

Prevalence and drivers of boys' engagement in artisanal gold mining in Kakamega County, Kenya

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ABSTRACT

Artisanal gold mining is a significant source of family livelihood in certain parts of Kakamega County and it offers a labour market that undermines boys' school attendance in areas close to public day secondary schools. This study determined the prevalence of boys' engagement in artisanal gold mining and examined the social and economic drivers of participation. The study was anchored in Economic Pressure Theory and Bronfenbrenner's Ecological Systems Theory and adopted a pragmatic paradigm with a convergent parallel mixed-methods design. The study was conducted in 18 public day secondary schools adjacent to mining areas in Kakamega East, Kakamega South, Kakamega Central, and Khwisero sub-counties. The sample consisted of 508 respondents: 322 boys identified through school-based screening, 32 boys in focus group discussions, 18 class teachers, 18 directors of studies, 18 deputy principals, 32 parents, 32 village elders, 24 mining officials, 8 ward administrators, and 4 quality assurance and standards officers. Purposive, stratified, proportional, and simple random sampling procedures were used as appropriate to the respondent categories. Quantitative and qualitative evidence was collected through questionnaires, interviews, focus group discussions, and document review. Descriptive statistics, Pearson correlation, and thematic analysis were conducted. The results indicated that 85.7% of the boys lived in artisanal gold mining areas and 78.6% reported personal involvement. School and community respondents also reported high levels of participation, while student prevalence indicators were closely consistent with teacher and deputy-principal estimates. Peer influence was the leading driver at 98.8%, followed by the allure of quick money at 89.4%. Two-thirds of the students had school-age relatives who mined instead of attending school. The study concluded that boys' participation in artisanal gold mining was widespread and sustained by interacting household, peer, and community pressures. It recommends coordinated enforcement of child-protection laws, parental accountability, sustained community sensitisation, and viable household livelihood alternatives.

Keywords: Artisanal Gold Mining, Boys, Child Labour, Kakamega County, Peer Influence, School Participation

I. INTRODUCTION

Artisanal gold mining is a labour-intensive way of mining gold by people individually or in small groups, with basic equipment and low technology. It is a source of cash in many rural communities where formal employment and credit are limited, and livelihoods are diversified. However, Schwartz et al. (2021) noted that artisanal and small-scale mining is intimately linked to both poverty and local livelihoods, but that the same activity can also present health and social hazards to the workers and surrounding communities. Mining livelihood is a challenge to overcome when it comes to education, especially for boys going to school. School might be a deferred and uncertain advantage to families who have an insecure income, because boys are seen as a resource immediately at their disposal. This can be understood from the household-survival argument of child labor: children may work when adult household earnings are inadequate. This economic push is compounded by the exposure to cash income in mining areas, and by the perception that boys are physically tough enough to work in the mines.

Household poverty is not the sole reason for boys' participation. Peer groups, family norms, community acceptance, access to mining areas, and poor monitoring and enforcement can assimilate mining as a legitimate means for young people to become adults and gain economic independence. Chandaengerwa and Bourdillon (2021) demonstrated that when young people engage in informal economic activities, this is not an isolated individual decision, but a way of being, a social relation. Not engaging in mining may seem out of place when family members or friends have motorcycles, clothes or other obvious indicators of income from mining. The physical nature of artisanal mining also poses child-protection issues. Children are likely to be involved in gold recovery activities where school-age boys are exposed to ore, shafts, crushing, washing and drying soils, pumping water and handling mercury. These occupations

involve heavy workloads, toxic materials, precarious diggings and extended shifts. The Convention on the Worst Forms of Child Labour forms part of the group of treaties designated under the UN Child Labour Convention, which includes existing instruments, and requires the elimination of dangerous work that endangers the health, safety, and morality of children (International Labour Organization, 1999).

Artisanal mining is prevalent in Kakamega East, Kakamega South, Kakamega Central and Khwisero sub-counties in Kakamega County. Khagali and Mulinya (2020) reported the socio-economic significance of gold mining in Rosterman, while Alwanga et al. (2020) reported environmental impacts in Kakamega South. These studies also found the linkages of mining with local livelihoods; however, they were not able to show an up-to-date figure of participation among boys who continued to attend public day secondary schools. Enrollment can mask significant educational risks; thus, understanding prevalence is crucial. A boy may continue to be formally registered in school but work at mine sites during examinations and selected weekdays, or at night or weekends. Boyden et al. (2019) highlighted that, even when a child is in school, he or she may still be working and putting less time into study. However, prevalence should be determined through personal involvement, school observation, family and community evidence and task types.

The present study, therefore, examined the scale and drivers of boys' participation in artisanal gold mining within mining-affected areas of Kakamega County. It integrated evidence from students, teachers, school leaders, community leaders, miners, parents, and education officials. This combination of sources was intended to differentiate between an occasional or peripheral activity and a socially addictive pattern that also challenges the educational activity.

