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Assessing Small-Scale Mining and Its Impact on Junior High School Pupils' Performance at Manwe in the Wa East District, Upper West Region

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Abstract

Small-scale mining has become a dominant livelihood strategy in many rural communities in northern Ghana, offering short-term income opportunities amid declining agricultural productivity and limited formal employment. However, its implications for basic education remain underexplored at the community level. This study assessed the impact of small-scale mining on the academic performance of Junior High School pupils in Manwe, Wa East District, Upper West Region. Guided by Human Capital Theory and household economic perspectives, the study adopted a descriptive cross-sectional mixed-methods design. Quantitative data were collected through structured questionnaires administered to pupils, while qualitative insights were obtained from semi-structured interviews with teachers and parents. Descriptive and inferential analyses were complemented by thematic analysis of qualitative data.

The findings reveal that pupils' involvement in small-scale mining is primarily driven by household poverty, income pressure, easy access to mining sites, and weak enforcement of child labour regulations. Mining participation significantly disrupts school attendance and punctuality, with widespread absenteeism and seasonal withdrawal during peak mining periods. Health-related effects, including physical fatigue, minor injuries, sleep deprivation, and reduced classroom concentration, further constrain pupils' learning capacity. These attendance and health challenges collectively mediate a strong, negative relationship between mining participation and academic performance, as reflected in reduced study time, poorer examination outcomes, and an increased risk of class repetition.

Teachers consistently perceive small-scale mining as a structural threat to education, while parents, though aware of its negative educational consequences, often rationalise children's participation as an economic necessity. The study concludes that the educational costs of small-scale mining outweigh its short-term livelihood benefits. It recommends integrated interventions that combine education and protection, alternative livelihood support, and strengthened institutional enforcement to reconcile household survival with sustainable educational outcomes in mining-dependent communities.

Keywords: *Small-Scale Mining, Perceive Small-Scale Mining, Gather Them & Sell, Gold Mining, Mining Engineering,*

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1.0 INTRODUCTION

Small-scale mining has become an entrenched livelihood strategy across rural Ghana, particularly in mineral-rich yet economically marginalised communities. In contexts marked by declining agricultural productivity, limited formal employment, and climatic stress, artisanal and small-scale mining offers an accessible pathway to income generation, asset accumulation, and short-term economic security. Empirical studies consistently demonstrate that mining has become a dominant livelihood option in several districts of northern Ghana, including the Wa East District, where households increasingly rely on mineral extraction to stabilise consumption and finance basic needs (Baddianaah, 2021; Arthur et al., 2016). This livelihood relevance, however, coexists with profound social externalities that remain insufficiently interrogated at the micro-community level.

Education constitutes a central pillar of human capital formation and long-term development, yet it is particularly vulnerable in resource-dependent rural economies. While mineral extraction may alleviate immediate income constraints, extensive literature warns that early engagement of children in extractive activities undermines schooling through irregular attendance, fatigue, declining concentration, and deteriorating health outcomes (de la Brière et al., 2017; Jonah, 2018). These disruptions weaken cognitive development and perpetuate intergenerational poverty traps. The contradiction is stark. Natural resource wealth, rather than translating into human capital accumulation, frequently coincides with poor educational outcomes, especially where governance and household survival pressures converge (de la Brière et al., 2017). In such settings, children's labour becomes an adaptive household strategy, but one that silently erodes future productivity and social mobility.

The Wa East District exemplifies this tension. Mining activities have expanded rapidly, reshaping livelihood structures and daily routines within communities such as Manwe. Junior High School pupils occupy a particularly precarious position within this transformation. At this developmental stage, pupils face increased academic demands alongside heightened expectations to contribute economically to household survival. Existing evidence suggests that pupils' involvement in mining, whether directly at sites or indirectly through ancillary activities, correlates with absenteeism, chronic lateness, health complications, and reduced classroom engagement (Jonah, 2018; Wilson et al., 2015). Yet district-level data rarely disaggregate these effects or systematically link them to academic performance indicators within specific school communities

This study is situated in Manwe, Wa East District, Upper West Region, and focuses explicitly on Junior High School pupils as a vulnerable yet policy-relevant group. By foregrounding pupils' lived educational experiences, the study interrogates the structural drivers that draw children into mining, the pathways through which mining participation affects attendance, punctuality, health, and concentration, and the measurable relationship between mining engagement and academic performance. It further extends analysis to the perceptions of teachers and parents, whose normative justifications and anxieties shape children's schooling decisions within mining-dependent households.

Guided by the general objective of assessing the impact of small-scale mining on the academic performance of Junior High School pupils in Manwe, the study pursues five specific objectives: identifying factors influencing pupils' involvement in mining; examining effects on school attendance and punctuality; assessing health and concentration outcomes; determining the relationship between mining and academic performance; and exploring parental and teacher perceptions of mining's educational consequences. These objectives anchor the analytical trajectory of the thesis and ensure coherence between empirical evidence and policy-relevant conclusions.

Structurally, this chapter establishes the study's contextual and conceptual foundation. It situates small-scale mining within rural livelihood systems and frames education as a threatened investment in human capital. It justifies the selection of Manwe and JHS pupils as the focal unit of analysis. Subsequent chapters build on this foundation through a critical review of relevant literature, a rigorous methodological framework, empirical analysis of field data, and evidence-based conclusions and recommendations to reconcile livelihood survival with educational sustainability.

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1.1 Background to the Study

Small-scale mining, commonly referred to in Ghana as artisanal and small-scale mining (ASM), constitutes a long-established livelihood strategy embedded within rural survival economies. Characterised by low capital intensity, rudimentary technology, and labour-intensive extraction methods, ASM has expanded rapidly in response to declining agricultural returns, limited rural employment opportunities, and rising global gold prices (Wilson et al., 2015; Baddianaah & Abdulai, 2023). In northern Ghana, particularly in the Upper West Region, small-scale mining has become an important supplementary income source for farming households, youth, and migrant labourers seeking immediate cash (Mensah-Abludo et al., 2023). Despite its contribution to household livelihoods, ASM operates largely outside formal regulation, exposing communities to environmental degradation, health risks, and complex social externalities.

One of the most contested dimensions of small-scale mining in Ghana concerns the involvement of children and adolescents. Nationally, evidence indicates that school-aged children participate in mining activities either directly as labourers or indirectly through support roles such as washing ore, carrying materials, or providing ancillary services (Jonah & Abebe, 2018). These practices are particularly prevalent in rural mining communities where household survival imperatives override long-term human capital considerations. Studies suggest that children's engagement in mining is driven by intersecting factors, including household poverty, parental influence, peer networks, weak enforcement of child labour regulations, and the perceived short-term financial rewards of mining compared to schooling (Nkomo & Mpofu, 2022). In mining-dependent districts, child participation is often normalised, blurring the boundary between acceptable household contribution and exploitative labour.

This reality stands in tension with Ghana's education policy framework, which emphasises education as a fundamental human right and a cornerstone of national development. The 1992 Constitution and subsequent reforms, such as the Free Compulsory Universal Basic Education (FCUBE) policy, mandate universal access to basic education, including Junior High School (JHS) (Alhassan, 2020). These policies aim to enhance school enrolment, attendance, retention, and academic performance, particularly in deprived regions such as the Upper West. However, empirical evidence reveals a persistent implementation gap. While enrolment figures have improved, attendance irregularities, late arrivals, poor concentration, and dropout rates remain high in rural and economically stressed communities (Porter et al., 2011; Alhassan, 2020). For many households, the indirect costs of schooling, opportunity costs of child labour, and immediate income needs undermine the practical realisation of compulsory education.

In mining communities, these contradictions are especially pronounced. Small-scale mining offers rapid financial returns that schooling cannot immediately match. Consequently, education competes directly with economic survival strategies. Children who participate in mining often experience fatigue, health complications, and reduced classroom engagement, all of which compromise learning outcomes and academic performance (Wilson et al., 2015; Nkomo & Mpofu, 2022). Teachers and parents frequently express ambivalent attitudes, acknowledging both the economic benefits of mining and its disruptive effects on schooling. This ambivalence sustains a cycle in which educational aspirations are subordinated to short-term livelihood imperatives.

The Wa East District, and Manwe in particular, exemplifies these dynamics. The area has witnessed an increase in small-scale mining activities alongside persistent educational challenges. Junior High School pupils represent a particularly vulnerable group, situated at a critical transition stage between completing basic education and potential withdrawal into full-time labour. Understanding how mining participation intersects with attendance, health, concentration, and academic performance is therefore essential for designing context-responsive education and child protection interventions.

Against this backdrop, the present study assesses the impact of small-scale mining on the academic performance of Junior High School pupils in Manwe, Wa East District. Guided by clearly defined objectives, the study examines the drivers of pupil involvement in mining, the effects on attendance and punctuality, the health and concentration implications, the relationship between mining and academic outcomes, and the perceptions of teachers and parents regarding these effects. This chapter situates the study conceptually and contextually. Subsequent sections of the thesis elaborate on the problem statement, research questions,

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objectives, significance of the study, and methodological orientation that structure the overall research direction.

1.2 Statement of the Problem

Junior High School (JHS) education constitutes a critical stage in Ghana's human capital formation agenda, as it bridges foundational literacy with future academic and vocational pathways. Despite sustained national investments in basic education through policies such as Free Compulsory Universal Basic Education (FCUBE) and complementary social interventions, academic underperformance and irregular school attendance persist in several rural and extractive economies. Mining-prone communities remain disproportionately affected. Empirical evidence from Ghana demonstrates that pupils in resource-extraction zones consistently record lower academic outcomes compared to their counterparts in non-mining areas, mainly due to competing livelihood demands and disrupted schooling trajectories (Ghanney, 2020; Baah et al., 2020).

In artisanal and small-scale mining (ASM) communities, child participation in mining-related activities has intensified rather than declined. Studies across Ghana reveal that poverty, household survival strategies, perceived low returns to education, and weak enforcement of child protection and mining regulations continue to draw school-going children into mining sites (Wilson et al., 2015; Jonah, 2018). This pattern directly contradicts Ghana's basic education policy framework, which mandates compulsory schooling up to the JHS level. However, in practice, the opportunity cost of schooling for poor rural households often outweighs the long-term educational benefits, particularly when mining offers immediate cash income (Hilson & Osei, 2014; Baah et al., 2020).

Beyond school absenteeism, participation in mining exposes pupils to physical exhaustion, hazardous working conditions, and environmental health risks, thereby undermining effective learning. Research indicates that prolonged exposure to mining-related dust, noise, and strenuous labour is associated with fatigue, respiratory challenges, stress, and reduced cognitive concentration among children and adolescents (Olufemi et al., 2019; Stanovská et al., 2024). Although much of the occupational health literature focuses on adult miners, emerging studies suggest that similar risk pathways affect children engaged in or living near mining operations, with direct implications for classroom attentiveness and academic performance (Kamugisha et al., 2018; Wilson et al., 2015).

While several studies have examined the educational effects of extractive activities, such as sand winning and illegal mining, in southern Ghana, there remains a marked geographical and empirical gap in the Upper West Region, particularly in the Wa East District. Existing research has largely overlooked Manwe, despite evidence that ASM forms a significant livelihood pillar in the area (Baddianaah, 2017; Mensah-Abludo et al., 2023). Crucially, there is limited localised empirical analysis linking pupils' involvement in small-scale mining to attendance patterns, health status, classroom concentration, and measurable academic outcomes at the JHS level in this context.

This absence of context-specific evidence constrains policy responsiveness and weakens district-level education and child protection interventions. Without a clear understanding of how small-scale mining shapes educational participation and performance in Manwe, stakeholders risk deploying generic solutions that fail to address local livelihood realities. This study, therefore, responds to a critical knowledge and policy gap by systematically assessing the impact of small-scale mining on the academic performance of JHS pupils in Manwe, while incorporating the perspectives of pupils, parents, and teachers to inform more grounded and practical educational and mining governance strategies.

