everyone along, and difficulty assessing students. In these environments, teachers struggle to incorporate interactive teaching techniques such as group work, discussions, and practical activities due to spatial limitations and time constraints. According to Ahamed and Salleh (2024), psychologically, students and teachers experience heightened stress, anxiety, and burnout, with very little support available to them. Collectively, these processes can hinder job performance among teachers and, more importantly, affect academic performance among students, especially those from disadvantaged backgrounds. According to an anonymous response, "Large class sizes make it more difficult for teachers to give pupils the individual attention they need and deserve. A crowded classroom is poorly suited to either teaching or learning; students and teaching staff need personal and pedagogical space. The pedagogical approach of differentiation becomes increasingly difficult when class sizes go up significantly." (YENGKOPIONG, 2023)

The overwhelming number of students per class could have a significant impact on the ability of teachers to effectively engage with each individual. Some teachers appeared overwhelmed and checked out, struggling to meet the diverse needs of their students or blatantly disregarding students who required additional assistance due to learning disabilities or personal circumstances. There were some that flat out ignored students or refused to teach the required lessons for the day, not caring what the students did. There were also faculty who were so enraged at the district for inadequate pay or refusal to provide funding for materials, they began to resent and lash out at their students. This situation created an unfortunate cycle

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where students felt neglected and disengaged, exacerbating the challenges faced in the classroom. (Chavez, 2023)

A bane on UN SDG Implementation:

Overpopulation in classrooms presents a critical barrier to achieving the United Nations Sustainable Development Goals, particularly in regions facing systemic teacher shortages. Notably, approximately 90% of Sub-Saharan African countries experience severe secondary-level teacher shortages, a structural condition that directly fuels classroom overcrowding and undermines the attainment of SDG 4 (Quality Education) (The Human Intelligence Unit, 2026). As the United Nations makes conscious efforts to advance the course of SDG 2030, a lot of factors still pose considerable backlog on this effort. One of these is overpopulation in the classroom. While this may have been fought and defeated in some developed countries, there are still some underserved and underrepresented nations, even across the Sub-Saharan regions, that are yet to achieve maximum success in overcoming this bane thereof. Moreover, because education is the right of every child, every right-thinking parent has seen a very good reason to send their children to school, no matter how many children they have. While we applaud such a right given to each child to access the four walls of the school system, it has become more pressing a need to ensure that such a child doesn't just access education, but accesses quality education as stipulated by United Nations Sustainable Development Goal number 4. In today's evolving world, it is important to provide young people with educational experiences that nurture their passions, curiosity, and creativity, that develop critical thinking and problem-solving skills, and that enable lifelong learning. The best solutions involve teachers, parents, students, schools, and communities, take advantage of available resources, are based on evidence, and draw inspiration from successful models. This goes to say that it is not just education that ensures the bright future parents dream for their children, but a quality education. On the other hand, school administrators and proprietors are determined to promote inclusivity by ensuring every child is admitted into schools. This won't make sense unless deliberate steps are taken to ensure that the number of school-age children admitted is at par with the available resources in the schools. If this is not checked, then there will be a continuous slack in the holistic actualization of Sustainable Development Goals 3, 4, 8, and 10, emphasizing good health and well-being, quality education, Decent Work and Economic Growth, and Reduced Inequalities, respectively.

Firstly, Sustainable Development Goal number 3 on Good Health and Well-being is adversely impacted here since uncontrolled overpopulation has potential negative effects on the health of those concerned. Evidently, Ahamed and Salleh (2024) have this to say: "Overcrowded schools, such as those recently reported in Kota Kemuning and Cyberjaya, raise significant implications for public health and the well-being of children, families, and teachers. Overcrowded classrooms not only lead to cramped spaces and insufficient facilities but also pose significant risks to mental and physical health. Physically, overcrowded environments increase the spread of infectious diseases and compromise hygiene. We have learnt so much from Covid-19 that prioritizing smaller classes is not just about comfort, but a crucial measure to restrict outbreaks." There is no hundred percent guarantee of the safety of students in a highly populated classroom setting, while such an environment may be less ventilated, hence hazardous to individuals with certain related health needs, some other students with certain visual impairments may find it difficult to access the teacher's demonstrations on the board, etc.

