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School Climate and Opportunities for Physics Learning in Resource-Constrained Schools

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Abstract

This descriptive mixed-methods case study examined how school-climate conditions were perceived and observed to shape opportunities for learning Physics in a Community Day Secondary School in Area 25, Lilongwe, Malawi. The study involved 43 participants: 40 students, two Physics teachers and one head teacher. Student questionnaire responses were summarised using frequencies and percentages (n = 40), while the research report also drew on school observations and focus-group discussions. A 25-item, four-response-option questionnaire covered infrastructure, learning resources, safety, rules and regulations, and interpersonal relationships. In the four reported quantitative figures, disagreement response categories comprised the plotted totals for infrastructure (22/40, 55%), learning resources (25/40, 62.5%) and safety (30/40, 75%), whereas agreement categories comprised the plotted total for interpersonal relationships (27/40, 67.5%). For school rules and regulations, the reported distribution comprised 28 agreement-category responses (70%) and 12 disagreement-category responses (30%). These results describe respondents' perceptions of school conditions and do not demonstrate a statistically significant effect on Physics achievement. The qualitative account described constraints on practical work, independent study and classroom interaction, and identified school rules and management as relevant contextual conditions. The study did not report analysed individual Physics test scores or inferential tests; therefore, its findings describe perceived learning conditions rather than demonstrate a statistically significant effect on achievement. The contribution is a Physics-specific account of how material, relational and organisational conditions jointly shape opportunities for practical STEM learning in a resource-constrained school.

Keywords: school climate; Physics learning; laboratory access; student perceptions; Community Day Secondary Schools; Malawi

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INTRODUCTION

Supporting effective Physics education in Malawi's Community Day Secondary Schools (CDSSs) requires attention not only to examination outcomes but also to the conditions in which instruction takes place. Physics combines mathematical reasoning, abstract concepts, demonstrations and practical investigation; limited laboratory access or opportunities to question teachers may therefore restrict the learning experiences available to students. School climate provides a useful framework for examining these environmental conditions (Cohen et al., 2009; Hofstein & Lunetta, 2004).

School climate encompasses the physical, interpersonal, safety-related and organizational features of school life (Thapa et al., 2013). Recent international research suggests that these features should be considered together: Yu and Jiang (2022) examined combinations of school-climate conditions across education systems, while Delgado-Galindo et al. (2025) identified differences in relationships and expectations between schools with differing levels of effectiveness. However, neither provides a direct account of how students experience the practical learning demands of Physics in a Malawian CDSS.

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Physics is particularly sensitive to the availability of equipment, secure and usable classrooms, opportunities for demonstration and practical investigation, and supportive teacher-student dialogue. These conditions matter because students must move between abstract explanations, mathematical representations and observable phenomena (Hofstein & Lunetta, 2004; Fraser, 2012). In resource-constrained secondary schools, the question is therefore not simply whether school climate is generally positive, but which dimensions of climate make Physics learning activities possible or difficult.

Evidence from different settings illustrates the need for a subject-specific and methodologically careful approach. Belton and Brinkmann (2024) examined school climate alongside measured reading achievement in US elementary schools, whereas Demwoze et al. (2026), in an Ethiopian study with Physics achievement data and structural equation modelling, reported an indirect relationship through academic engagement rather than a statistically significant direct effect. These studies cannot be assumed to establish the same relationship in Malawi; they instead show why perceptions of learning conditions must be distinguished from demonstrated achievement effects.

The gap addressed here is the limited integrated description of laboratory and classroom infrastructure, instructional materials, safety, teacher-student interaction, and school management as conditions for Physics learning within an under-resourced Malawian CDSS. The present single-school case adds contextualized, Physics-specific descriptive evidence; it does not test a new causal model or claim that geographical location alone constitutes originality. Its potential relevance beyond Malawi lies in identifying school-climate dimensions that other resource-constrained STEM education systems may need to examine together.

Research Objectives

This study was guided by the following specific research objectives:

1. To describe students' perceptions of the school-climate conditions that support or constrain opportunities to learn Physics in the selected Community Day Secondary School.
2. To summarise perceptions of school infrastructure, teaching and learning resources, safety, interpersonal relationships, and school rules and management practices.
3. To interpret questionnaire patterns alongside the available observation and focus-group accounts, with attention to the practical-learning requirements of Physics.

The study contributes a subject-specific description of the conditions under which Physics is taught and learned in a resource-constrained Malawian CDSS. Its originality lies in examining physical facilities, resources, safety, teacher-student relationships and school rules together, rather than in claiming a new statistical effect of school climate on achievement.

For policymakers, the descriptive evidence helps identify possible priorities for supporting practical science instruction, such as usable laboratories, equipment, textbooks and safe learning spaces. These are implications rather than demonstrated estimates of how much an intervention would raise Physics examination scores.

For school leaders and teachers, the findings highlight the value of maintaining orderly routines, supportive teacher-student interactions and access to whatever practical materials are available. Such measures may protect opportunities for students to ask questions, investigate phenomena and practice Physics problems even where the material environment is constrained.

Internationally, the case offers a transferable set of questions for examining Physics/STEM learning environments in schools facing similar shortages. Transferability should be judged against the circumstances of each setting; this single-school descriptive study does not establish statistical generalizability.