1.5 Purpose of the Study

The primary purpose of this study is to generate context-specific empirical evidence on the educational consequences of small-scale mining on Junior High School pupils in Manwe, within the Wa East District of the Upper West Region. While small-scale mining remains an important livelihood strategy in rural Ghana, its intersection with compulsory basic education has not been sufficiently interrogated at the community level, particularly regarding learning outcomes.

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Beyond evidence generation, the study seeks to inform local education authorities, traditional leaders, and relevant policy actors on the nature and magnitude of the educational disruptions associated with pupils' participation in mining activities. Such evidence is necessary for designing targeted child protection measures and education enforcement strategies that are sensitive to local livelihood realities. Finally, the study contributes to the broader academic discourse on child labour, rural livelihoods, and human capital formation by extending empirical inquiry to an under-researched geographical and social context. In doing so, it strengthens the analytical bridge between extractive livelihoods and educational development in northern Ghana.

1.7 Significance of the Study

The significance of this study is multidimensional. From a policy perspective, the findings provide empirical support for interventions in child protection enforcement, education regulation, and mining governance at the district and community levels. Evidence from the study can inform strategies to reduce child labour without undermining household livelihood security. In terms of educational planning, the study offers school administrators and education officers practical insights into how livelihood pressures shape attendance, punctuality, classroom concentration, and performance. This facilitates the design of context-sensitive school-based interventions rather than generic policy responses. Academically, the study expands the limited, localised empirical literature on the nexus between small-scale mining and basic education in Ghana, particularly in the Upper West Region. It strengthens theoretical debates on the erosion of human capital in extractive rural economies. At the community level, the study provides evidence to enhance parental awareness and stimulate informed dialogue among traditional authorities regarding the long-term educational costs of children's involvement in mining activities.

2.0 MATERIALS AND METHODS

2.1 Introduction

This chapter examines existing scholarship on small-scale mining and its intersections with children's education, with particular emphasis on Junior High School pupils in rural mining contexts. It synthesises theoretical arguments, conceptual perspectives, and empirical findings that explain why children engage in extractive activities and how such engagement shapes schooling outcomes. The discussion treats small-scale mining not merely as an economic activity but as a livelihood system embedded in household survival strategies, social norms, and local opportunity structures. Education is approached as both a developmental right and a form of human capital that is especially vulnerable in communities where mining competes directly with schooling for children's time, energy, and attention. The chapter, therefore, interrogates how mining participation affects attendance, punctuality, health, concentration, and academic performance, while also considering the mediating roles of parents, teachers, and community institutions. The review is organised thematically in line with the study's specific objectives, enabling a focused, analytical engagement with the literature rather than a descriptive catalogue of studies. It concludes by identifying unresolved empirical and contextual gaps, particularly the limited location-specific evidence on Junior High School pupils in Manwe, which the present study seeks to address.

2.2 Conceptualising Small-Scale Mining

2.2.1 Definition and Characteristics of Small-Scale Mining

Small-scale mining occupies an analytically complex space within the extractive sector, mainly because it resists a single, universally accepted definition. In the literature, the term is often used interchangeably with artisanal mining, yet important conceptual distinctions persist. Broadly, artisanal and small-scale mining (ASM) refers to mineral extraction activities undertaken by individuals, families, or small groups using rudimentary methods, limited capital, and low levels of mechanisation (Hilson, 2016; Morante-Carballo et al., 2022). The emphasis is less on output volume alone and more on production processes, labour organisation, and technological intensity.

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Conceptually, artisanal mining is typically associated with highly informal, subsistence-oriented operations that rely almost exclusively on manual labour and simple tools. Small-scale mining, by contrast, may involve slightly higher levels of organisation, modest mechanisation, and, in some cases, legal recognition by the state (Hilson, 2016). Large-scale mining differs fundamentally from both, as it is capital-intensive, technologically advanced, and dominated by multinational corporations operating under formal regulatory regimes. These distinctions are critical, as they shape not only environmental and economic outcomes but also the social dynamics surrounding labour participation, including children's involvement (Morante-Carballo et al., 2022).

A defining characteristic of small-scale mining is its labour-intensive nature. ASM operations typically absorb large numbers of workers because production depends more on human effort than on machinery. This feature explains its prominence as a rural livelihood strategy in contexts of limited agricultural productivity and scarce formal employment opportunities, particularly in northern Ghana (Baddianaah, 2023). The sector is also marked by low technological input, which constrains productivity but lowers entry barriers, making it accessible to impoverished households, including school-aged children. Informality constitutes another central feature. Although Ghana has a legal framework for small-scale mining, a substantial proportion of operators function outside state regulation. Studies consistently show that more than four-fifths of ASM activities in Ghana occur without valid licenses, a situation shaped by bureaucratic bottlenecks, weak enforcement, and tensions between customary land tenure systems and statutory mineral rights (Kokofu et al., 2022; Kumah, 2022). As a result, the boundary between legal and illegal small-scale mining remains blurred, with legality often reduced to what local actors perceive as “paper compliance” rather than substantive regulatory control.

The coexistence of legal and illegal dimensions has profound implications. Legally registered small-scale mining is intended to promote safer practices, environmental management, and accountability. However, illegal operations, commonly referred to as galamsey, operate with minimal oversight, exacerbating social and environmental risks while deepening household dependence on mining income (Mensah-Abludo et al., 2023). In mining-prone districts such as Wa East, this duality reinforces the normalisation of mining as a livelihood option, even for children, thereby intersecting directly with educational participation and performance. In sum, small-scale mining is best understood not merely as a scaled-down version of industrial mining, but as a distinct socio-economic system characterised by informality, labour intensity, low technology, and regulatory ambiguity. These characteristics provide the structural context within which pupils’ involvement in mining activities emerges, making ASM a critical variable in analyses of schooling, attendance, health, and academic performance in rural mining communities.

2.2.2 Small-Scale Mining as a Rural Livelihood Strategy

Artisanal and small-scale mining (ASM) has become a critical livelihood strategy in many rural economies across sub-Saharan Africa, particularly in contexts characterised by persistent poverty, declining agricultural productivity, and limited formal employment opportunities. The literature consistently frames ASM as a “push–pull” response to structural rural deprivation, in which households are driven into mining by economic necessity rather than by opportunity alone (Wilson et al., 2015; Arthur et al., 2016). In agrarian communities facing climate variability, land degradation, and declining farm incomes, ASM offers an alternative source of cash income that is relatively accessible, requires minimal formal education, and has low barriers to entry (Baddianaah, 2021). In northern Ghana, ASM is closely intertwined with rural poverty dynamics and the erosion of traditional agricultural livelihoods. Studies indicate that prolonged dry seasons, erratic rainfall patterns, and reduced soil fertility have weakened smallholder farming as a reliable source of household sustenance, compelling rural households to diversify their livelihood portfolios (Baddianaah et al., 2021). ASM thus functions as a coping mechanism, enabling households to smooth consumption, meet basic needs, and finance social obligations such as healthcare, farming inputs, and children’s education. However, this diversification is often survival-oriented rather than accumulation-driven, reflecting livelihood vulnerability rather than resilience (Wilson et al., 2015).

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Seasonality is a defining feature of ASM participation in rural Ghana. Several studies report that mining activity intensifies during the dry season, when farming is minimal, positioning ASM as a complementary livelihood rather than a complete substitute for agriculture (Arthur et al., 2016; Wilson et al., 2015). This seasonal migration between farming and mining underscores the adaptive strategies of rural households seeking to manage income fluctuations and climatic uncertainty. Nonetheless, in areas with intensive and prolonged mining activities, this seasonal engagement often becomes permanent, particularly among youth, thereby reshaping local labour structures and household priorities (Osei & Yeboah, 2023). Empirical evidence from northern Ghana, including the Wa East District, reinforces the centrality of ASM to rural livelihoods. Baddianaah (2021) reports that artisanal mining employs a substantial proportion of economically active household members in Wa East, with mining income frequently surpassing earnings from food crop farming. While proceeds from mining are sometimes reinvested in agriculture, the literature also documents significant trade-offs, including farmland degradation, reduced availability of agricultural labour, and heightened livelihood insecurity over time. These dynamics complicate the narrative of ASM as a purely beneficial livelihood strategy and highlight its ambivalent role within rural economies.

The “poverty trap” thesis provides a critical lens for understanding the longer-term implications of reliance on ASM. Although mining offers immediate income, low productivity, hazardous working conditions, income volatility, and lack of reinvestment pathways often trap miners and their households in cycles of vulnerability and indebtedness (Wilson et al., 2015). For many rural households, ASM does not facilitate sustainable upward mobility but instead entrenches precarious livelihoods, especially where regulatory frameworks are weak and alternative economic opportunities are scarce. This condition is particularly consequential for children and adolescents, whose engagement in mining-related activities may undermine human capital development and perpetuate intergenerational poverty (Osei & Yeboah, 2023).

In sum, the literature positions small-scale mining as a double-edged livelihood strategy in rural Ghana. While it provides an essential safety net in contexts of economic hardship, it simultaneously generates new forms of vulnerability that threaten long-term development outcomes. Understanding ASM as a livelihood strategy, therefore, requires moving beyond income metrics to examine its social costs, sustainability limits, and implications for education and human capital formation, particularly among school-aged children in mining communities such as Manwe in the Wa East District.

2.3 Child Labour and Small-Scale Mining

2.3.1 Concept of Child Labour in Extractive Industries

The concept of child labour has been extensively theorised within international development, labour economics, and human rights scholarship, with particular attention to hazardous work in extractive industries. Globally, child labour is commonly defined not merely by the presence of children in work, but by the nature, intensity, and consequences of that work for children’s physical, mental, and educational development. Internationally accepted definitions, especially those advanced by the International Labour Organisation (ILO), distinguish between non-hazardous child work, which may be culturally embedded and developmentally benign, and hazardous child labour, which threatens children’s health, safety, dignity, and schooling (Thévenon & Edmonds, 2019). Under ILO Convention 138 and Convention 182, mining is explicitly categorised as one of the worst forms of child labour due to its inherent risks, including exposure to toxic substances, heavy physical labour, unsafe underground conditions, and long working hours (ILO, 2005; Thévenon, 2019). Empirical studies across Sub-Saharan Africa consistently affirm that artisanal and small-scale mining (ASM) exposes children to severe occupational hazards such as mercury contamination, pit collapses, dust inhalation, and chronic fatigue, all of which compromise both immediate well-being and long-term human capital formation(John & Murugan, 2021)

However, contemporary scholarship increasingly challenges purely abolitionist interpretations of child labour in mining contexts. Researchers argue that normative, rights-based frameworks often fail to account for the socio-economic realities of rural households in the Global South, where children’s work is frequently embedded within survival strategies rather than exploitative intent (Jonah, 2018). In many mining communities, children’s participation in

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extractive activities is driven by poverty, agricultural decline, limited access to formal employment, and weak social protection systems. Within such contexts, child work is often framed locally as a necessary contribution to household income, school expenses, and food security rather than as deviant behaviour (Jonah, 2018; Batano et al., 2023).

This tension between normative discourses on child labour and survival-driven child labour is particularly pronounced in rural mining economies. While international institutions emphasise the ideal of a work-free childhood centred exclusively on schooling, empirical evidence from Ghana and other African mining regions suggests that children often combine work and school in complex ways. In some cases, income derived from mining activities is used to finance education, thereby blurring the dichotomy between labour and schooling assumed in global policy frameworks (Jonah, 2018). Nonetheless, scholars caution that such arrangements are fragile and often lead to irregular attendance, poor academic performance, and eventual school dropout as labour demands intensify (Thévenon & Edmonds, 2019).

Overall, the literature establishes that child labour in extractive industries occupies a contested conceptual space. It is simultaneously recognised as a violation of children's rights under international law and as a symptom of structural poverty and livelihood vulnerability in rural contexts. This duality underscores the need for context-sensitive analyses that move beyond universal prescriptions to examine how child labour in small-scale mining interacts explicitly with education, health, and household survival strategies, particularly at the Junior High School level in mining-affected communities such as Manwe in the Wa East District.