Secondly, Sustainable Development Goal number 4 on Quality Education, which aims to ensure inclusive and equitable quality education for all and promote lifelong learning opportunities, is similarly affected negatively because in such an overpopulated classroom setting, teaching is rarely tailored to the individual needs of the learners concerned, which hampers lifelong learning opportunities. Moreover, the teacher concerned struggles to attend to each learner's needs, especially with the limited time allocated for each lesson delivery. A lot will definitely be overlooked by the teacher who is aiming to cover a set course syllabus. The strain placed on teachers due to overwhelming class sizes leads to diminished attention and engagement with students. Students, in turn, face challenges such as limited resources, inadequate support, and a sense of being overlooked (Chavez, 2023). Teachers in this situation may also find it difficult to accurately assess each student's performance in the classroom, and this doesn't help the learner's academic growth. More so, quality education is hampered in an overpopulated classroom since the number of students here far outweighs the amount of available instructional materials per time. Hence, while such students may seem to be in the class during lesson delivery, their active participation is never guaranteed at such a moment. This challenge is particularly acute in Sub-Saharan Africa, where approximately 90% of countries

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face severe secondary-level teacher shortages, a key driver of classroom overpopulation that directly undermines the achievement of SDG 4.

Thirdly, decent work and economic growth is United Nations Sustainable Development Goal number 8, fighting to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. Teachers within the school setting are also not left out in this 'equation'. According to Innocent (2025), "Times Higher Education has maintained a commendable height of accuracy as a global performance table assessing research-intensive universities around the world. The assessment metrics cut across THE's core operational values, thus, teaching (the learning environment); the learning environment here could incorporate the staff-to-student ratio, rated at 4.5%. Times Higher Education (THE) has meticulously assessed and ranked 1,149 universities from 107 countries/regions for their impactful contributions to the United Nations' Sustainable Development Goal 8: decent work and economic growth. The top institutions excel in promoting productive employment opportunities, fostering secure working environments, and driving substantial economic growth. Emphasis on 'fostering secure working environments', this is relevant to the context of this research because an overpopulated classroom makes less of a secure working environment for the teacher concerned. To an extent, such a work environment may appear to be modern slavery, emphasized in the 'employment practices' one of the comprehensive indicators used to evaluate universities' efforts in promoting sustainable economic growth and decent employment by Times Higher Education (THE) 2024.

Lastly, in this session, is United Nations Sustainable Goal number 10 on Reduced Inequalities. There are chances of increased inequalities in an overpopulated classroom, especially when considering the policy of 'leave no child behind'. Moreover, SDG 10 promotes universal social, economic and political inclusion, stating that by 2030, it will have empowered and promoted the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status. Relating the foregoing to the classroom setting, it is relatively impossible to carry everyone along as regards lesson delivery and holistic learner assessment. Since the teacher in such an overpopulated classroom is unable to give attention to everyone simultaneously, a section of the students in the class is likely to miss out on a particular moment in the lesson delivery. Probably the teacher may pay more attention to the students sitting in the front row, leaving out those occupying the rear positions in the classroom. According to the findings of Kobusiingye (2024), student-centered teaching, regular formative assessments, and teacher professional development significantly improve student learning outcomes. However, challenges such as inadequate resources, overcrowded classrooms, and teacher absenteeism persist. There is also reduced inequality since there is uneven measure of attention given to the set of students who really are attentive compared to the other set of students who are not attentive, since their lackadaisical behaviors are hidden in the large class population at the time being, during lesson delivery. Meanwhile, for want of further buttressing, overpopulated classrooms also exacerbate internal inequalities within learning environments. Students seated at the back of overcrowded classrooms are more likely to experience reduced teacher attention, limited access to instructional materials, and diminished participation opportunities, a phenomenon that may be described as "rear-seat neglect." This micro-level inequality mirrors broader societal disparities and directly contradicts SDG 10's mandate to reduce inequalities and ensure inclusive participation for all learners.