Previous school-climate research has examined broad academic outcomes and, in some cases, directly measured achievement (Belton & Brinkmann, 2024; Yu & Jiang, 2022). Physics-specific evidence is developing: Demwoze et al. (2026) found that academic engagement mediated the relationship between perceived school climate and Physics achievement among Ethiopian high-school students. The present study differs in both purpose and evidence: it combines student response patterns with a qualitative account of everyday Physics

learning conditions within one Malawian CDSS. It offers an integrated description of five contextual dimensions, not a test of direct, indirect or statistically significant achievement effects.

LITERATURE REVIEW

School climate refers to the quality of school life as reflected in physical conditions, safety, relationships, teaching practices and organizational arrangements (Cohen et al., 2009; Thapa et al., 2013). These dimensions need not affect every subject in the same way: in Physics, access to laboratory tasks, explanations, problem-solving practice and teacher feedback give the general concept of school climate a specific instructional meaning.

Theoretical Framework

Three complementary perspectives guide interpretation rather than serve as causal models tested by this descriptive study. School Climate Theory organises the five dimensions assessed; Ecological Systems Theory situates students' experiences within their immediate school environment; and Social Constructivist Theory helps interpret the importance of dialogue and guided practice in Physics.

Together, these theoretical perspectives provide complementary lenses for interpreting how school-level environmental conditions may shape students' opportunities to learn Physics, particularly in resource-constrained Community Day Secondary Schools (CDSSs) in Malawi. They guide the interpretation of the reported learning conditions but do not establish causal effects on academic achievement.

School Climate Theory has its roots in organisational climate research and was comprehensively synthesised by Cohen and colleagues, who defined school climate as the quality and character of school life, encompassing norms, values, relationships, teaching practices, and organisational structures (Cohen et al., 2009). Contemporary scholarship conceptualises school climate as a multidimensional construct including safety, interpersonal relationships, teaching and learning practices, and the physical environment (Thapa et al., 2013). Scholars argue that positive school climates enhance student motivation, engagement, and instructional effectiveness, which in turn improve academic outcomes (Hopson et al., 2014).

In this study, the school-climate perspective links infrastructure (items 1–5), teaching and learning resources (items 6–10), safety (items 11–15), school rules and regulations (items 16–20), and interpersonal relationships (items 21–25) with reported opportunities for learning. It does not imply that the questionnaire itself measures Physics achievement.

Ecological Systems Theory treats the school as a microsystem of interactions between learners, teachers and their immediate environment (Bronfenbrenner, 1979). Applied here, the physical safety and availability of school facilities help describe the circumstances in which Physics classes and practical activities occur; the study does not estimate their separate causal effects.

Social Constructivist Theory emphasises guided interaction and scaffolding in learning (Vygotsky, 1978). For Physics, teacher-student relationships matter because learners may need opportunities to question explanations, discuss abstract concepts and receive feedback while solving problems. This interpretation is compatible with the descriptive reports of classroom interaction but does not verify gains in conceptual understanding or examination scores.

Conceptual Framework

Figure 1 proposes that school infrastructure, teaching materials, safety, relationships and management routines create conditions for Physics instruction and student participation. These pathways reflect the three theoretical perspectives (Bronfenbrenner, 1979; Cohen et al., 2009; Vygotsky, 1978). The current data describe selected aspects of these conditions; because achievement was not analyzed as an outcome variable, the arrows in the figure are conceptual, not statistically established.

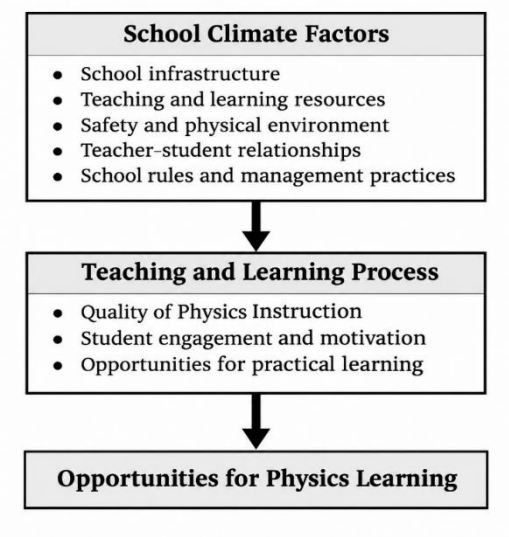


Figure 1. Conceptual framework of proposed school-climate conditions and Physics learning opportunities (conceptual pathways, not empirically tested effects).

Empirical Review

Prior research varies substantially in its setting, outcome and analytical design. Belton and Brinkmann (2024) linked climate survey data to reading test performance in US primary schools; Yu and Jiang (2022) examined combinations of school-climate characteristics using international PISA data; and Delgado-Galindo et al. (2025) used leadership interviews to compare schools in Spain. Together, these studies support a multidimensional view of school climate, but they cannot independently establish effects on Physics learning in a Malawian CDSS.