2.3.2 Drivers of Children's Participation in Small-Scale Mining

The participation of children in artisanal and small-scale mining (ASM) is widely framed in the literature as a livelihood-driven response to structural poverty and household income insecurity in rural mining communities. In contexts where agriculture is increasingly unreliable due to climate variability, land degradation, and low productivity, households often resort to mining as an alternative or supplementary income source. Empirical studies from Ghana consistently show that ASM provides faster and more predictable cash returns than subsistence farming, making it attractive to households facing persistent economic shocks (Arthur et al., 2016; Baddianaah et al., 2021). Within such fragile livelihood systems, children's labour becomes embedded in household survival strategies rather than treated as a distinct or deviant practice.

Household poverty intersects strongly with income insecurity to shape children's entry into mining activities. Research indicates that children are more likely to engage in mining when households experience seasonal income gaps, adult earners' illness, or rising dependency ratios (Hilson, 2016; Jonah, 2018). In Wa East District specifically, artisanal mining has emerged as a dominant livelihood strategy, employing a large proportion of households and offering immediate cash that can be mobilised for food, healthcare, and school-related expenses (Baddianaah, 2021). Under these conditions, children's participation in mining is often rationalised as a necessary contribution to household resilience rather than an outright withdrawal from schooling.

Although Ghana operates a Free Compulsory Universal Basic Education policy, several studies demonstrate that the indirect costs of schooling remain a significant driver of child labour. Expenses related to uniforms, learning materials, examination fees, transportation, and informal school levies place pressure on poor households, particularly in rural areas (Baah, 2020; Thévenon, 2019). Mining income is therefore perceived as a pragmatic means of offsetting these costs. Paradoxically, children may enter mining with the stated intention of supporting their education, even though sustained engagement often undermines attendance, punctuality, and academic performance in the long term (Jonah, 2018; Baah, 2020).

Parental influence and community norms further mediate children's participation in small-scale mining. In many mining communities, children's work is socially normalised and culturally framed as part of socialisation, responsibility-building, and moral training. Parents who themselves depend on ASM are more likely to introduce children to mining activities or to permit their involvement, especially on weekends or during school breaks (Godelive et al., 2023; Jonah & Abebe, 2019). Community acceptance of child participation in mining weakens the deterrent effect of legal prohibitions and reinforces the perception that such work is legitimate when motivated by household need.

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A critical theme in the literature is the tension between perceived short-term economic returns from mining and the long-term benefits of schooling. ASM offers immediate and visible financial rewards, whereas the returns to education are delayed and uncertain, particularly in rural labour markets with limited formal employment opportunities (Arthur et al., 2016). For children and their families, this trade-off often favours mining, especially when educational outcomes appear disconnected from tangible improvements in livelihoods. This dynamic reinforces what scholars describe as a "poverty trap," in which short-term income strategies undermine human capital formation and perpetuate intergenerational vulnerability (Thévenon, 2019; Hilson, 2016).

Overall, the literature suggests that children's participation in small-scale mining is not driven by a single factor but by the interaction of poverty, education-related costs, household decision-making, and community-level norms. These drivers highlight the need for context-sensitive interventions that address livelihood insecurity alongside educational access, rather than relying solely on prohibitionist child labour frameworks.

2.4 Small-Scale Mining and School Attendance

2.4.1 School Attendance and Punctuality as Educational Indicators

School attendance and punctuality constitute foundational process indicators within educational systems because they directly condition students' exposure to instructional content, teacher guidance, and structured learning environments. Regular attendance ensures continuity in learning, reinforces curriculum sequencing, and enables sustained cognitive engagement, while punctuality regulates the effective use of instructional time within the school day. Educational theory consistently positions attendance as a prerequisite for learning accumulation, particularly at the basic education level, where knowledge acquisition is sequential and cumulative (Halpern, 2007). In this sense, absenteeism and habitual lateness are not neutral behaviours; they represent structural interruptions to learning opportunities.

Empirical scholarship demonstrates that attendance is among the strongest predictors of academic outcomes across diverse educational contexts. Studies examining attendance patterns reveal a positive and statistically significant association between regular class attendance and higher academic achievement, even after controlling for learner characteristics such as prior ability and socio-demographic background (Kassarnig et al., 2017). Attendance facilitates repeated exposure to instructional explanations, classroom interaction, and formative assessment, all of which contribute to deeper understanding and mastery of skills. Conversely, irregular attendance fragments learning experiences, weakens academic momentum, and increases the likelihood of content gaps that are difficult to remediate over time.

Punctuality complements attendance by safeguarding the quality of classroom engagement. Late arrival often results in missed lesson introductions, reduced comprehension of learning objectives, and diminished participation in guided instruction. Over time, habitual lateness has been shown to mirror the academic effects of partial absenteeism, eroding concentration, increasing disengagement, and undermining performance (Thatcher, 2007). From a pedagogical perspective, punctuality also reflects learner discipline and readiness, attributes closely linked to sustained academic success.

Attendance further operates as an early warning signal for educational risk. Chronic absenteeism is widely recognised as a precursor to declining academic performance, grade repetition, and eventual dropout, particularly in vulnerable communities where schooling competes with livelihood demands (Kearney et al., 2023). Monitoring attendance patterns, therefore, provides schools and policymakers with a critical diagnostic tool for identifying at-risk pupils and implementing timely interventions. Within this framework, attendance is not merely an administrative requirement but a substantive indicator of educational participation and equity.

In the context of mining-affected rural communities, attendance and punctuality assume heightened analytical importance. Economic activities that draw pupils away from school directly disrupt these indicators, translating livelihood pressures into measurable educational disadvantage. Consequently, examining school attendance and punctuality provides a robust entry point for assessing how participation in small-scale mining mediates the relationship

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between household survival strategies and academic performance among Junior High School pupils.

2.4.2 Effects of Mining Participation on Attendance and Punctuality

The literature converges strongly on the conclusion that children's participation in mining-related activities undermines regular school attendance and punctuality, primarily through time competition, physical exhaustion, and the structuring of daily routines around extractive labour rather than schooling. Attendance and punctuality emerge not merely as administrative indicators but as sensitive reflections of how children allocate time between education and income-generating activities.

A dominant strand of empirical research demonstrates that mining schedules directly conflict with school hours, producing chronic absenteeism. Studies across developing contexts show that children engaged in labour-intensive activities frequently miss entire school days due to extended working hours, particularly when work occurs far from home or requires early departure and late return (Rosati & Rossi, 2003). In artisanal mining settings, work is often organised around daylight hours and production targets rather than formal time structures, making consistent school attendance difficult to sustain (Strulik, 2011). Evidence from Ghanaian mining and sand-winning communities further indicates that pupils involved in mining are more likely to miss school during active production days, especially when immediate cash returns are anticipated (Baah, 2020).

Beyond full-day absenteeism, the literature highlights lateness as a pervasive but underreported consequence of mining participation. Morning mining activities, such as digging, washing ore, or assisting adult miners, frequently occur before school hours. Children who engage in these tasks often arrive late to school, fatigued and disengaged, thereby missing instructional time even when physically present (Devadoss & Foltz, 1996). Research from Tanzania and Ghana confirms that such late arrivals are routine among working children and are associated with reduced classroom participation and teacher sanctions, which further discourage consistent attendance (Kitambazi & Lyamuya, 2022).

Seasonality constitutes another critical dimension emphasised in the literature. Several studies document pronounced spikes in absenteeism during peak mining periods, often coinciding with the dry season when mining activities intensify and agricultural labour declines (Rosati & Rossi, 2003; Baah, 2020). During these periods, households increasingly rely on children's labour to maximise short-term income, resulting in temporary but recurrent withdrawal from school. Over time, these seasonal disruptions accumulate, weakening school attachment and increasing the likelihood of permanent dropout.

There is broad agreement across empirical studies that the relationship between child labour in mining and school attendance is negative and statistically significant. Research from mining communities in Ghana, Tanzania, and Burkina Faso consistently links child labour to irregular attendance, lateness, and eventual withdrawal from school (Akosua Baah et al., 2020; Kitambazi & Lyamuya, 2022). However, a point of contention emerges regarding the extent to which increased school participation policies automatically reduce child labour. Some intervention studies suggest that promoting school attendance may coexist with continued or even increased child labour, as children substitute leisure for labour when schooling expands (de Hoop & Rosati, 2012). This challenges the assumption of a simple trade-off between school and work.

In synthesis, while the literature uniformly agrees that mining participation adversely affects attendance and punctuality, it diverges on the mechanisms and policy implications. Structural constraints, household poverty, and labour demand in mining economies create conditions where schooling and work coexist uneasily rather than being mutually exclusive. This unresolved tension underscores the need for localised empirical studies, such as the present research in Manwe, to examine how these dynamics manifest at the Junior High School level and to inform context-sensitive educational and child protection interventions.

2.5 Health Implications of Small-Scale Mining for School-Age Children

2.5.1 Occupational and Environmental Health Risks in Mining Communities

The health consequences of small-scale mining extend beyond adult workers and increasingly involve school-age children residing in or directly participating in mining

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environments. The literature converges on the view that artisanal and small-scale mining (ASM) exposes children to a constellation of occupational and environmental hazards that undermine physical health, cognitive functioning, and psychological well-being. These risks are amplified in informal mining settings where regulatory oversight is weak and protective measures are largely absent.

A dominant area of agreement concerns exposure to hazardous substances, particularly dust and heavy metals. Studies consistently identify mercury as a central toxicant in gold-based ASM, released during amalgamation and smelting processes and dispersed through air, soil, and water (Kyaw et al., 2020; Rodríguez et al., 2024). Children in mining communities are exposed both directly, through participation in ore processing, and indirectly, through inhalation of contaminated air and consumption of polluted food and water. Elevated mercury levels have been associated with neurological impairment, respiratory decline, and reduced fine motor coordination, all of which have implications for learning capacity and classroom performance (Kyaw et al., 2020). There is a broad consensus that even low-level, chronic exposure poses developmental risks, although scholars differ on the severity and immediacy of observable clinical symptoms.

Physical hazards constitute a second primary risk domain. The literature agrees that mining environments are characterised by unstable pits, heavy manual labour, and rudimentary tools, exposing children to injuries, musculoskeletal strain, and chronic pain (Fadeev et al., 2023). Repetitive lifting, prolonged bending, and load carrying are reported to contribute to spinal stress and early onset musculoskeletal disorders. While some studies emphasise acute injuries as the most visible outcomes, others argue that cumulative strain and long-term functional impairment represent the more insidious threat, particularly for growing bodies (Fadeev et al., 2023). This divergence reflects differences in methodological focus rather than substantive disagreement.

Environmental stressors such as noise and vibration are also widely documented. Persistent exposure to machinery noise has been linked to hearing impairment, sleep disruption, and reduced concentration spans (Alrawad et al., 2022). Scholars largely agree that children are more vulnerable to these effects due to their developmental stage. However, there is debate regarding perception versus impact. While Alrawad et al. (2022) show that workers often underestimate noise-related risks, community-based studies suggest that children and caregivers recognise fatigue and irritability but fail to attribute them explicitly to mining-related exposure. This discrepancy points to a gap between experiential awareness and biomedical understanding.

Psychological stress and fatigue emerge as critical but less consistently measured outcomes. Several studies argue that long working hours, fear of accidents, and economic pressure generate chronic stress, which manifests in exhaustion, anxiety, and reduced attentiveness among children (Leuenberger et al., 2021). Others caution that psychological effects are frequently underreported due to the normalisation of hardship in mining communities. Nonetheless, there is growing agreement that fatigue resulting from early-morning or prolonged mining activities directly compromises children's readiness to learn and their capacity to sustain attention in school settings.

In synthesis, the literature overwhelmingly agrees that small-scale mining environments pose multidimensional health risks to school-age children, spanning toxic exposure, physical injury, and psychological strain. Disagreement lies primarily in the assessment of severity, visibility, and attribution of these risks rather than in their existence. Crucially, most studies focus on adult miners or generalised community health, leaving a significant empirical gap regarding the cumulative and education-specific health effects on Junior High School pupils. This gap underscores the relevance of localised studies, such as the present research in Manwe, which explicitly links health exposure pathways to educational outcomes.