Conceptual Framework

The conceptual approach guiding this study views classroom overcrowding as the main independent variable influencing sustainability and educational results. By increasing effort, stress, and restricting instructors' instructional capacity, crowded classrooms are predicted to decrease teacher motivation and student active involvement.

The United Nations Sustainable Development Goals (SDGs) are impacted by classroom overcrowding through mediating factors such as decreased teacher motivation and decreased student participation. The framework specifically connects these impacts to obstacles in reaching SDG 4 (Quality Education) and associated results that impact SDG 3 (Sound Health and Well-Being) and SDG 10 (Decreased Inequalities).

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Overall, the paradigm makes the assumption that structural limitations, particularly overcrowding, have the greatest direct impact on SDG implementation outcomes in the educational setting, even though teacher motivation and student involvement are significant channels.

Methodology

This study employed a quantitative, cross-sectional survey approach to examine the effects of classroom overcrowding on teacher motivation, student engagement, and challenges in attaining the UN Sustainable Development Goals (SDGs) in education. Information was gathered from 222 respondents using convenience sampling. The poll was distributed online through academic networks, professional networks, and educational forums. This method limits the findings' generalizability, even though it permitted participation from a range of geographic places; the results should be interpreted cautiously and as perception-based trends rather than region-specific causal claims.

Instrument and Measures

Data were collected using a self-developed structured questionnaire, informed by relevant literature and SDG-related indicators. The instrument consisted of: (1) Demographic information; (2) Likert-scale items measuring Overpopulated Classroom (OC); (3) Likert-scale items measuring Students' Active Participation (SAP); (4) Likert-scale items measuring Teacher Motivation (TM); and (5) items measuring SDG implementation challenges (BANE_SDG) associated with classroom overpopulation.

Reliability

Internal consistency reliability was assessed using Cronbach's Alpha. All subscales met or exceeded the acceptable threshold ($\alpha \geq 0.80$), indicating satisfactory reliability.

Data Analysis

Overall response patterns and respondent characteristics were compiled using descriptive statistics. While means and standard deviations summed up opinions about classroom overcrowding, student participation, teacher motivation, and difficulties implementing the SDGs, frequencies and percentages described demographic characteristics. For SAP, TM, OVERPOP_Mean, and BANE_SDG_MEAN, composite mean indices were calculated in order to improve measurement stability and enable the analysis of complicated structures as scale variables. The direction and intensity of correlations between important variables (student involvement, teacher motivation, classroom overcrowding, and SDG implementation issues) were then examined using Pearson's correlation. This stage determined whether there were any significant correlations before predictive modeling. The combined and distinct contributions of classroom-level elements to SDG implementation issues were finally ascertained by multiple regression analysis. SDG implementation issues (BANE_SDG_MEAN) were the dependent variable in the regression model, and classroom overcrowding (OVERPOP_Mean), teacher motivation (TM), and student active participation (SAP) were the predictors. This analysis produced findings pertinent to educational planning and policy, as well as the strongest predictor or predictors of SDG implementation issues.

Diagnostic Tests

Diagnostic and assumption tests, such as residual diagnostics (Durbin–Watson and normality checks), model fit indices (R, R2, and F-test), and multicollinearity checks (VIF and tolerance), were performed to guarantee the validity of the regression results. These methods increased trust in the statistical findings. Overall, a quantitative survey framework that combined descriptive, correlational, and regression analyses offered a methodical way to comprehend how teacher motivation, student participation, and classroom overcrowding interact to shape SDG implementation issues in education.

Results and Discussion

1) Respondents' Demographic Characteristics

The study's examination of the replies from 222 participants revealed that the data were complete and suitable for statistical analysis, with no missing data. The demographic profile is summarized in Table

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1, which includes respondents' job (designation), gender, specialization/discipline, educational background, geographic region (work/study destination), and level of acquaintance with the UN SDGs. Convenience sampling was used, but even though the diversity of respondents increases the range of perspectives documented, the results are considered to be perceived patterns rather than actually generalizable conclusions.