Subject-specific studies are especially relevant. Okokon et al. (2022) examined school-environment factors and a separate Physics achievement test among Nigerian secondary-school students, providing an example of an outcome-based design. More recently, Demwoze et al. (2026) analysed Ethiopian high-school Physics results and found that academic engagement mediated the association between perceived school climate and achievement; the direct effect was not statistically significant. The methodological difference is essential: the present study reports environmental perceptions, not a tested achievement pathway.

For practical Physics learning, laboratory access and material resources may determine which demonstrations, investigations and problem-solving tasks can be offered (Hofstein & Lunetta, 2004). However, descriptions of scarce equipment should not be converted directly into claims about lower test scores. In the present study, material constraints, safety and relational experiences are interpreted as interconnected opportunities and barriers to participation, not independently estimated determinants of examination performance.

Safety and school rules represent distinct but related dimensions: students may need secure facilities and predictable routines to participate in lessons. Yu and Jiang (2022) identified discipline and punctuality among school-climate combinations examined internationally, while Delgado-Galindo et al. (2025) highlighted relational and leadership features of effective school contexts. Such evidence motivates examining management practices alongside safety and interpersonal relationships, without presuming that these conditions caused particular Physics results in the present case.

Teacher-student dialogue is especially relevant when Physics concepts require explanation, mathematical practice and iterative correction (Vygotsky, 1978). The Ethiopian Physics study by Demwoze et al. (2026) further suggests that academic engagement may provide an important pathway between climate and achievement. The current study examines how students described these classroom opportunities but does not measure mediation or establish an improvement in academic performance.

The empirical contribution of the present study is therefore deliberately bounded: it provides a five-dimension, school-level description of perceived and observed conditions for Physics learning in an under-resourced Malawian secondary-school setting. Unlike studies with achievement tests or multi-school comparisons, it cannot estimate causal effects or support generalizations to all CDSSs.

RESEARCH METHOD

The study is reported as a descriptive mixed-methods case study of school-climate conditions for Physics learning in one Community Day Secondary School in Area 25, Lilongwe, Malawi. The quantitative strand summarized questionnaire response distributions; the qualitative strand provided observations and focus-group or open-response accounts relevant to interpreting those patterns. The combination supports contextual interpretation, not an assessment of statistically significant effects on Physics examination achievement (Creswell & Plano Clark, 2018).

The manuscript reports 43 participants: 40 students from Forms One and Three, two Physics teachers and one head teacher. The original study report specifies 20 Forms One and 20 Form Three students. Student participants were described as selected using random sampling, while the teachers and school leader were selected purposively for their instructional and management knowledge. The four questionnaire figures each total 40 responses and are therefore reported with n = 40, not n = 43. As this is a single-school case, the sample should not be treated as representative of all Malawian CDSSs.

The appended student/teacher school-climate questionnaire consists of 25 four-category agree/disagree items organized into five dimensions of five items each: infrastructure (items 1–5), teaching and learning resources (6–10), safety (11–15), school rules and regulations (16–20), and interpersonal relationships (21–25). Response options are strongly agreed, agree, disagree and strongly disagree. The head-teacher instrument includes background items, an incomplete table requesting annual Physics performance percentages, and open questions on school conditions; the eight-item observation schedule records physical features of the school. The research account also describes focus-group discussions. No completed examination-result dataset is presented or analyzed in this article, and its figures must not be interpreted as measured Physics achievement.

Quantitative data collected during the original undergraduate study were analyzed using Microsoft Excel and presented through descriptive frequency distributions and graphs. The questionnaire comprised 25 items organized into five school-climate dimensions: school infrastructure, teaching and learning resources, safety, school rules and regulations, and interpersonal relationships. Each dimension contained five items measured using four response categories: strongly agree, agree, disagree, and strongly disagree.

For the present article, frequencies and corresponding percentages were calculated from the response distributions presented in the original research report. The reported distributions for each school-climate dimension total 40 responses, and percentages are therefore presented using a denominator of 40. The three school staff members were included in the overall study participation of 43 but not in the denominators used for the student-response charts. However, the undergraduate thesis does not explain how the five questionnaire items within each dimension were combined into a single four-category distribution or whether negatively worded items were reverse coded. Consequently, the reported frequencies and percentages are interpreted as descriptive summaries of the original charts rather than independently validated composite measures of school climate.

The original research also employed qualitative thematic analysis, with information from two reported focus-group discussions, participant accounts, and observations organized around the school-climate dimensions. These qualitative findings were compared with the descriptive questionnaire patterns to provide contextual explanations of the learning environment. The analysis was descriptive and did not involve inferential statistical tests, effect-size estimation, or statistical modelling of students' Physics achievement. Accordingly, the findings describe perceived and observed learning conditions rather than establish statistically

significant or causal relationships between school climate and academic achievement (Creswell & Plano Clark, 2018; Denzin, 2012).

Instrument quality and research transparency

The research instruments were developed in accordance with the objectives of the original undergraduate study and the five identified dimensions of school climate. The principal questionnaire contained 25 items addressing school infrastructure, teaching and learning resources, safety, school rules and regulations, and interpersonal relationships. The questionnaire items corresponded to the research questions and were designed to capture respondents' perceptions of conditions within the school environment. Additional instruments included a semi-structured questionnaire for the head teacher, an observation schedule comprising eight items, and focus-group discussions involving students and school personnel.