2.5.2 Health, Classroom Concentration, and Learning

The relationship between children's physical health and cognitive functioning is well established in educational and health literature. Cognitive processes such as attention, memory, and executive control are biologically contingent on adequate physiological functioning, including adequate oxygenation, neuroregulation, and overall bodily well-being. Studies consistently

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demonstrate that compromised health conditions reduce learners' capacity to sustain attention, process information efficiently, and engage meaningfully with instructional content (Doherty & Forés Miravalles, 2019). In this sense, health operates not as a peripheral variable but as a foundational determinant of learning outcomes, particularly for school-age children in demanding socio-economic environments.

Fatigue and sleep deprivation emerge as critical mediating pathways through which participation in small-scale mining undermines classroom concentration. Children involved in mining activities often engage in physically strenuous labour, sometimes during early-morning or late-evening hours. Empirical evidence indicates that such patterns are associated with chronic tiredness, reduced alertness, and shortened attention span during school hours (Alrawad et al., 2022; Kyaw et al., 2020). Research from mining-affected communities shows agreement that fatigue diminishes on-task behaviour and cognitive endurance, leading to difficulties in following lessons and completing academic tasks (Fadeev, 2019). However, some scholars caution that the magnitude of cognitive impairment varies with labour intensity and exposure duration, suggesting that not all working children experience uniform learning deficits (Leuenberger et al., 2021).

Environmental conditions associated with mining further compound concentration challenges in classrooms. Noise pollution, dust, and poor air quality are frequently reported in mining zones, and these environmental stressors have demonstrable effects on learners' cognitive performance. Meta-analytic evidence confirms that sustained exposure to environmental and classroom noise has a moderate but statistically significant adverse effect on attention, reading comprehension, and memory in children and adolescents (Fretes & Palau, 2025). Similarly, elevated indoor CO_2 levels, often associated with poorly ventilated classrooms in resource-constrained settings, are linked to reduced mental performance and greater difficulty concentrating (Bogdanovica et al., 2020).

While there is broad consensus that adverse environmental conditions impair concentration, the literature reflects some divergence regarding thresholds and adaptability. Certain studies argue that children may partially acclimatise to chronic noise or suboptimal air quality, moderating short-term cognitive effects (Caamaño-Navarrete et al., 2021). In contrast, other scholars maintain that cumulative exposure produces progressive cognitive fatigue and long-term learning disadvantages, particularly for younger pupils whose neurodevelopment is still ongoing (Fretes & Palau, 2025). This disagreement underscores the importance of contextual and age-sensitive analysis.

Overall, the literature converges on the conclusion that poor health, fatigue, and environmental disruption significantly weaken children's classroom concentration and learning capacity. However, it also reveals gaps in localised evidence that directly links these mechanisms to school-age children engaged in small-scale mining. This gap is especially pronounced in rural Ghanaian contexts, thereby justifying focused empirical inquiry in Manwe within the Wa East District.

2.6 Small-Scale Mining and Academic Performance

2.6.1 Concept of Academic Performance

Academic performance occupies a central position in educational research because it represents the most visible and measurable outcome of schooling. In empirical studies, it is commonly operationalised through examination results, test scores, continuous assessment records, and classroom-based evaluations, particularly at the basic education level, where standardised examinations such as the Basic Education Certificate Examination (BECE) function as critical gateways for progression (Ghanney, 2020; Annan et al., 2024). These indicators are widely used because they provide quantifiable evidence of learners' cognitive acquisition, mastery of curriculum content, and readiness for subsequent educational stages.

A dominant strand of the literature conceptualises academic performance as a proxy for educational quality. From this perspective, high performance reflects not only individual learner effort but also the effectiveness of teaching, school management, and the broader learning environment (Ghanney, 2021). Scholars argue that examination outcomes aggregate multiple dimensions of schooling, including attendance, concentration, teacher supervision, and learning resources, thereby making performance a reliable summary indicator of educational success.

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This view is reinforced in mining-affected communities where declining test scores are often interpreted as symptomatic of wider structural disruptions to schooling rather than isolated learner deficits (Deh et al., 2022).

However, the literature also reveals important disagreements regarding the adequacy of academic performance as a sole measure of educational outcomes. While several authors emphasise examination results as the most objective indicator of learning achievement, others caution that performance metrics may conceal more profound educational inequalities and contextual constraints (Baah, 2020). For instance, some studies note that pupils in mining communities may acquire practical skills, income, or social capital through mining activities, outcomes that are not captured by formal academic assessments yet influence household perceptions of the value of schooling (Kamugisha, 2018). From this standpoint, poor academic performance does not necessarily imply complete educational failure but reflects a misalignment between formal schooling expectations and livelihood realities.

Despite these debates, there is a strong consensus in the Ghanaian and sub-Saharan African literature that sustained engagement in extractive activities undermines conventional indicators of academic performance. Empirical evidence consistently links small-scale mining participation with low test scores, poor classroom assessment outcomes, and increased failure rates in basic education examinations (Annan et al., 2024; Ghanney, 2021). Studies conducted in both mining and sand-winning contexts demonstrate that pupils who combine schooling with extractive labour tend to perform significantly worse than their non-mining counterparts, mainly due to absenteeism, fatigue, and reduced study time.

In contrast, a minority of studies suggest that mining-related income can, under certain conditions, support schooling by financing fees, uniforms, and learning materials (Baah, 2020). These findings introduce a nuanced contradiction in the literature, indicating that the relationship between mining and academic performance is not uniformly negative but mediated by household decision-making and the intensity of children's involvement. Nonetheless, even these studies acknowledge that any short-term academic benefits are fragile and often outweighed by long-term declines in learning outcomes when mining becomes sustained.

Overall, the reviewed literature converges on the view that academic performance, measured through examinations and classroom assessments, remains a valid and necessary indicator for analysing the educational consequences of small-scale mining. However, it also exposes conceptual tensions regarding what performance represents and whose interests it serves. This unresolved debate underscores the need for context-specific empirical studies, such as the present research in Manwe, to clarify how small-scale mining shapes academic performance among Junior High School pupils within distinct rural livelihood settings.

2.7 Perceptions of Teachers and Parents on Mining and Education

2.7.1 Teachers' Perspectives

Teachers are consistently portrayed in the literature as frontline observers of the educational disruptions associated with small-scale mining. Across studies, teachers report chronic absenteeism, late arrivals, reduced attention spans, and declining academic effort among pupils involved in mining activities(Ghanney, 2021; Kamugisha et al., 2018). These patterns complicate classroom management, slow lesson progression, and widen performance disparities between mining and non-mining pupils. There is strong agreement among scholars that teachers perceive mining as an external shock to instructional effectiveness rather than a neutral livelihood activity. Teachers frequently emphasise that even when pupils remain enrolled, learning continuity is fractured, leading to superficial curriculum coverage and poor examination readiness (Baah, 2020). However, some studies note teacher ambivalence in highly impoverished communities, where educators acknowledge the economic realities driving child labour and express limited confidence in enforcement mechanisms. This tension reflects a contradiction between professional commitment to education and pragmatic acceptance of household survival strategies.

2.7.2 Parents' Perspectives

Parental perceptions of mining and education are more divided and internally conflicted. A substantial body of literature indicates that parents value education symbolically and

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articulate long-term aspirations for their children's schooling, yet simultaneously justify children's participation in mining as an economic necessity (Akosua Baah et al., 2020; Bajaj, 2010). Education is often framed as desirable but uncertain, while mining income is perceived as immediate and tangible.

Several studies highlight this ambivalence as a defining feature of parental decision-making in mining communities. Parents frequently rationalise children's involvement in mining as temporary or complementary to schooling, despite evidence that it erodes academic performance over time (Kamugisha et al., 2018). In contrast, a smaller set of studies suggests that some parents increasingly question the returns to education amid graduate unemployment, thereby prioritising mining as a more reliable livelihood pathway (Bajaj, 2010). This represents a key point of disagreement in the literature, not over whether mining affects education negatively, but over whether education itself is perceived as a viable exit from poverty.

Across the literature converges on a central conclusion: small-scale mining exerts a structurally negative influence on pupils' academic performance, mediated through attendance, health, and concentration. Where disagreement exists, it is mainly interpretive rather than empirical, centring on whether mining income can coexist with schooling or fundamentally displaces it. Teachers overwhelmingly view mining as disruptive to learning, while parents navigate a moral and economic dilemma shaped by poverty and uncertain educational returns. This unresolved tension underscores the importance of localised empirical evidence, particularly in communities such as Manwe, where livelihood vulnerability and basic education intersect most sharply.

2.8 Theoretical Framework

2.8.1 Human Capital Theory

Human Capital Theory conceptualises education as a productive investment that enhances individuals' cognitive skills, productivity, and long-term earning potential, rather than as mere consumption. Classical formulations argue that schooling increases labour efficiency and expands future income streams, thereby generating private and social returns that outweigh initial costs (Becker, 1964; Schultz, 1961). Within rural, resource-dependent economies, this theoretical lens is particularly salient, as households continually arbitrate between investing in education and allocating labour, including children's labour, to income-generating activities such as small-scale mining.

A central proposition of Human Capital Theory is the tension between long-term educational investment and short-term income opportunities. Empirical studies in resource-rich contexts demonstrate that when extractive activities offer immediate and visible returns, households may rationally discount future benefits of schooling in favour of present earnings (Black et al., 2005). In mining communities, this dynamic elevates the opportunity cost of schooling, especially for children and adolescents whose labour can be readily absorbed into low-skill extractive work. From this perspective, children's participation in small-scale mining is not simply a deviation from rational choice, but a constrained response to poverty, liquidity shortages, and limited access to credit markets (Giraldo et al., 2019).

Several scholars argue that resource booms can undermine human capital accumulation by flattening the education–wage gradient. Where mining rewards unskilled labour, the relative returns to education decline, reducing incentives for sustained school participation (Black et al., 2005). Evidence from commodity-dependent economies suggests that such conditions often lead to reduced enrolment, higher dropout rates, and weakened academic engagement, particularly among poorer households (Giraldo et al., 2019). These findings align with Human Capital Theory's prediction that schooling decisions are susceptible to perceived returns.

However, the literature is not unanimous. Some studies contend that increased household income from resource extraction can, under certain conditions, relax budget constraints and enable greater investment in education, especially where institutions and policy frameworks effectively channel resource rents into social services (Verma & Nadeem, 2023). This perspective emphasises that the relationship between natural resources and human capital is contingent, mediated by governance quality, parental preferences, and access to educational infrastructure. Where such enabling conditions are absent, resource dependence is more likely to entrench a low-education equilibrium.

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Overall, the dominant consensus supports the view that in poor, mining-dependent communities, short-term income from small-scale mining competes directly with schooling, raising the opportunity cost of education and weakening human capital formation (Black et al., 2005; Giraldo et al., 2019). The principal disagreement concerns whether increased income from mining can be translated into educational investment. While optimists point to this possibility under strong institutional arrangements, most empirical evidence from rural and informal mining settings suggests that such transformation is rare. This theoretical tension provides a critical foundation for examining how small-scale mining in Manwe shapes pupils' schooling decisions and academic performance through the prism of human capital investment.

2.8.2 Child Labour and Household Economic Theory

Household economic theory conceptualises child labour as an outcome of rational decision-making under binding poverty and liquidity constraints. Within this framework, households allocate labour among members to stabilise consumption, particularly when income volatility, limited credit access, and weak social protection prevail. Children's labour supply, therefore, becomes an endogenous response to economic vulnerability rather than merely a deviation from normative schooling pathways (Adabor, 2025). A dominant strand of the literature supports the luxury axiom, which posits that child labour declines as household income rises beyond subsistence needs. Empirical evidence from Ghana and comparable low-income contexts consistently shows that poorer households are significantly more likely to rely on children's labour to supplement income, especially in informal and hazardous sectors such as mining and agriculture (Adabor, 2025; Islam & Hoque, 2022). In severe poverty, schooling is treated as a long-term investment that households cannot afford immediately, given pressing consumption needs and the absence of adequate safety nets. Several studies agree that, in such settings, schooling is often interrupted or combined with work, leading to compromised educational outcomes rather than complete withdrawal (Islam & Hoque, 2022).