Table 1 Respondents' demographic profile (N = 222)

Variable	Category	Frequency	Percentage
Gender	Female	126	56.8
	Male	96	43.2
Designation	Teacher	112	50.5
	Student	83	37.4
	Teacher & Student	11	5.0
	Others	16	7.2
Teachers' specialization*	Language	—	57.7
	Mathematics	—	9.5
	Arts/Humanities	—	9.0
	Commercial Studies	—	5.9
	Sciences	—	5.0
	Others (e.g., vocational, special ed., IT)	—	7.7
Students' discipline/career path*	Education-related	—	50.0
	Arts	—	16.7
	Business	—	16.7
	Language Studies	—	12.2
	Sciences	—	4.5
Educational background	High school	25	11.3
	Undergraduate	73	32.9
	Master's	57	25.7
	Doctoral	18	8.1
	Post-doctoral	49	22.1
Work/Study destination	Africa	58	26.1
	Asia	41	18.5
	Europe	32	14.4
	South America	30	13.5
	Australia	30	13.5
	North America	29	13.1
	Antarctica	2	0.9
Knowledge of UN SDGs	High/Very high	126	56.8
	Average	62	27.9
	Low/None	34	15.4

The sample includes a slightly higher proportion of female respondents and a larger share of teachers than students. This composition enhances the relevance of the findings for classroom-level realities, particularly teacher workload and instructional constraints in overcrowded settings. The geographical distribution suggests the issue is perceived across multiple regions; however, regional comparisons are not the focus of this study and are not used to draw causal, region-specific conclusions.

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2) Interpretation Framework for Likert-Scale Responses

The following criteria were used to categorize mean scores in order to interpret responses measured on the Likert scale: 3.50 and above indicate agreement, values around 3.00 imply neutrality, and values below 3.00 indicate disagreement. To guarantee consistent and clear interpretation of the findings, this interpretation framework was applied consistently to both item-level statistics and composite (mean index) scores throughout the research.

3) Descriptive Statistics: Overpopulation, Participation, Motivation, and SDG Implementation Challenges

Descriptive findings indicate strong perceived classroom overcrowding and its negative implications for learning conditions, teacher experiences, and SDG implementation.

Table 2. Summary of composite mean indices (Likert-scale)

Construct (Composite)	Key interpretation	Mean ($\bar{x}$)
Classroom Overpopulation (OVERPOP_Mean)	High overcrowding perception	—
Students' Active Participation (SAP)	Lower-than-optimal participation	**2.96**
Teacher Motivation (TM)	Lower motivation / strained effectiveness	—
SDG Implementation Challenges (BANE_SDG_MEAN)	High perceived barriers	**3.94**

Highlights and interpretation at the item level. Overcrowding in schools (OC): Respondents strongly agreed that overcrowding poses significant learning obstacles (OC4, $\bar{x}$ = 3.90; OC5, $\bar{x}$ = 4.04) and that classrooms are overcrowded (OC1, $\bar{x}$ = 4.27). Respondents, however, disagreed with claims that overcrowding offers advantages (OC2, OC3, $\bar{x} \approx 2.6–2.9$). Overall, the pattern shows that there is broad agreement that overcrowding in classrooms is a detrimental factor that limits learning conditions. With a composite mean of $\bar{x}$ = 2.96 and item values ranging from $\bar{x}$ = 2.51 to 3.88, students' active participation (SAP) appears to be below ideal levels in packed classes. This supports the notion that interactions, feedback, and student-centered learning are diminished in high class sizes. Teacher motivation (TM): Respondents disputed that overcrowding enhances teaching circumstances (TM1, TM4, $\bar{x} \approx 2.6–2.8$) and acknowledged that it compromises teaching efficacy (TM2, TM3, $\bar{x}$ = 3.83). This suggests that, most likely as a result of stress and task pressures, overcrowding is linked to decreased motivation and professional effectiveness. SDG implementation issues (BANE_SDG): There was broad agreement that classroom overcrowding is a major obstacle to SDG implementation, especially SDG 4 (Quality Education), with mean scores ranging from $\bar{x}$ = 3.72 to 4.08 and a composite mean of roughly $\bar{x}$ = 3.94. According to the study's conceptual framework, the findings also point to spillover effects on goals related to equality and general wellness (such as learning stress and decreased inclusivity), which is in line with connections to SDGs 3 and 10.