The alignment of questionnaire items with the research objectives provided a basis for assessing their content relevance. Furthermore, the use of questionnaires, observations, and participant discussions enabled the researcher to examine school-climate conditions through different sources of evidence. This methodological triangulation strengthened the contextual interpretation of the reported findings by allowing questionnaire responses to be considered alongside observations and participant accounts.

Nevertheless, the original undergraduate research report does not document formal expert validation, pilot testing, statistical reliability coefficients, or inter-rater reliability assessments. Consequently, the present study does not claim that the instruments demonstrated established psychometric validity or internal consistency. Similarly, although the original report describes qualitative thematic analysis, detailed coding records and independent coding checks were not available for verification. These limitations are acknowledged when interpreting the descriptive findings, particularly because the questionnaire contained both positively and negatively worded items and the procedure used to aggregate item-level responses was not fully documented. The findings are therefore interpreted as context-specific perceptions and observations rather than validated measurements of the statistical influence of school climate on Physics achievement.

Ethical procedures

Ethical considerations were addressed during the original undergraduate research through procedures intended to protect the rights, privacy, and confidentiality of participants. As documented in the undergraduate thesis, the researcher sought permission from the relevant school authorities and individual respondents before conducting the investigation. The researcher also explained the purpose of the study to participating students and teachers during the organization of the focus-group discussions. Participation was voluntary, and respondents were informed of their freedom to participate or decline participation.

Confidentiality was addressed by avoiding the use of participants' names in the reported research findings and presenting the collected information in a generalized form without identifying individual respondents. In the present journal article, the participating institution is described as a Community Day Secondary School located in Area 25, Lilongwe, Malawi, rather than being identified by its institutional name. This reporting decision reduces direct identification of the school, although complete anonymity cannot be guaranteed from a geographical description alone.

The original undergraduate thesis does not provide a formal institutional research ethics approval number or specific documentation explaining whether parental or guardian consent and student assent were obtained for participants below the age of 18. Accordingly, the present article reports only the ethical procedures documented in the original research and does not claim that additional approval or consent procedures were undertaken without supporting evidence. This limitation is acknowledged as part of the methodological transparency of the study.

RESULTS

This section presents the descriptive findings on five dimensions of school climate: infrastructure, teaching and learning resources, safety, interpersonal relationships, and school rules and management practices. Figures 2–5 present the response distributions for the first four dimensions, while Table 1 summarises the frequencies and percentages for all five dimensions. The quantitative findings are based on 40 student respondents, while the qualitative evidence from observations and focus-group discussions provides contextual explanations of the reported school conditions. The findings are interpreted descriptively because the study did not report inferential statistical tests or analysed individual Physics achievement scores.

School Infrastructure and Opportunities for Physics Learning

Figure 2 shows 9 strongly agree (22.5%), 9 agree (22.5%), 10 disagree (25.0%), and 12 strongly disagree (30.0%) responses. The two disagreement categories together account for 22 of 40 responses (55.0%), indicating that disagreement categories exceeded agreement categories (18/40, 45.0%) in this plotted summary. Respondents and the observation account described limitations involving laboratory and library provision, classroom maintenance and furniture.

The importance of Physics is primarily an opportunity-to-learn issue: the reported absence or poor condition of laboratories and reference spaces may restrict practical demonstrations, investigations and independent reading (Hofstein & Lunetta, 2004). The accompanying field account described classroom-infrastructure concerns; it did not establish a measured reduction in examination achievement.

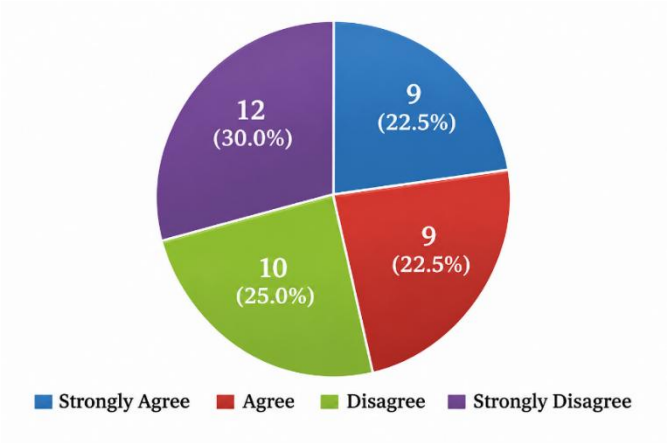


Figure 2. Student response categories for school infrastructure (n = 40; frequencies shown).

Teaching and Learning Resources

Figure 3 records 5 strongly agree (12.5%), 10 agree (25.0%), 11 disagree (27.5%), and 14 strongly disagree (35.0%) responses. Thus, 25 of 40 responses (62.5%) are in the two disagreement categories. The research account notes limited access to textbooks and practical materials; the head teacher described reliance on lesson notes where books were scarce, and teachers proposed additional textbooks and teaching aids.

These responses identify perceived constraints on reference reading, independent problem-solving and practical Physics activities. They should not be interpreted as evidence that a quantified amount of academic achievement was lost or that a resource intervention would produce a specific examination gain.