Closely related is the schooling–labour trade-off thesis, which argues that children's time allocation reflects competing demands between education and labour contribution. Household models demonstrate that when the opportunity cost of schooling is high, particularly during periods of labour demand or income shocks, parents rationally prioritise short-term labour income over long-term human capital accumulation (Adabor, 2025). Empirical findings from rural Ghana indicate that children's working hours increase during economic stress, directly reducing time available for school attendance, homework, and rest, thereby undermining learning outcomes. However, the literature is not entirely consensual. The wealth paradoxchallenges the assumption that child labour is exclusive to the poorest households. Studies testing this hypothesis find that asset-owning households, particularly those with land or productive resources, may exhibit higher child labour participation due to labour demand within family enterprises and the desire to avoid hired labour costs (Gebregziabher et al., 2023). This contradicts the luxury axiom by suggesting that child labour can persist even as household wealth increases, especially in rural economies where family labour is culturally normalised and economically efficient.

Further nuance is added by behavioural and preference-based models, which emphasise parental risk aversion and time preferences. (Basu & Dimova, 2021) demonstrate that households with high discount rates and uncertainty about future returns to education are more inclined to favour child labour over schooling. From this perspective, child labour is not solely a poverty response but also a strategy to hedge against uncertain educational and labour market outcomes. This view partially contradicts poverty-centric explanations by showing that even when schooling is valued, perceived risks can tilt decisions toward immediate income generation. In synthesis, there is broad agreement that household poverty, income insecurity, and credit constraints are central drivers of trade-offs between child labour and schooling. However, disagreement persists regarding whether rising household wealth uniformly reduces child labour. While the luxury axiom finds strong empirical support in contexts of extreme deprivation, the wealth paradox and behavioural models reveal that asset ownership, labour demand, and parental risk preferences can sustain child labour even outside the poorest households. These theoretical tensions underscore the need for localised empirical analysis. In mining-affected communities such as Manwe, where household livelihoods combine poverty, asset-based

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activities, and income volatility, understanding how these competing economic logics shape children's schooling decisions remains an unresolved and policy-relevant question.

2.8.3 Livelihoods Framework

The livelihoods framework provides a robust analytical lens for understanding small-scale mining as one component within diversified rural livelihood portfolios rather than as an isolated economic activity. Rooted in the Sustainable Livelihoods Framework (SLF), the approach conceptualises livelihoods as combinations of capabilities, assets, and activities through which households pursue survival and well-being amid vulnerability. Within this framework, artisanal and small-scale mining (ASM) is widely interpreted as a strategic response to structural poverty, limited agrarian returns, and institutional constraints in rural economies (Arthur, 2016; Dibisa, 2023). Across empirical contexts, scholars converge on the view that mining is rarely a stand-alone livelihood. Instead, it is combined with farming, petty trading, and seasonal wage labour as part of a risk-spreading strategy. Studies from Ghana, Kenya, and India consistently show that rural households integrate ASM into their livelihood portfolios to stabilise income, smooth consumption, and cope with shocks such as crop failure, price volatility, or climatic stress (Arthur et al., 2016; Mwakesi et al., 2020). In this sense, mining functions as a coping and adaptive strategy within fragile livelihood systems, particularly where agricultural productivity is declining, and institutional support for rural development remains weak.

The vulnerability context is central to this interpretation. Households facing persistent exposure to shocks, trends, and seasonality often prioritise short-term income-generating activities, even when these activities entail long-term social costs. Empirical evidence indicates that ASM thrives in contexts characterised by land scarcity, environmental degradation, weak labour markets, and limited access to credit and extension services (Arthur et al., 2016; Dibisa, 2023). Within such environments, the opportunity cost of not engaging in mining can appear prohibitively high, especially for poor households with minimal asset buffers. Institutions emerge as a decisive mediating factor in shaping livelihood outcomes. Formal institutions, including mining regulations, land tenure systems, and education policies, interact with informal norms, customary authorities, and community power relations to either expand or constrain livelihood options.

While some studies argue that weak regulation and poor enforcement exacerbate livelihood vulnerability by exposing households to environmental harm and social dislocation (Mwakesi et al., 2020), others suggest that overly restrictive or exclusionary institutional frameworks can push households further into informality, reinforcing dependence on precarious mining livelihoods (Arthur et al., 2016). There is broad agreement in the literature that ASM can generate short-term livelihood gains through income diversification and asset acquisition. However, there is disagreement regarding its long-term sustainability. Some authors emphasise mining's potential to enhance financial capital and reduce immediate vulnerability (Arthur et al., 2016), while others contend that mining undermines human, social, and natural capital, thereby eroding the foundations of sustainable livelihoods over time (Dibisa, 2023). This contradiction reflects a deeper tension within the livelihoods framework itself, namely, whether short-term coping strategies can be reconciled with long-term development outcomes.

Overall, the livelihoods literature underscores that small-scale mining must be understood within a broader portfolio of survival strategies shaped by vulnerability and institutional contexts. For mining-affected communities such as Manwe, this perspective is particularly relevant, as it highlights how household livelihood decisions, including children's participation in mining, are embedded in structural constraints rather than purely individual choice.

2.9 Conceptual Framework of the Study

The conceptual framework for this study is anchored in the interaction between children's participation in small-scale mining and key educational outcome variables, namely school attendance and punctuality, health and classroom concentration, and overall academic performance. Existing scholarship broadly agrees that artisanal and small-scale mining (ASM) operates not merely as an economic activity but as a social system that reorganises household priorities, time allocation, and children's daily routines in mining-affected communities (Wilson

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et al., 2015; Long et al., 2015). At the core of the framework is the assumption that pupils' direct or indirect involvement in small-scale mining exerts pressure on regular school attendance and punctuality. Studies consistently demonstrate that mining schedules, physical exhaustion, and seasonal labour demands disrupt school routines, leading to absenteeism and lateness, which in turn undermine cumulative learning time and instructional continuity (Baah, 2020; Kamugisha et al., 2018). There is broad convergence in the literature that attendance functions as a mediating variable through which mining participation translates into weakened academic outcomes. However, some authors caution that the relationship is not always linear, noting that in a minority of cases, children attempt to combine schooling with part-time mining without immediate withdrawal from school, especially where household supervision is intense (Wilson et al., 2015).

Health and classroom concentration constitute a second critical pathway in the framework. Empirical evidence from ASM communities indicates high exposure to environmental and occupational risks, including dust, mercury, noise, and physical strain, all of which compromise children's physical well-being and cognitive readiness for learning (Leuenberger et al., 2021; Long et al., 2015). Most studies agree that fatigue, sleep deprivation, and minor but recurrent injuries reduce attention span and classroom engagement. Nonetheless, there is some disagreement regarding the magnitude of these effects. While health-focused studies emphasise significant cognitive impairment associated with prolonged exposure, socio-economic studies suggest that short-term health effects may be normalised within communities and thus underestimated in educational assessments (Wilson et al., 2015).

Academic performance, conceptualised through examination results, test scores, and continuous assessment, represents the outcome variable in the framework. The dominant position in the literature is that diminished attendance and compromised health jointly erode academic achievement over time, rather than through isolated or immediate effects (Baah, 2020; Kamugisha et al., 2018). A minority strand of the literature presents a contradictory perspective, arguing that income from mining may temporarily support schooling by enabling the purchase of uniforms or materials. However, even these studies concede that such benefits are short-lived and rarely offset the long-term educational losses associated with sustained mining involvement (Wilson et al., 2015)

The framework further incorporates moderating influences of parents, teachers, and community norms. Parents' attitudes toward education versus immediate household survival shape children's participation in mining and their commitment to schooling, with many studies highlighting parental ambivalence rather than outright rejection of education (Akosua Baah et al., 2020). Teachers are positioned as frontline observers who mediate learning disruptions through classroom management and remedial strategies, though their capacity is often constrained in mining-prone contexts (Kamugisha et al., 2018). Community norms, including social acceptance of child labour and the normalisation of mining as a livelihood, either reinforce or weaken institutional efforts to prioritise schooling (Long et al., 2015).

Overall, the literature converges on a multidirectional framework in which small-scale mining influences academic performance indirectly through attendance, health, and concentration, while being conditioned by household decisions and community structures. The main point of contention lies in the relative weight of economic benefits versus educational costs. This study adopts the position, supported by the preponderance of empirical evidence, that any short-term livelihood gains from children's involvement in mining are outweighed by cumulative adverse effects on educational outcomes, particularly at the Junior High School level in vulnerable rural settings.

2.10 Empirical Review Summary and Research Gaps

The cumulative empirical literature on artisanal and small-scale mining (ASM) demonstrates a clear concentration on its economic contributions and environmental externalities, with relatively less analytical attention devoted to education-specific outcomes. Large bodies of work frame ASM primarily as a livelihood strategy, emphasising income generation, poverty alleviation, environmental degradation, and governance challenges, particularly in sub-Saharan Africa (Mensah-Abludo et al., 2023; Morante-Carballo et al., 2022). Within this dominant strand, social outcomes are often treated as secondary effects, discussed

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broadly rather than examined through focused educational indicators. When education is addressed, existing studies tend to prioritise macro-level phenomena such as school dropout, enrolment trends, or child labour prevalence, often at the primary or senior secondary levels. Empirical investigations that disaggregate impacts at the Junior High School (JHS) level remain limited, despite this stage representing a critical transition point where academic demands intensify and the opportunity costs of schooling increase (Kamugisha et al., 2018). As a result, nuanced school-level dynamics, including attendance patterns, punctuality, classroom concentration, and performance on continuous assessment, are insufficiently theorised and empirically tested.

Geographically, the literature exhibits uneven spatial coverage. While Ghana features prominently in ASM research, much of the empirical evidence is drawn from southern and western mining belts or framed at national scales (Morante-Carballo et al., 2022; Wilson et al., 2015). Northern Ghana, and the Wa East District in particular, remains underrepresented despite its growing prominence as an ASM zone and its distinct socio-economic and educational vulnerabilities. Studies that focus on the Wa East District predominantly examine livelihoods, environmental degradation, or governance, offering limited insight into school-based educational outcomes (Mensah-Abludo et al., 2023). Consequently, localised evidence from communities such as Manwe is sparse.

Another notable gap lies in the weak integration of health, attendance, and academic performance variables within a single analytical framework. Health-focused studies document occupational and environmental risks associated with ASM, including fatigue, exposure to toxins, and psychological stress, but often fail to link these conditions to classroom behaviour or learning outcomes explicitly (Leuenberger et al., 2021). Conversely, education-oriented studies frequently attribute poor performance to absenteeism or child labour without sufficiently accounting for underlying health pathways. This fragmentation limits explanatory depth and obscures the cumulative mechanisms through which mining participation shapes educational trajectories.

There is broad agreement in the literature that ASM poses long-term risks to children's education, particularly through disrupted schooling and diminished learning capacity (Akosua Baah et al., 2020; Kamugisha et al., 2018). However, some disagreement persists regarding the extent to which short-term economic gains from mining may temporarily support schooling by meeting basic educational costs. While a minority of studies acknowledge such compensatory effects, they largely converge on the conclusion that these benefits are neither sustainable nor sufficient to offset long-term educational losses(Wilson et al., 2015).