4) Recommended Appendix Tables

It is advised that elaborate tables be moved to the Appendix and labeled similarly to prevent misunderstanding with tables in the main text in order to improve clarity and facilitate reviewers' evaluation. The suggested appendix tables are as follows: • Appendix Table A1: Means and standard deviations for each item of the item-level descriptive statistics for all study variables, such as Classroom Overpopulation (OC), Students' Active Participation (SAP), Teacher Motivation (TM), and SDG Implementation Challenges (BANE_SDG). • Appendix Table A2: Detailed frequency distributions of respondents' demographic attributes, such as gender, title, field of expertise, discipline or career path of students, educational background, work/study location, and degree of familiarity with the Sustainable Development Goals (SDGs) of the UN.

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This arrangement of the detailed statistical outputs makes the main results section easier to read while enabling reviewers and interested readers to look at the complete dataset structure and measurement features in the appendix.

Correlation Analysis

Table 3 presents the results of the Pearson correlation analysis examining the relationships among Students' Active Participation (SAP), Teacher Motivation (TM), and SDG Implementation Challenges (BANE_SDG).

Table 3 Pearson Correlation Matrix among SAP, TM, and BANE_SDG

Relationship	r	Strength	Significance
SAP ↔ TM	.397	Moderate positive	p < .001
SAP ↔ BANE_SDG	.208	Weak positive	p = .002
TM ↔ BANE_SDG	.258	Weak–moderate positive	p < .001

The findings show a moderately positive and statistically significant link (r =.397, p <.001) between students' active participation and teacher motivation, indicating a close relationship between changes in student engagement and changes in teacher motivation in classroom settings.

Furthermore, there were small but statistically significant positive correlations between teacher motivation and SDG implementation challenges (r =.258, p <.001) and between students' active participation and them (r =.208, p =.002). It's crucial to remember that the SAP scale was coded so that decreased student engagement is reflected in higher scores. Consequently, the positive correlations show that lower teacher motivation is linked to worse SDG-related outcomes and that lower student participation is linked to more difficulties in implementing the SDGs.

The suggested conceptual framework is empirically supported by the Pearson correlation analysis, which shows that the study variables are substantially related overall. These results are consistent with earlier studies that highlight how students' abilities, engagement, and long-term educational achievements are significantly shaped by the caliber of daily classroom interactions between teachers and students (Hamre & Pianta, 2001).

The complete correlation matrix, which verifies the statistical significance of the connections between SAP, TM, and SDG implementation issues, is also included in the Appendix for transparency and completeness.

Multiple Regression Analysis

Multiple regression analysis was utilized to identify the determinants of SDG implementation challenges (BANE_SDG_MEAN). The complete model had an outstanding fit and was statistically significant, with R =.439, R^2 =.193, Adjusted R^2 =.182, F (3, 218) = 17.368, p <.001. This implies that the variables of teacher motivation, classroom overcrowding, and student active involvement together may account for 19.3% of the variance in SDG implementation challenges. In social science research, this degree of explained variance is important, particularly when examining complex structural and pedagogical processes.

Regression Coefficients and Predictive Strength

Table 4 Multiple Regression Results Predicting SDG Implementation Challenges (BANE_SDG_MEAN)

Predictor	B	SE B	β	t	p	Interpretation
(Constant)	—	—	—	—	—	—
Students' Active Participation (SAP)	−0.384	0.067	−.420	−5.73	< .001	Reduced participation significantly predicts poorer SDG outcomes
Teacher Motivation (TM)	0.062	0.051	.085	1.22	.224	Not a significant predictor

Citation
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Predictor	B	SE B	β	t	p	Interpretation
Classroom Overpopulation (OVERPOP_Mean)	0.591	0.074	.691	7.99	< .001	Strongest predictor of SDG challenges

Model statistics: R = .439, R^2 = .193, Adjusted R^2 = .182, F (3, 218) = 17.368, p < .001

Interpretation of Regression Results

According to the model coefficients, SDG implementation issues are significantly predicted by students' active participation (SAP) (β = −.420, p <.001). The negative correlation suggests that decreased student involvement considerably impacts SDG-related outcomes because the SAP scale was coded so that higher scores indicate lower levels of participation.