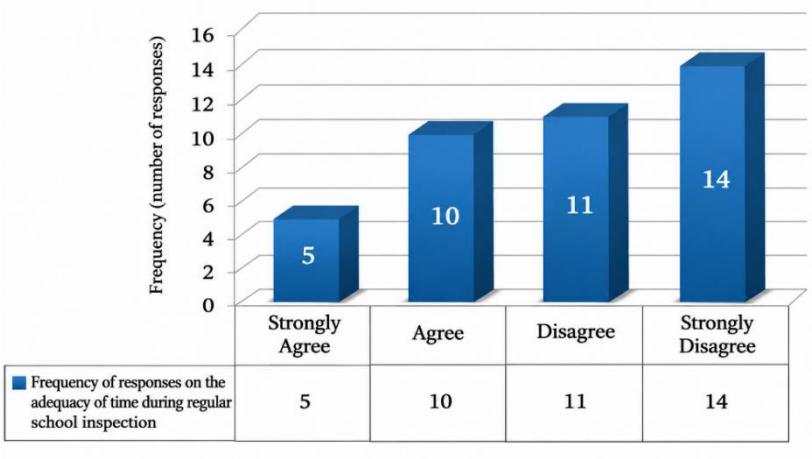


Figure 3. Student response categories for teaching and learning resources (n = 40; frequencies shown).

Safety Conditions and the Learning Environment

Figure 4 displays 4 strongly agree (10.0%), 6 agree (15.0%), 13 disagree (32.5%), and 17 strongly disagree (42.5%) responses. The disagreement categories comprise 30/40 responses (75.0%), compared with 10/40 (25.0%) in the agreement categories. The questionnaire asks about toilets, classroom security, general learning environment, personal safety and perimeter fencing; the displayed category frequencies are not direct measures of anxiety, absenteeism or Physics attainment.

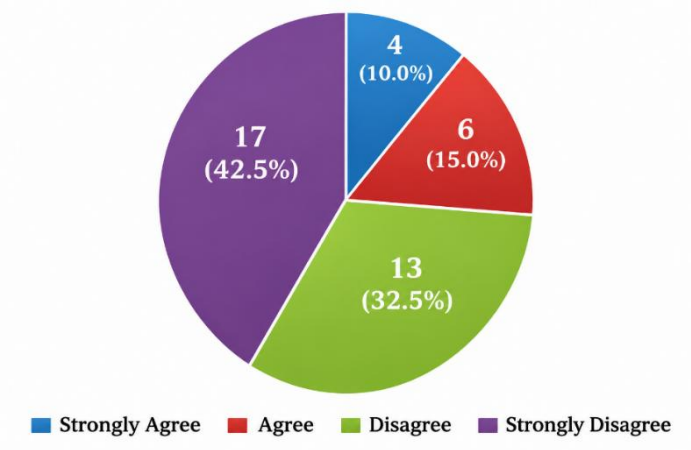


Figure 4. Student response categories for school safety (n = 40; frequencies shown).

For Physics instruction, perceived safety can be discussed as part of the conditions for students to attend, concentrate and participate, including during practical tasks. The present data do not demonstrate that unsafe conditions caused a reduction in Physics marks.

Teacher-Student Interpersonal Relationships

Figure 5 shows 9 strongly agree (22.5%), 18 agree (45.0%), 8 disagree (20.0%) and 5 strongly disagree (12.5%) responses. Agreement categories total 27/40 (67.5%), whereas disagreement categories total 13/40 (32.5%). These charted responses concern the interpersonal-relationship questionnaire dimension, which includes both positively and negatively worded items; because reverse coding and category aggregation are not reported, they should be interpreted as displayed rather than as a validated positive-relationship scale.

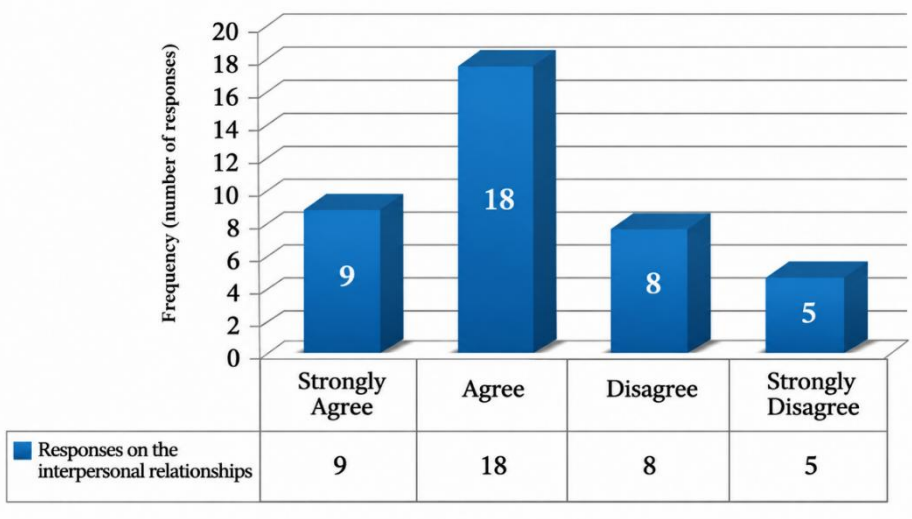


Figure 5. Student response categories for teacher-student interpersonal relationships (n = 40; frequencies shown).