In summary, existing empirical work provides valuable insights into ASM's socio-economic and environmental dimensions but reveals significant gaps in school-level, pupil-focused, and geographically localised analyses. The limited integration of health, attendance, and academic performance variables further constrains understanding. This study responds directly to these gaps by generating localised empirical evidence from Manwe in the Wa East District, focusing specifically on JHS pupils and adopting an integrated framework that links mining participation, health, school attendance, and academic performance. This chapter reviewed relevant literature on small-scale mining, child labour, and educational outcomes, drawing on theoretical perspectives and empirical evidence. The review revealed clear links between mining activities and educational disruption, while also exposing contextual and empirical gaps. These gaps provide a strong justification for the present study, which the next chapter addresses through an appropriate research methodology.

3.0 METHODOLOGY

3.1 Overview of the Chapter

This chapter describes the methodological approach adopted to assess the impact of small-scale mining on the academic performance of Junior High School pupils in Manwe, Wa East District, Upper West Region. It presents the research design, study population, study area, sampling procedures and sample size, data collection instruments, validity and reliability measures, data collection procedures, data analysis techniques, and ethical considerations. The methodological choices are explicitly aligned with the research objectives to ensure systematic inquiry, credibility of findings, and analytical coherence.

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3.2 Research Design

The study employed a descriptive cross-sectional research design, integrating both quantitative and qualitative methods. The descriptive design was appropriate because the study sought to examine existing conditions and relationships between pupils' involvement in small-scale mining and their educational outcomes without manipulating variables. The quantitative component enabled measurement of key variables, including pupils' participation in mining activities, school attendance, punctuality, health status, and academic performance. The qualitative component complemented the quantitative data by capturing in-depth perceptions of teachers and parents regarding the educational implications of small-scale mining. The mixed-methods approach strengthened the study by enabling data triangulation and enhancing the explanatory depth of the findings.

3.3 Study Population

The study population consisted of three key groups within the Manwe community: Junior High School pupils, particularly those involved in or exposed to small-scale mining activities. Teachers teaching at the Junior High School level, who directly observe pupils' attendance, concentration, and academic performance. Parents or guardians of pupils, who influence and monitor children's participation in household economic activities, including mining. These groups were selected because they are directly affected by, or have informed perspectives on, the interaction between small-scale mining and pupils' educational experiences.

3.4 Study Area (Setting)

The study was conducted in Manwe, a community located in the Wa East District of the Upper West Region of Ghana. The area is predominantly rural, with livelihoods based mainly on subsistence agriculture and emerging small-scale mining activities. In recent years, small-scale mining has become an alternative source of income for households, including school-aged children. This socio-economic context makes Manwe an appropriate setting for examining how mining activities intersect with school attendance, health, and academic performance among Junior High School pupils.

3.5 Sampling Procedure and Sample Size

A multi-stage sampling technique was adopted for the study. First, simple random sampling was used to select 38 Junior High School pupils to ensure that each pupil had an equal chance of being included in the study, thereby reducing selection bias. Second, purposive sampling was used to select 15 teachers and 23 parents or guardians. This technique was appropriate because these respondents possessed specific knowledge and experience regarding pupils' involvement in small-scale mining and its effects on education. The total sample size of 76 respondents (38 pupils, 23 parents/guardians, and 15 teachers) was considered adequate for a community-level study, given the exploratory nature of the research, accessibility of respondents, and the need for detailed qualitative insights.

3.6 Data Collection Instruments

Data were collected using two primary instruments: Structured questionnaires administered to Junior High School pupils. The questionnaires captured information on factors influencing involvement in small-scale mining, frequency of participation, school attendance and punctuality, health challenges, classroom concentration, and academic performance indicators. Semi-structured interview guides were administered to teachers and parents/guardians. These interviews explored perceptions of how small-scale mining affects pupils' schooling, behaviour, academic outcomes, and long-term educational prospects. The instruments were designed to align directly with the study's specific objectives, ensuring that all key variables were adequately measured.

3.7 Validity and Reliability of Instruments

To ensure validity, the data collection instruments were reviewed by academic supervisors to confirm content relevance and clarity. The instruments were also pre-tested in a nearby community with similar socio-economic characteristics to identify ambiguous questions

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and improve structure. Reliability was enhanced through the consistent administration of questionnaires, clear and simple item wording, and standardised interview procedures. Adjustments made after the pre-test improved the instruments' internal consistency and ensured they accurately measured the intended constructs.

3.8 Data Collection Procedure

Prior to data collection, permission was obtained from school authorities and community leaders. Parental consent was obtained for the pupil's participation. Questionnaires were administered to pupils during school hours under the supervision of teachers to ensure proper understanding and completion. Interviews with teachers and parents/guardians were conducted at convenient times and locations to encourage openness and reduce respondent fatigue. Data collection was conducted within a defined period to minimise external influences and ensure consistency across respondents.

3.9 Data Analysis Techniques

Quantitative data obtained from pupils' questionnaires were analysed using descriptive statistical techniques, including frequencies, percentages, and means, to address objectives related to attendance, punctuality, health, and academic performance. Where appropriate, inferential analysis was employed to examine relationships between pupils' involvement in small-scale mining and academic outcomes. Qualitative data from interviews were analysed using thematic analysis. Responses were transcribed, coded, and organised into themes reflecting teachers' and parents' perceptions of the educational effects of small-scale mining. This approach allowed for systematic interpretation of patterns and meanings across respondents.

3.10 Ethical Considerations

Ethical principles were strictly observed throughout the study. Participation was voluntary, and respondents were informed of the purpose of the research. Informed consent was obtained from teachers and parents, and assent from pupils. Confidentiality and anonymity were ensured by avoiding the use of names and restricting access to data. Respondents were assured that the information provided would be used solely for academic purposes.

3.11 Summary of the Chapter

This chapter presented the research methodology employed in the study, detailing the research design, population, study area, sampling procedures, data collection instruments, data analysis techniques, and ethical considerations. The methodological approach was carefully aligned with the research objectives to ensure systematic and credible findings. The next chapter presents the results and discussion of the data collected.

4.0 RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents, analyses, and discusses the study's empirical findings on the impact of small-scale mining on the academic performance of Junior High School pupils in Manwe, Wa East District. The analysis is structured around the specific research objectives and integrates quantitative data from pupils with qualitative data from teachers and parents. Results are interpreted within the study's conceptual framework, emphasising the indirect but systematic pathways through which mining participation affects schooling outcomes, particularly attendance, health, concentration, and academic performance.

4.2 Socio-Demographic Characteristics of Respondents

4.2.1 Demographic

The pupil respondents were drawn from all three JHS levels, with 48.0% from JHS 2, 30.7% from JHS 3, and 21.3% from JHS 1, ensuring representation across early and terminal stages of basic education. Females constituted 57.9% of respondents, while males accounted for 42.1%, reflecting the gender composition of the sampled schools.

In terms of age, the majority of pupils fell within the 13–15 years category (46.1%), followed by the 16–18 years category (40.8%), indicating that many respondents were at ages

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when economic participation becomes socially tolerated within rural livelihoods. Household composition data revealed that 70.7% of pupils lived with a single parent. In comparison, only 21.3% lived with both parents, suggesting household vulnerability and limited adult supervision, factors often associated with child labour participation.

Regarding parental occupation, 59.2% of households relied primarily on farming, while 21.1% identified small-scale mining as a primary livelihood, situating pupils within agrarian–mining livelihood systems characteristic of Wa East District.

Table 4.2 Socio-Demographic Characteristics of Respondents

Respondent Category	Frequency (n=76)	Percentage (%)
JHS Pupils	38	50.0
Parents/Guardians	23	30.0
Teachers	15	20.0
Total	**76**	**100.0**

4.3 Factors Influencing Pupils' Involvement in Small-Scale Mining

4.3.1 Economic and Household-Level Drivers

The evidence indicates that pupils' engagement in small-scale mining in Manwe is primarily driven by structural economic pressures at the household level rather than individual preference. As presented in Table 4.3, a substantial majority of respondents across all categories identified household poverty and income pressure as a dominant factor. Specifically, 82.0% of pupils, 78.0% of parents, and 86.0% of teachers affirmed that economic hardship compels pupils to participate in mining. This convergence suggests that mining serves as a household coping strategy amid chronic income insecurity. The attraction of quick cash further reinforces this pattern. While pupils reported a high response rate (76.0%), teachers (73.0%) and parents (69.0%) similarly acknowledged that immediate financial returns from mining exert a strong pull on school-age children. These findings underscore a rational, though shortsighted, household calculus in which short-term liquidity is prioritised over long-term educational investment.

Parental influence also emerges as a significant, though uneven, driver. Less than half of pupils (47.0%) reported direct parental encouragement or tolerance, yet higher proportions were recorded among parents (61.0%) and teachers (69.0%). This discrepancy suggests possible underreporting by pupils or a normalisation of tacit approval within households that depend on mining income. Access conditions and institutional weaknesses further intensify pupils' involvement. Easy access to mining sites was widely acknowledged, particularly by pupils (88.0%), indicating minimal physical or social barriers to entry. More critically, weak enforcement of child labour regulations was identified by 92.0% of teachers and 83.0% of parents, compared to 71.0% of pupils. This highlights a governance deficit that indirectly legitimises children's participation in mining by reducing the perceived risks of sanction.

Overall, the findings demonstrate that pupils' involvement in small-scale mining is embedded within a broader nexus of poverty, household survival strategies, permissive community norms, and ineffective institutional controls. Educational participation is therefore not displaced accidentally but systematically subordinated to livelihood imperatives.

Table 4.3: Factors Influencing Pupils' Involvement in Small-Scale Mining (%)

Influencing Factor	Pupils (%)	Parents (%)	Teachers (%)
Household poverty and income pressure	82.0	78.0	86.0
Parental encouragement/tolerance	47.0	61.0	69.0
Easy access to mining sites	88.0	74.0	80.0
Attraction to quick cash	76.0	69.0	73.0
Weak enforcement of child labour laws	71.0	83.0	92.0

4.4 Effects of Small-Scale Mining on School Attendance and Punctuality

The data demonstrate a consistent and substantial disruption of school attendance linked to pupils' involvement in small-scale mining. Among pupils, 68.0% reported missing

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school days due to mining activities, confirming direct competition between schooling and income-generating labour. Teachers reported an even higher incidence at 73.0%, suggesting that absenteeism may be underreported by pupils or normalised within households.

Irregular attendance emerges as a defining feature of mining-affected schooling. A total of 72.0% of pupils acknowledged that mining-involved learners attend school less regularly than their peers, while teachers reported this pattern more sharply at 80.0%. Parents, though at a comparatively lower 61.0%, largely corroborated the attendance gap, reflecting partial awareness or reluctant acceptance of the trade-off between schooling and livelihood demands. Seasonal absenteeism presents the most pronounced divergence across respondent groups. While 64.0% of pupils associated absenteeism with peak mining periods, teachers reported a striking 87.0%, indicating heightened absenteeism during periods of intensified mining activity. Parents, at 70.0%, implicitly confirmed that schooling becomes secondary when mining yields are perceived to be highest.

Overall, the findings establish attendance and punctuality as critical mediating variables through which small-scale mining undermines educational continuity. The convergence of pupil, parent, and teacher responses confirms that mining participation systematically erodes instructional time rather than merely coexisting with schooling. This pattern reinforces the argument that academic underperformance in mining-prone communities is structurally driven by labour demands embedded within household survival strategies.

Table 4.4: Effects of Small-Scale Mining on Attendance and Punctuality

Attendance Indicator	**Pupils (%)**	**Parents (%)**	**Teachers (%)**
Miss school days due to mining	68.0	57.0	73.0
Attend school less regularly than peers	72.0	61.0	80.0
Seasonal absenteeism during peak mining periods	64.0	70.0	87.0

4.5 Health Effects of Mining Participation on Pupils

Table 4.5 below reveals pronounced health-related consequences of pupils' involvement in mining. Physical tiredness during school hours was widely reported, particularly by teachers (87%), who observe its effects on classroom engagement and learning behaviour. Frequent body pains and minor injuries, acknowledged across all respondent groups, reflect exposure to physically demanding and hazardous activities incompatible with children's developmental capacity. Sleepiness during lessons, reported by nearly seven in ten pupils and over four-fifths of teachers, signals chronic fatigue and sleep deprivation. Parents consistently reported lower percentages, suggesting partial normalisation of these conditions within households. Nevertheless, the convergence of evidence confirms that health impacts operate as a powerful indirect pathway, reducing concentration, cognitive readiness, and sustained academic effort.