1.1 Statement of the Problem

Kenyan law and education policy protect children's right to basic education and prohibit their engagement in hazardous labor. However, boys living in mining regions may find themselves in an environment where it is possible to earn more immediately after finishing school. Many of the mines are near homes or schools, reducing barriers to participation and increasing opportunities for boys to shift back and forth between school and work. Existing research in Kakamega has focused mainly on the environmental, livelihood, and general socio-economic consequences of artisanal mining. Khagali and Mulinya (2020) interviewed key informants and miners, but not school-going boys. Alwanga et al. (2020) focused on the environmental impacts. Thus, the extent of participation among boys in public day secondary schools, the most significant factors influencing such participation and the role of families and communities in facilitating participation have not been sufficiently documented.

From the above discussion, it is evident that there is no clear participation estimate and no sufficient understanding of the mechanisms that attract boys to AGM. Thus, interventions may target only school discipline and pay less attention to the role of economic pressure, peer normalisation, parental encouragement, and community acceptance. This study filled this gap by combining school-based evidence with community-based evidence related to participation, drivers, tasks, and utilization of mining income.

1.2 Research Objective

To assess prevalence and drivers of boys' participation in artisanal gold mining in Kakamega County, Kenya.

1.3 Research Question

What is the prevalence of boys' participation in artisanal gold mining, and why are boys involved in these activities in Kakamega County?

II. LITERATURE REVIEW

2.1 Theoretical Review

The study was guided by Economic Pressure Theory and Bronfenbrenner's Ecological Systems Theory. Economic Pressure Theory focuses on how household shocks, income shortfalls, and limited access to credit can push children from school to work. Basu and Van (1998) pointed out that child labour is not necessarily the child's free choice of occupation, but in many cases it is a survival strategy of the household. In the mining sector, boys' wages might be applied to basic necessities such as food, clothing, school or general household consumption. The economic explanation also clarifies the attraction of immediate rewards. While schooling offers future rewards, mining can offer same-day income. Merton's (1938) theory of strain is pertinent as people and families can find alternative ways to achieve what they want if regular routes to achieving the things they are accepted as wanting are unavailable. Gold mining could thus seem a shortcut to economic status and household contribution for boys from low-income mining communities.

Bronfenbrenner's Ecological Systems Theory expands this explanation by situating boys within their social contexts. The microsystem includes family, peers, school, and the mine site. The mesosystem concerns the interconnections between these environments, especially when, for example, parents' expectations and peer influence conflict with school participation. The exosystem includes local labor markets and enforcement institutions (Bronfenbrenner, 1979), while the macrosystem includes gender norms linking masculinity with physical strength and

financial provision. The theories collectively indicate that material and social pressures interact to shape boys' involvement. Engagement can be triggered by economic necessity, reinforced by peers, parents, and communities, and sustained by weak monitoring. This integrated framework was therefore appropriate for addressing both the high level of participation among boys who were formally in school and the reasons participation remained high.

2.2 Empirical Review

Artisanal mining surveys in sub-Saharan Africa have demonstrated that there exists a strong link between artisanal mining and rural livelihoods. Hilson (2016) discovered that mining and agriculture were often combined as survival activities. Bryceson (2018) also referred to gold-rush mining as being part of broader "frontier economies" that, through quickened income flows, reconfigure community life. These studies explain the pull of mining on households but are less specific about school-going boys who continue to mine while enrolled in school. Youth in the informal sector have been studied, and it has been shown that participation is both economic and social. Chandaengerwa and Bourdillon (2021) reported that mining and related informal employment provide ways for youth to respond to restricted opportunities. They found that participation depends on household need, identity, peer networks and attitudes toward adulthood. This evidence suggests that, while a boy might initially be involved in mining to help support his family, he could end up doing it because of the status and social recognition gained.

In addition, evidence on child labour warns against relying on a single indicator such as school enrolment as a gauge for access to education. Boyden et al. (2019) explained that working children may stay in school but have less time for school, less energy to study, and disruptions to their learning. This is particularly important in artisanal mining as work might happen at night, during weekends or on certain days of the week. A learner is therefore considered enrolled when significant educational time is given over to mining. In Kenya, evidence links mining proximity and educational transitions of boys. Nyakan (2019) investigated the impact of artisanal gold mining on boys' transition from primary to secondary school in Rongu Sub-County. The study highlighted proximity to mines and the economic pull of mining areas, but it did not provide countywide estimates of participation among secondary-school boys. The present study elaborated on this line of inquiry by employing boys' self-reports of their experiences along with evidence in the school and community.

The embedded character of mining in Kakamega has been determined through local studies. Khagali and Mulinya (2020) reported socio-economic benefits associated with artisanal mining in Rosterman. In Kakamega South, Alwanga et al. (2020) reported environmental effects. Machariah et al. (2020) demonstrated that community livelihoods are touched by mining-related conflict in Ikolomani. Together, these studies point to the significance of mining to the local society; they do not specify the prevalence, extent, or drivers of participation among school-going boys. Health evidence also alerts to issues of tasks assigned to boys. Ondayo et al. (2023) reported cases of possible human exposure and health risks caused by gold mining in Kakamega and Vihiga counties. According to Pijpers et al. (2021), the handling and reprocessing of mining residues are part of artisanal production systems. Physical and chemical exposures and loss of educational time can result from where children wash ore, crush materials, carry stones, enter shafts and/or handle mercury.