The accompanying research account notes that some students were reluctant to approach teachers, while teachers emphasized the value of stronger interaction and cooperation. These observations add context to the chart and identify access to explanation and feedback as relevant Physics-learning opportunities, without demonstrating improved examination performance.

School Rules and Management Practices

School rules and management practices were examined through questionnaire items addressing respect for teachers, discipline, punishment, lateness, and the reporting of disciplinary cases. The reported response distribution comprised 13 strongly agree responses (32.5%), 15 agree responses (37.5%), 7 disagree responses (17.5%), and 5 strongly disagree responses (12.5%), based on 40 respondents. The combined agreement categories accounted for 28 respondents (70%), while the disagreement categories accounted for 12 respondents (30%).

The findings indicate that agreement responses were more frequent than disagreement responses regarding school rules and management practices. However, because the questionnaire included statements addressing different aspects of discipline and school administration, these responses should be interpreted as descriptive indicators of students' perceptions rather than definitive evidence of effective school management. Qualitative findings also highlighted the importance of discipline and consistent management in maintaining order and protecting instructional time.

However, the questionnaire includes statements with different wording and implications. Consequently, the category totals should be interpreted descriptively rather than as a validated measure of management effectiveness. The findings identify school rules and management as relevant aspects of the learning environment, but they do not establish that these practices caused improvements in Physics achievement.

Table 1. Reported Student Response Categories by School-Climate Dimension

Dimension	Strongly agree	Agree	Disagree	Strongly disagree
Infrastructure	9 (22.5%)	9 (22.5%)	10 (25%)	12 (30%)
Teaching/learning resources	5 (12.5%)	10 (25%)	11 (27.5%)	14 (35%)
Safety	4 (10%)	6 (15%)	13 (32.5%)	17 (42.5%)
Interpersonal relationships	9 (22.5%)	18 (45%)	8 (20%)	5 (12.5%)
Rules and management	13(32.5%)	15(37.5%)	7(17.5%)	5(12.5%)

Note. Percentages were calculated using n = 40. The school rules and management distribution are included in the reported quantitative findings. Because the questionnaire items differ in wording and the scoring and aggregation procedure is not fully documented, the frequencies are presented as reported response categories rather than as a validated composite score.

Integration of Quantitative and Qualitative Findings

Table 2 distinguishes the questionnaire patterns from the qualitative material documented in the manuscript. Because the available records do not include verbatim transcripts or a complete coding trail, the qualitative column summarizes reported accounts rather than presenting quotations. The table also identifies where the current records do not support a claim of independent qualitative corroboration.

Table 2. Joint display of quantitative and qualitative findings

Dimension and quantitative pattern	Qualitative evidence documented in the manuscript	Integrated interpretation and limitation
Infrastructure Disagreement categories: 22/40 (55.0%).	The narrative reports concerns about laboratory and library provision, classroom maintenance, and furniture.	The account contextualises perceived constraints on practical investigation and independent reading. It does not show that facilities caused lower Physics marks.
Teaching and learning resources Disagreement categories: 25/40 (62.5%).	The head teacher reportedly described reliance on lesson notes where books were scarce; teachers proposed additional textbooks and teaching aids.	This is consistent with reported concerns about access to learning materials, but the study did not measure the effect of resource availability on achievement.
Safety Disagreement categories: 30/40 (75.0%).	The questionnaire covers toilets, classroom security, the learning environment, personal safety, and fencing. The supplied narrative does not report dimension-specific observation results or verbatim qualitative excerpts on safety.	The survey summary signals perceived safety concerns, but independent qualitative corroboration cannot be established from the available records.
Interpersonal relationships Agreement categories: 27/40 (67.5%); disagreement categories: 13/40 (32.5%).	The account notes that some students were reluctant to approach teachers, while teachers emphasised interaction and cooperation.	This suggests a mixed relational context. Because item polarity and scoring are undocumented, agreement categories should not be treated as a validated positive-relationship score.
Rules and management Agreement categories: 28/40 (70.0%); disagreement categories: 12/40 (30.0%).	The account highlights discipline and consistent management as relevant to maintaining order and instructional time; no verbatim excerpt is available.	Agreement responses were more frequent, but varied item wording and undocumented scoring prevent a validated management-effectiveness or achievement claim.

DISCUSSION

As Table 2 shows, the qualitative accounts provide context for some questionnaire patterns, particularly those concerning infrastructure, resources, interpersonal relationships and management. The available records do not provide equally specific qualitative evidence for every dimension, especially safety; integration is therefore partial and descriptive rather than independent confirmation of all five questionnaire summaries.

Infrastructure: Practical-Learning Opportunities

A modest majority of charted student responses fell into disagreement categories for infrastructure items (22/40, 55%). As one item is negatively phrased and the coding of the chart is not documented, this total is not a validated infrastructure-adequacy score. In a subject that draws on demonstrations, investigations and mathematical representations, inadequate laboratory and classroom provision is plausibly relevant to which learning activities teachers can offer. The accompanying observations provide contextual support for this interpretation, not proof that the missing facilities caused low Physics marks (Hofstein & Lunetta, 2004). The school-level case illustrates the distinction between access to practical learning and measured achievement. Unlike the Nigerian outcome-based study by Okokon et al. (2022), this investigation neither assessed laboratory exposure against test scores nor compared schools. Its stronger contribution is documenting the practical-learning environment experienced by participating students.