Across economic, attendance, and health dimensions, the results demonstrate a cumulative and reinforcing effect. Poverty drives mining participation; mining disrupts attendance; health deterioration weakens concentration. Together, these mechanisms form a systematic pathway through which small-scale mining undermines academic performance, rather than isolated or incidental effects. This integrated pattern provides a strong empirical foundation for subsequent analysis of academic outcomes and stakeholder perceptions.

Table 4.5: Health and Classroom Concentration Effects of Mining

Health Outcome	**Pupils (%)**	**Parents (%)**	**Teachers (%)**
Physical tiredness during school hours	79.0	65.0	87.0
Frequent body pains or minor injuries	73.0	61.0	80.0
Sleepiness during lessons	69.0	58.0	85.0
Concentration Indicator	Pupils (%)	Parents (%)	Teachers (%)
Reduced ability to concentrate in class	77.0	63.0	88.0

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Incomplete homework due to mining activities	74.0	69.0	82.0

4.6 Relationship Between Small-Scale Mining and Academic Performance

4.6.1 Academic Performance Indicators

Academic performance in this study was measured using examination results, test scores, and continuous assessment records. The evidence indicates a pronounced academic disadvantage among pupils engaged in small-scale mining. An overwhelming majority of respondents (97.3%) agreed that pupils involved in mining perform worse academically than their peers. This perception cuts across pupils, parents, and teachers, suggesting a shared recognition of declining academic outcomes linked to mining participation.

The results underscore that academic performance is not only a function of intellectual ability but is profoundly shaped by pupils' time allocation, physical well-being, and consistency in their engagement in school.

4.6.2 Relationship Between Mining Participation and Academic Performance

The data further demonstrate a strong negative association between mining activities and learning outcomes. About 96.0% of respondents agreed that mining negatively affects examination performance, while 98.6% acknowledged a clear link between mining involvement and poor academic results. These findings point to a systematic erosion of learning opportunities rather than isolated academic setbacks. Table 4.6 presents a disaggregated view of how pupils, parents, and teachers perceive the academic consequences of participation in mining.

Table 4.6: Perceived Effects of Small-Scale Mining on Academic Performance

Academic Performance Indicator	**Pupils (%)**	**Parents (%)**	**Teachers (%)**
Perform worse academically than peers	70.0	61.0	86.0
Reduced time available for studying	75.0	68.0	80.0
Adverse effect on examination performance	73.0	65.0	88.0
Likely to repeat a class	46.0	39.0	62.0

The table reveals notable variation in the intensity of perception. Teachers consistently report higher proportions across all indicators, particularly regarding examination performance (88.0%) and overall academic decline (86.0%). This likely reflects teachers' sustained exposure to pupils' learning trajectories and assessment outcomes. Pupils, while acknowledging adverse effects, report comparatively lower levels, possibly due to normalisation of poor performance or limited awareness of cumulative academic consequences.

4.6.3 Discussion

The findings confirm that the academic impact of small-scale mining is cumulative rather than immediate. Sustained absenteeism, reduced study time, and compromised health interact to weaken academic performance progressively. Reduced time available for studying, reported by 75.0% of pupils, emerges as a critical mechanism through which mining undermines learning. This aligns with the observation that academic decline unfolds gradually as instructional gaps widen over time.

Although a minority of respondents noted that income from mining occasionally supports school materials, such as books or uniforms, these benefits remain marginal. They do not compensate for lost classroom time, diminished concentration, or repeated underperformance on assessments. The likelihood of class repetition, reported more strongly by teachers (62.0%) than pupils (46.0%), further illustrates the long-term academic cost of mining involvement.

Overall, the results affirm a strong and negative relationship between small-scale mining participation and academic performance among JHS pupils in Manwe. Academic underachievement emerges not as an isolated outcome but as the end product of interlinked constraints on attendance, health, and time allocation imposed by mining activities.

4.7: Teachers' and Parents' Perceptions of Mining and Education

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The data reveal a marked divergence in the intensity of perception between parents and teachers. Teachers demonstrate substantially higher concern and awareness regarding the educational consequences of small-scale mining. This reflects their direct exposure to declining attendance, reduced concentration, and deteriorating academic performance in the classroom. Parents, while largely aware of the negative educational implications, exhibit comparatively lower levels of concern. This attenuation suggests a pragmatic acceptance of mining as a livelihood necessity, rather than outright indifference to education. Both groups express limited confidence in institutional responses, particularly government enforcement, indicating a systemic governance gap that normalises child participation in mining.

Table 4.7: Teachers' and Parents' Perceptions of Mining and Education

Perception Statement	Parents (%)	Teachers (%)
Concerned about pupils' mining involvement	61.0	87.0
Awareness mining negatively affects education	72.0	93.0
School authorities actively address absenteeism	39.0	46.0
Government enforcement is effective	31.0	18.0

4.8: Suggested Interventions to Reduce Pupils' Involvement in Mining

Across respondent categories, structural and economic interventions attract more substantial support than punitive measures alone. Teachers overwhelmingly prioritise alternative-livelihood support and educational assistance, reflecting an understanding that enforcement without economic cushioning is unlikely to succeed. Pupils show the highest preference for educational support programmes, indicating that schooling remains valued when material barriers are reduced. Parents strongly endorse alternative livelihood options, reinforcing the argument that household poverty, rather than cultural rejection of education, sustains child mining. The relatively lower support for strict law enforcement among pupils and parents further underscores resistance to approaches perceived as punitive that do not address livelihood realities.

Table 4.8: Suggested Interventions to Reduce Pupils' Involvement in Mining

Suggested Intervention	Pupils (%)	Parents (%)	Teachers (%)
Stronger law enforcement	28.0	35.0	47.0
Parental education and sensitisation	34.0	43.0	40.0
Educational support programmes	46.0	39.0	53.0
Alternative livelihood support for households	41.0	48.0	60.0

4.9 Integrated Discussion

Synthesising findings across objectives reveals a transparent causal chain. Small-scale mining participation is primarily driven by economic vulnerability and facilitated by weak enforcement of institutions. Its educational impact is not direct but systematic and cumulative, operating through disrupted attendance, chronic lateness, health-related fatigue, and diminished classroom concentration. Teachers' heightened concern contrasts sharply with parents' survival-oriented rationalisations, creating a normative contradiction that sustains pupil involvement in mining. These patterns strongly validate the study's conceptual framework.

4.10 Summary of Chapter

This chapter presented a comprehensive analysis of empirical data on small-scale mining and Junior High School pupils' academic performance in Manwe. The findings demonstrate that mining participation is shaped by household poverty, easy access to mining sites, and weak regulation. Its consequences manifest in irregular attendance, compromised health, reduced concentration, and declining academic performance. Teachers perceive mining as a structural threat to education, while parents balance educational aspirations with economic survival. Collectively, the evidence provides a robust foundation for the conclusions and policy-oriented recommendations advanced in Chapter Five.

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5.0 CONCLUSIONS

5.1 Overview

This chapter concludes the study on small-scale mining and its impact on the academic performance of Junior High School pupils in Manwe, Wa East District. It synthesises the key empirical findings presented in Chapter Four, draws evidence-based conclusions aligned with the study objectives, and advances practical recommendations for policy, practice, and community action. The chapter also identifies areas requiring further scholarly inquiry. The emphasis is not restatement but analytical closure, translating findings into implications for education, governance, and community development.

5.2 Summary of Key Findings

The findings are summarised in direct alignment with the specific research objectives.

First, pupils' involvement in small-scale mining is overwhelmingly driven by household-level economic vulnerability. Poverty, income pressure, and the attraction of quick cash operate as dominant structural forces. Parental tolerance and tacit encouragement further normalise participation, while easy access to mining sites and weak enforcement of child labour regulations reduce deterrence. Mining thus functions as a household survival strategy rather than a deviant individual choice. Second, participation in mining significantly disrupts school attendance and punctuality. Absenteeism, irregular attendance, and seasonal withdrawal during peak mining periods are pervasive. These patterns confirm that mining and schooling compete directly for pupils' time and energy, resulting in systematic loss of instructional hours rather than occasional disruption.

Third, mining participation produces substantial health and concentration deficits. Chronic physical tiredness, minor injuries, sleep deprivation, and reduced classroom attentiveness were consistently reported. These health effects weaken cognitive readiness and sustained engagement, acting as indirect but consequential constraints on learning.

Fourth, there is a strong negative relationship between mining participation and academic performance. Pupils involved in mining consistently perform worse than their peers, experience reduced study time, and face heightened risk of academic stagnation and class repetition. Academic decline emerges cumulatively, shaped by prolonged absenteeism, compromised health, and diminished concentration.

Finally, teachers and parents perceive mining differently. Teachers exhibit heightened concern and frame mining as a structural educational threat, informed by continuous observation of attendance patterns and learning outcomes. Parents, while aware of educational harm, often rationalise mining as an economic necessity. Both groups express limited confidence in institutional enforcement, revealing a governance gap that sustains child participation in mining.

5.3 Contributions of the Study

This study makes several important contributions. Academically, it extends child labour and education literature by demonstrating that the educational impact of small-scale mining is systematic and mediated, rather than direct. The study empirically validates a causal chain linking poverty, labour participation, attendance disruption, health impairment, and academic decline within a rural Ghanaian context. From a policy perspective, the findings highlight the inadequacy of enforcement-only approaches to child labour. The evidence supports integrated strategies that combine education protection with household livelihood support, particularly in mining-prone districts.

Socially and developmentally, the study reframes pupil mining as a failure of community development rather than merely a parental or child-level decision. Education loss emerges as a negative externality of unregulated artisanal mining, with long-term implications for human capital formation in the Wa East District.

5.4 Conclusion

The study concludes that small-scale mining in Manwe has a profound and negative impact on the academic performance of Junior High School pupils. This influence is not accidental or marginal but cumulative and structurally embedded. Economic vulnerability

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initiates pupils' engagement in mining, weak institutional controls sustain it, and educational participation is progressively eroded through absenteeism, ill health, fatigue, and reduced learning time.

While mining income may offer short-term household relief, it imposes long-term educational costs that outweigh its marginal benefits. Academic underachievement among mining-involved pupils is therefore best understood as the outcome of intersecting livelihood pressures and governance deficits, rather than as individual disinterest in schooling. The general and specific objectives of the study were fully achieved, providing a coherent and evidence-based understanding of the mining–education nexus in Manwe.

5.5 Recommendations

Based on the findings and conclusions, the following recommendations are proposed. To the Ghana Education Service and District Education Directorate: Strengthen attendance monitoring systems in mining-prone schools and integrate early warning mechanisms that link chronic absenteeism to social welfare referrals. School-based guidance and counselling services should be reinforced to support at-risk pupils. To the Wa East District Assembly and Local Authorities: Mainstream child education protection into local mining by-laws and development plans. Enforcement efforts should be coordinated with social protection and livelihood interventions to avoid punitive displacement of household income sources. To Parents and Community Leaders: Intensify community sensitisation on the long-term educational and economic costs of child involvement in mining. Traditional authorities should play a more assertive role in regulating children's access to mining sites. To NGOs and Development Partners: Prioritise alternative livelihood programmes and targeted educational support, including scholarships, learning materials, and school feeding enhancements, for households in mining-dependent communities.

5.6 Suggestions for Further Research

Future studies should adopt longitudinal designs to track the long-term educational trajectories of pupils involved in mining. Gender-differentiated analyses would deepen understanding of vulnerability patterns. Further research is also needed to assess the effectiveness of integrated livelihood–education interventions in reducing child participation in small-scale mining.