On the other hand, despite its strong bivariate correlation with SDG implementation issues, teacher motivation (TM) did not show up as a statistically significant predictor (β =.085, p =.224). This implies that when taken into account in conjunction with other factors, teacher motivation is not enough to counteract more extensive institutional restrictions.

Crucially, the most powerful and significant predictor of SDG implementation difficulties was classroom overcrowding (OVERPOP_Mean) (β =.691, p <.001). This result emphasizes how structural and environmental factors play a major role in undermining educational sustainability and the successful execution of the Sustainable Development Goals (SDGs) of the United Nations, especially SDG 4 (Quality Education).

Students' active participation is a significant predictor of SDG implementation issues, according to the regression coefficients (β = −.420, p <.001). The negative coefficient implies that decreased student engagement considerably deteriorates SDG-related results, since higher SAP scores correspond to lower levels of participation.

In contrast, whereas teacher motivation showed a substantial bivariate connection with SDG implementation issues, it did not show up as a statistically significant predictor in the regression model (β =.085, p =.224). This data suggests that although teacher motivation and SDG outcomes are correlated, when structural factors are taken into consideration, their independent predictive value decreases. Interestingly, the biggest and most significant predictor of SDG implementation issues was found to be classroom overcrowding (β =.691, p <.001). This outcome highlights how overcrowding in classrooms undermines educational sustainability and the successful execution of SDG targets, especially SDG 4 (Quality Education). According to the findings, individual-level characteristics like teacher motivation are subordinated to structural and environmental constraints, such as a lack of classroom space, poor infrastructure, and limited learning tools.

These findings provide credence to the argument that systemic and policy-level interventions are more critical than relying solely on individual motivation or resilience. This interpretation is consistent with prior research indicating that structural deficiencies—such as inadequate classroom facilities, limited access to electricity, and shortages of learning materials—constitute major barriers to achieving Sustainable Development Goal 4, particularly in rural and resource-constrained contexts (UNESCO, 2020; World Bank, 2018).

Conclusion

The problem of overcrowding in the classroom doesn't seem to be a regional thing; it is experienced in different parts of the world, and since it affects all stakeholders in education, it abruptly disrupts certain functionality of an entire civic society, as no nation can grow beyond the level of its education system. All of the pitfalls explained in the context of this study raise serious concern, hence a need to take action**,** which may include building more schools, investing in teacher recruitment, investing in school infrastructure, technology adaptation, assigning seats and rotating, when necessary, hence in a large class, teachers must be structured, and this starts with strategically assigning seats as situation demands in the classroom. Students who are low academically and/or have behavior issues may be assigned seats toward the front.

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Students who are high achievers and/or are well behaved may be provided seats toward the back, as classroom situations demand, from time to time. This study is highly recommended for use to UNESCO, UNICEF funding of such vulnerable schools, The ministry of education whose responsibility comprises giving quotas on the students' enrolment in government secondary schools, a way to check and control overcrowding in such secondary schools.

Recommendations

Policy Level: Governments should implement enrolment quotas aligned with available infrastructure, invest in the construction of additional classrooms, and prioritize large-scale teacher recruitment to reduce student-teacher ratios.

Institutional Level: International organizations such as UNESCO and UNICEF should increase targeted funding for overcrowded and under-resourced schools, particularly in developing regions, to support infrastructure development and instructional materials.

Classroom Level: Teachers should adopt strategic seating arrangements, placing low-achieving or behavior-challenged students closer to instructional focal points, and employ group-based learning to maximize engagement.

Technology Adaptation: Digital tools such as hybrid learning models, online assessments, learning management systems, and classroom response applications can help teachers manage large class sizes by automating feedback, tracking participation, and extending learning beyond physical classroom constraints.

Ethical Consideration

Participation in the study was entirely voluntary. All respondents were informed of the purpose of the research, with full guarantee of the confidentiality and anonymity of their responses, and informed of their right to withdraw at any stage without penalty. Written informed consent was obtained electronically from all participants before they participated in the survey. Moreover, the data collected were assured to be used strictly for academic purposes.

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