Instructional Resources and Learning Participation

Disagreement categories were more frequent for instructional resources (25/40, 62.5%). The head-teacher's account of reliance on lesson notes and teachers' requests for textbooks and visual materials help explain why students might have limited opportunities for independent Physics practice. These are triangulated descriptions of learning conditions; the study cannot estimate the effect of resource shortages on examination results.

This interpretation fits the broader argument that school climate is multidimensional rather than reducible to equipment alone (Yu & Jiang, 2022). Where practical apparatus is scarce, the availability of explanations, classroom materials and guided exercises becomes especially relevant; nevertheless, the present figures are descriptive category totals and cannot rank the independent effects of competing factors.

Safety Conditions and the Learning Environment

Safety drew the highest share of disagreement categories among the four charted dimensions (30/40, 75%). This pattern indicates a particularly salient concern in students' assessments of toilets, locked classrooms, perimeter security and feeling safe at school. Without direct measures of anxiety, attendance or Physics outcomes, the appropriate inference is that these conditions were perceived as unfavorable for learning, rather than that they demonstrably reduced marks.

The ecological perspective treats safety as an element of learners' immediate school setting (Bronfenbrenner, 1979). Administrators could reasonably review sanitation and facility security as part of improving the environment for instruction, but the likely benefit should be evaluated with future attendance and achievement data rather than assumed.

Interpersonal Relationships and Engagement

Interpersonal-relationship responses were more frequently in the agreement categories (27/40, 67.5%), although item wording and scale scoring require caution. The research account also included concerns about students' comfort in approaching teachers. Viewed together, these results suggest a mixed but important relational context for Physics explanation, question-asking and feedback; they do not quantify gains in motivation or achievement.

Social Constructivist Theory helps frame the importance of guided interaction for understanding abstract Physics concepts (Vygotsky, 1978). Demwoze et al. (2026) reported that academic engagement mediated the

school-climate/Physics-achievement association in an Ethiopian study using achievement data and a different analytical design. That finding strengthens the international rationale for examining engagement, while the present study remains limited to descriptive accounts of the conditions that may support it.

School Rules, Management and the International STEM Contribution

The reported school-rules and management distribution showed that 28 of 40 respondents (70%) selected agreement categories, while 12 (30%) selected disagreement categories. The original study account interpreted this distribution as indicating that most respondents perceived the rules as working and providing guidance. Qualitative observations also highlighted the relevance of discipline and management routines to maintaining order and instructional time. These findings complement the four other school-climate dimensions by showing that the learning environment includes organizational as well as physical and interpersonal conditions. Nevertheless, because the scoring procedure for the differently worded questionnaire items is not fully documented, the distribution should be interpreted cautiously. It does not establish a causal or statistically significant relationship between school management and Physics achievement.

Across the five dimensions, the case points to a transferable instructional problem: Physics education depends both on material opportunities to investigate phenomena and on safe, orderly and supportive conditions for sustained explanation and practice. This synthesis resonates with international school-climate research on configurations of conditions (Yu & Jiang, 2022), relational and leadership context (Delgado-Galindo et al., 2025), and the role of engagement in Physics (Demwoze et al., 2026). The Malawi case can inform what comparable resource-constrained STEM systems should assess together but cannot establish that the same response patterns or outcomes occur elsewhere.

CONCLUSION

This single-school study reported disagreement-category proportions of 55% for infrastructure, 62.5% for instructional resources and 75% for safety, alongside a 67.5% agreement-category proportion for interpersonal relationships. Because item polarity and summary aggregation were not documented, these proportions are reported as chart-category distributions rather than validated dimension ratings. The qualitative account also highlighted school routines and management as conditions relevant to instruction. Interpreted together, these findings suggest that opportunities to learn Physics through practical work, independent study and teacher-guided explanation may be constrained by material and organizational circumstances. The evidence is descriptive, perception-based and context-specific: it contains no analyzed Physics achievement variable, inferential test or causal estimate. Its contribution is to make visible the combination of material, relational, safety and management conditions that matter for considering equitable, practice-oriented Physics/STEM education in resource-constrained schools internationally.

IMPLICATIONS FOR EDUCATIONAL PRACTICE AND FUTURE RESEARCH

The findings highlight the importance of understanding school climate as a multidimensional condition that may shape opportunities for effective Physics teaching and learning in Community Day Secondary Schools (CDSSs) in Malawi. In resource-constrained educational settings, laboratory access, classroom conditions, textbooks, and practical teaching materials constitute interconnected aspects of the instructional environment. Improving these conditions may expand opportunities for experimentation, demonstration, and guided practice, consistent with the importance of practical experiences in science education (Hofstein & Lunetta, 2004). However, the present study identifies perceived constraints rather than establishing causal relationships between resource availability and Physics examination achievement.