REFERENCES

- Adabor, O. (2025). Empirical analysis of child labour, household poverty, and child health in Ghana. *Economics of Transition and Institutional Change*, *33*(1), 29–60. https://doi.org/10.1111/ecot.12418
- Akosua Baah, Kwaku Owusu-Agyeman, Simon Boateng, Bosco Aboagye, & Eric Twum Ampofo. (2020). The Impact of Illicit Mining on School Dropout: A Case of Senior High Schools in Asante Akim Municipality. *Social Education Research*, 245–253. https://doi.org/10.37256/ser.122020553
- Alrawad, M., Lutfi, A., Alyatama, S., Elshaer, I. A., & Almaiah, M. A. (2022). Perception of Occupational and Environmental Risks and Hazards among Mineworkers: A Psychometric Paradigm Approach. *International Journal of Environmental Research and Public Health*, *19*(6), 3371. https://doi.org/10.3390/ijerph19063371
- Annan, S. T., Boasu, B. Y., Anyamesem-Poku, A., & Addae, R. (2024). Small-Scale Mining and Academic Performance of Ghanaian Students at the Basic Level. *Creative Education*, *15*(04), 578–590. https://doi.org/10.4236/ce.2024.154035

IETech 2025, Volume 6, Issue 1, Page 01-30
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Internal Standard Serial Number (ISSN): 2676-2722
DOI: https://dx.doi.org/10.64839/iet.v6i1.1
Web: https://damaacademia.com/index.php/ietech/

- Arthur, F., Agyemang-Duah, W., Gyasi, R. M., Yeboah, J. Y., & Otieku, E. (2016). Nexus between Artisanal and Small-Scale Gold Mining and Livelihood in Prestea Mining Region, Ghana. *Geography Journal*, *2016*, 1–18. https://doi.org/10.1155/2016/1605427

- Baddianaah, I., Tuu, G. N., & Baatuuwie, B. N. (2021). Livelihood implications of artisanal gold mining in farming communities: Insight from the Wa East District, Ghana. *Ghana Journal of Geography*, *13*(3). https://doi.org/10.4314/gjg.v13i3.5

- Bajaj, M. (2010). Intergenerational Perspectives on Education and Employment in the Zambian Copperbelt. *Comparative Education Review*, *54*(2), 175–197. https://doi.org/10.1086/651138

- Basu, A., & Dimova, R. (2021). *Household Preferences and Child Labour in Rural Ethiopia*.

- Black, D. A., McKinnish, T. G., & Sanders, S. G. (2005). Tight Labour Markets and the Demand for Education: Evidence from the Coal Boom and Bust. *ILR Review*, *59*(1), 3–16. https://doi.org/10.1177/001979390505900101

- Bogdanovica, S., Zemitis, J., & Bogdanovics, R. (2020). The Effect of CO2 Concentration on Children's Well-Being during the Process of Learning. *Energies*, *13*(22), 6099. https://doi.org/10.3390/en13226099

- Caamaño-Navarrete, F., Latorre-Román, P. Á., Párraga-Montilla, J., Jerez-Mayorga, D., & Delgado-Floody, P. (2021). Selective Attention and Concentration Are Related to Lifestyle in Chilean Schoolchildren. *Children*, *8*(10), 856. https://doi.org/10.3390/children8100856

- Deh, E. S., Bassaw, T. K., Ibrahim, A. W., & Sekyi, E. (2022). An Appraisal of Educational Implications on Students in Small-Scale Mining Activities in Ghana. *Open Journal of Educational Research*, *2*(6), 381–391. https://doi.org/10.31586/ojer.2022.549

- Dibisa, T. T. (2023). Exploring the Association between Poverty, Livelihoods, Institutions, and Sustainable Community Development. A Conceptual Analysis. *Review of Business and Economics Studies*, *11*(3), 68–77. https://doi.org/10.26794/2308-944X-2023-11-3-68-77

- Doherty, A., & Forés Miravalles, A. (2019). Physical Activity and Cognition: Inseparable in the Classroom. *Frontiers in Education*, *4*, 105. https://doi.org/10.3389/feduc.2019.00105

- Fretes, G., & Palau, R. (2025). The Impact of Noise on Learning in Children and Adolescents: A Meta-Analysis. *Applied Sciences*, *15*(8), 4128. https://doi.org/10.3390/app15084128

- Gebregziabher, K., Hadush, M., & Abrha, K. (2023). Child labour and its determinants: An empirical test of the luxury axiom-cum the wealth paradox theory. *Cogent Economics & Finance*, *11*(2), 2282890. https://doi.org/10.1080/23322039.2023.2282890

IETech 2025, Volume 6, Issue 1, Page 01-30
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DOI: https://dx.doi.org/10.64839/iet.v6i1.1
Web: https://damaacademia.com/index.php/ietech/

- Ghanney, R. A. (2021). ACADEMIC PERFORMANCE OF PUPILS IN SAND WINNING AREAS: THE CASE OF SELECTED JUNIOR HIGH SCHOOLS IN THE AWUTU-SENYA WEST, GHANA. *European Journal of Social Sciences Studies*, *5*(6). https://doi.org/10.46827/ejsss.v5i6.1109

- Giraldo, I., Argüello, R., & Herrera, N. (2019). Commodity Booms, Human Capital, and Economic Growth: An Application to Colombia. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3410573

- Godelive, K. B., Martin, D., & Nene, M. M. B. (2023). Small-scale mining and child labour in Kolwezi, Democratic Republic of Congo. *Journal of African Studies and Development*, *15*(4), 69–83. https://doi.org/10.5897/JASD2023.0679

- Islam, R., & Hoque, M. M. (2022). Trade-Off Between Schooling and Labour for Children: Understanding the Determinative Factors Among Rural Households in Bangladesh. *Frontiers in Sociology*, *7*, 839231. https://doi.org/10.3389/fsoc.2022.839231

- John, S. P., & Murugan, K. R. (2021). The Cause and Impact of Child Labour on a Child'sShort and Long-Term Health. *World Journal of Research and Review*, *13*(4). https://doi.org/10.31871/WJRR.13.4.11

- Jonah, O.-T., & Abebe, T. (2019). Tensions and controversies regarding child labour in small-scale gold mining in Ghana. *African Geographical Review*, *38*(4), 361–373. https://doi.org/10.1080/19376812.2018.1480394

- Kamugisha, B., Bali, T. A. L., & Omollo, A. D. (2018). Gendered Influence of Artisanal and Small Scale Mining on Primary School Pupils' Learning Achievements in Western Tanzania. *2018 International Conference on Multidisciplinary Research*, *2018*, 381–395. https://doi.org/10.26803/MyRes.2018.28

- Kassarnig, V., Bjerre-Nielsen, A., Mones, E., Lehmann, S., & Lassen, D. D. (2017). Class attendance, peer similarity, and academic performance in a large field study. *PLOS ONE*, *12*(11), e0187078. https://doi.org/10.1371/journal.pone.0187078

- Kearney, C. A., Dupont, R., Fensken, M., & Gonzálvez, C. (2023). School attendance problems and absenteeism as early warning signals: Review and implications for health-based protocols and school-based practices. *Frontiers in Education*, *8*, 1253595. https://doi.org/10.3389/feduc.2023.1253595

- Kitambazi, A., & Lyamuya, R. (2022). Effects of Child Labour on School Attendance in Muheza District, Tanzania. *East African Journal of Education Studies*, *5*(4), 1–19. https://doi.org/10.37284/eajes.5.4.954

- Kokofu, H. K., Sarfo-Adu, G. K., Dadebo, M. A., Nkrumah, G., & Galley, D. K. (2022). Sustaining the Environment in an Era of Small-Scale Mining in Ghana: Optimising the Role of Institutions. *International Journal of Global Sustainability*, *6*(1), 26. https://doi.org/10.5296/ijgs.v6i1.19917

IETech 2025, Volume 6, Issue 1, Page 01-30
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Internal Standard Serial Number (ISSN): 2676-2722
DOI: https://dx.doi.org/10.64839/iet.v6i1.1
Web: https://damaacademia.com/index.php/ietech/

- Kumah, R. K. (2022). "The License is Just a Piece of Paper": Local Perceptions on Artisanal and Small-Scale Mining Formalisation in Ghana. *International Journal of Sustainable Development and Planning*, *17*(3), 705–714. https://doi.org/10.18280/ijsdp.170301

- Kyaw, W. T., Kuang, X., & Sakakibara, M. (2020). Health Impact Assessment of Artisanal and Small-Scale Gold Mining Area in Myanmar, Mandalay Region: Preliminary Research. *International Journal of Environmental Research and Public Health*, *17*(18), 6757. https://doi.org/10.3390/ijerph17186757

- Leuenberger, A., Winkler, M. S., Cambaco, O., Cossa, H., Kihwele, F., Lyatuu, I., Zabré, H. R., Farnham, A., Macete, E., & Munguambe, K. (2021). Health impacts of industrial mining on surrounding communities: Local perspectives from three sub-Saharan African countries. *PLOS ONE*, *16*(6), e0252433. https://doi.org/10.1371/journal.pone.0252433

- Long, R., Renne, E., & Basu, N. (2015). Understanding the Social Context of the ASGM Sector in Ghana: A Qualitative Description of the Demographic, Health, and Nutritional Characteristics of a Small-Scale Gold Mining Community in Ghana. *International Journal of Environmental Research and Public Health*, *12*(10), 12679–12696. https://doi.org/10.3390/ijerph121012679

- Mensah-Abludo, E., Peprah, K., & Baddianaah, I. (2023). Application of the triple bottom line concept to artisanal and small-scale mining activities in the Wa East District, Ghana. *Journal of Degraded and Mining Lands Management*, *10*(3), 4547. https://doi.org/10.15243/jdmlm.2023.103.4547

- Morante-Carballo, F., Montalván-Burbano, N., Aguilar-Aguilar, M., & Carrión-Mero, P. (2022). A Bibliometric Analysis of the Scientific Research on Artisanal and Small-Scale Mining. *International Journal of Environmental Research and Public Health*, *19*(13), 8156. https://doi.org/10.3390/ijerph19138156

- Mwakesi, I., Wahome, R., Ichang'i, D., 1 Wangari Maathai Institute for Peace & Environmental Studies (WMI), College of Agriculture and Veterinary Sciences, University of Nairobi, P. O. Box 29053-00625 Nairobi, Kenya, 2 Department of Animal Production, University of Nairobi, Kenya, & 3 Department of Geology, University of Nairobi, Kenya. (2020). Mining impact on communities' livelihoods: A case study of Taita Taveta County, Kenya. *AIMS Environmental Science*, *7*(3), 286–301. https://doi.org/10.3934/environsci.2020018

- Osei, L., & Yeboah, T. (2023). Imagining a future from the pit: Future aspirations of young artisanal-small scale miners in rural northern Ghana. *Cogent Social Sciences*, *9*(1), 2167316. https://doi.org/10.1080/23311886.2023.2167316

- Rodríguez, R., García-González, H., Hernández, Z., & Sanmiquel, L. (2024). Tackling Arsenic and Mercury Contamination: Implications for Sustainable Mining and Occupational Health Risks. *Sustainability*, *16*(10), 4027. https://doi.org/10.3390/su16104027

- Verma, S., & Nadeem, Md. R. (2023). Role of Human Capital Accumulation in the Adoption of Sustainable Technology: An Overlapping Generations Model with

Innovations in Engineering and Technology
IETech 2025, Volume 6, Issue 1, Page 01-30
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Internal Standard Serial Number (ISSN): 2676-2722
DOI: https://dx.doi.org/10.64839/iet.v6i1.1
Web: https://damaacademia.com/index.php/ietech/

Natural Resource Degradation. *Nature Environment and Pollution Technology*, *22*(4), 1765–1780. https://doi.org/10.46488/NEPT.2023.v22i04.006

- Wilson, M., Renne, E., Roncoli, C., Agyei-Baffour, P., & Tenkorang, E. (2015). Integrated Assessment of Artisanal and Small-Scale Gold Mining in Ghana — Part 3: Social Sciences and Economics. *International Journal of Environmental Research and Public Health*, *12*(7), 8133–8156. https://doi.org/10.3390/ijerph120708133