Beyond physical resources, the findings underscore the relevance of interpersonal relationships, instructional interaction, and school management practices in shaping students' learning experiences. Opportunities for questioning, constructive feedback, and supportive teacher–student communication may contribute to more participatory learning environments, consistent with sociocultural perspectives on learning

(Vygotsky, 1978) and research emphasizing student engagement (Demwoze et al., 2026). Similarly, concerns regarding sanitation, classroom security, and predictable school routines suggest that institutional management and community participation warrant consideration alongside instructional resources. These dimensions should be understood as potentially interacting conditions of school climate rather than independently demonstrated determinants of academic achievement.

For future research, the findings point to the need for comparative and longitudinal investigations across multiple CDSSs, supported by validated school climate instruments, transparent qualitative analysis, and independently collected Physics achievement data. Such designs would enable more rigorous examination of whether and how physical, interpersonal, and organizational dimensions of school climate relate to academic outcomes, including the potential mediating role of student engagement. This approach could advance international STEM education research by moving beyond descriptive accounts of school conditions toward empirically testable explanations of how learning environments influence educational opportunities and achievement in resource-constrained contexts.

LIMITATIONS OF THE STUDY

This study concerns one school and a small participant group (40 students and three school staff), so it does not support statistical generalization. The four reported figures summarize perceptions and do not document how five item responses per dimension were aggregated. The supplied records do not provide psychometric reliability estimates, a fully documented qualitative coding audit trail, or confirmed formal ethics approval/guardian-consent procedures. The qualitative source account supplies context but contains no presented verbatim transcript excerpts. The school-level descriptions and data provenance should be checked against the original response records before submission. Most importantly, no analyzed Physics examination/test scores or inferential statistics are presented; the design therefore cannot establish a significant association, improvement or causal influence on achievement.

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APPENDICES

Appendix A: QUESTIONAIRE FOR HEADTEACHERS

A. Background information

1. Age range

   20-29[ ] 30-39[ ] 40-49[ ] 50-59[ ]

2. Sex

   Male [ ] female [ ]

B. Please answer the following questions:

Table below fill in the average percentage performance of the students in physics in the following years including 2021 M.S.C.E results:

YEAR	average percentage performance of students
2021	
2022	
2023	
2024	

What are some of challenges that hinders students' academic performance as regard to:

i. School infrastructure? _____

ii. Teaching and learning resources? _____

iii. Safety? _____

iv. Rules and regulations? _____

Appendix B: QUESTIONAIRE FOR TEACHERS AND STUDENTS

This questionnaire has been designed to get your opinions and attitudes concerning your school. Your responses are strictly anonymous and you will not be asked to identify yourself at any time of the study. Please answer all questions completely and in an honest way possible.

BACKGROUND INFORMATION

Age range

10-19[ ] 20-29[ ] 30-39[ ] 40-49[ ] 50-59[ ]

Sex

Male [ ]female [ ]

GENERAL QUESTIONS

Please indicate your opinion or attitude with a (✓) where appropriate.

PART A. STATE OF SCHOOL INFRASTRUCTURE

Present state of school infrastructure	**Strongly agree**	**Agree**	**Disagree**	**Strongly disagree**
1. Some wall has cracks.				
2. This school has a laboratory.				
3. There is enough furniture in this school.				
4. The classrooms are well painted.				
5. This school has a library.				

PART B. ADEQUACY OF TEACHING AND LEARNING RESOURCES

Adequacy of teaching and learning resources	**Strongly agree**	**Agree**	**Disagree**	**Strongly disagree**
6. There are enough text books at this school.				
7. The text books are in good condition.				
8. Chalkboards are well painted.				
9. This school has enough teachers.				
10. Laboratory has enough chemicals and equipment for practical lessons.				

PART C. SAFETY OF TEACHERS AND STUDENTS AT SCHOOL

Safety	**Strongly agree**	**agree**	**disagree**	**Strongly disagree**
11. The toilets are clean.				
12. The classrooms are well locked.				
13. The school has good learning environment.				
14. I feel safe at this school.				
15. There is a fence around our school.				

PART D. RULES AND REGULATIONS OF THE SCHOOL

Rules and regulations	**Strongly agree**	**agree**	**disagree**	**Strongly disagree**
16. Students in this school respect teachers.				
17. In his school strict discipline is needed to control students.				
18. Sometimes students are punished.				
19. Most students come to school late.				
20. In discipline cases are reported at this school.				

PART E. INTERPERSONAL RELATIONSHIPS AT THE SCHOOL

Interpersonal relationships	**Strongly agree**	**agree**	**disagree**	**Strongly disagree**
21. The surrounding community is friendly to students and teachers.				
22. In this school students fear asking for homework.				
23. Teachers are friendly to students.				
24. Some students in this school fear teachers.				
25. This school has a suggestion box.				

TEACHERS COMMENTS: _____

Appendix C

OBSERVATION SCHEDULE

Does the school have the following infrastructures?

QUESTION NUMBER	OBSERVATIONS	YES	NO
1	Classrooms big enough for students?		
2	Staffroom?		
3	Are toilets girl friendly?		
4	Are classrooms clean?		
5	Are desks in good conditions		
6	Is the staffroom neat?		
7	Does the school have flowerbeds?		
8	Are the learners tidy?		

COMMENT: _____