The literature hence identifies three similar gaps. First, livelihood and environmental studies do not provide a precise estimate of school-going boys' participation. Second, wider child labour research often fails to differentiate between types of work and work in mining. Third, poverty is the primary explanation in many studies, yet there is no measure of peer influence, family facilitation, and community normalization. The present study aimed to fill these gaps with a multi-responder mixed-methods approach.

III. METHODOLOGY

3.1 Research Design

The research adopted a pragmatic paradigm and a convergent parallel mixed-methods design. Quantitative and qualitative data were gathered in the same phase, and a synthesis of those data was done during interpretation. The quantitative strand was used to describe the scale and the pattern of participation, and the qualitative strand was used to explain processes of participation at the household, peer, school, and community levels. A correlational component was also applied to make comparisons between prevalence estimates for respondent categories.

3.2 Study Area

The study was conducted in Kakamega County, Western Kenya. The four sub-counties were selected based on the presence of a high proportion of artisanal mining in and around these sub-counties, which included Kakamega East, Kakamega South, Kakamega Central, and Khwisero. There were 36 public day secondary schools within the sub-counties, and from these, a total of 18 public day secondary schools near the mine sites were selected by proportional allocation and simple random sampling procedures.

3.3 Target Population

The target population comprised 36 public day secondary schools located near active gold mining areas and 2,062 boys in the 18 sampled schools, together with school personnel and community stakeholders involved in education and mining. The school-based respondent categories included boys, class teachers, directors of studies, and deputy principals, while community and administrative categories included parents, village elders, mining officials, ward administrators, and quality assurance and standards officers.

3.4 Sampling and Sample Size

The four mining-affected sub-counties were purposively selected. The 36 eligible public day secondary schools near active gold mines were treated within sub-county strata, and 18 schools were selected through proportional allocation and simple random sampling. The final sample comprised 508 respondents: 322 boys identified through school-based screening, 32 boys in four focus group discussions, 18 class teachers, 18 directors of studies, 18 deputy principals, 32 parents, 32 village elders, 24 mining officials, 8 ward administrators, and 4 quality assurance and standards officers. Boys for focus group discussions were selected through stratified random sampling, while school personnel and community or administrative respondents were purposively selected because of their direct knowledge of mining and schooling.

3.5 Data Collection Instruments and Procedures

Data was gathered using semi-structured questionnaires, interview schedules, focus group discussions, and document analysis. Students' involvement, perceived drivers, mining tasks, and related school experiences were obtained through questionnaires. Institutional and community perspectives were obtained through interviews with education, administrative, and mining officials. Social norms, family decision-making, peer influence, and meanings attached to mining income were explored through focus group discussions with boys, parents, and village elders. The test-retest reliability coefficient was .80, which exceeded the study threshold of .75.

3.6 Data Analysis

Quantitative data were analysed using SPSS through frequencies, percentages, and Pearson correlations. Qualitative data were transcribed, coded, and organised into themes. Evidence from the different instruments and respondent categories was triangulated to identify convergence, divergence, and possible underreporting.

3.7 Ethical Considerations

Prior to fieldwork, institutional approval and a research permit were obtained. Informed consent and assent were obtained through the schools and parents because minors were involved. Participation was voluntary, confidentiality was assured, and respondents were informed that they could withdraw without repercussions. The study also sensitised mine supervisors and community leaders before data collection to minimise suspicion among miners and safeguard participants.

IV. FINDINGS & DISCUSSION

4.1 Findings

4.1.1 Prevalence and Cross-Respondent Confirmation

The first indicator of prevalence was geographical exposure. Of the 322 student respondents, 276 (85.7%) indicated that artisanal gold mining operated in their localities. This close proximity meant that many mining sites were integrated into the daily life of homes and schools. Mining was therefore readily visible and physically accessible to boys travelling to and from school. There was also substantial personal involvement: 253 boys (78.6%) reported that they participated in artisanal gold mining. Class teachers and deputy principals independently confirmed extensive involvement, while all community-level respondent groups reported boys' participation. The key prevalence measures from the various data sources are presented in Table 1.

Table 1*Key Indicators of Boys' Engagement in Artisanal Gold Mining*

Indicator	Result
Boys reporting that AGM occurred in their locality (n = 322)	85.7%
Boys reporting personal participation in AGM (n = 322)	78.6%
Class teachers confirming substantial participation (n = 18)	72.0%
Deputy principals confirming boys' participation (n = 18)	88.9%
Village elders, ward administrators, mining officials, and QASOs confirming participation	100.0% in each category
Correlation between student and teacher prevalence indicators	$r = .995, p < .01$
Correlation between student and deputy-principal prevalence indicators	$r = .997, p < .01$

Note: AGM = artisanal gold mining. Percentages are reported as presented by each respondent category.

The agreement of values in Table 1 suggests that participation was not a fringe phenomenon reported by one group and no other. Learners identified direct involvement, school staff noted high rates of involvement, and community respondents found that the pattern was similar at mine-site and local-government levels. Near-perfect correlation between student, teacher, and deputy-principal prevalence indicators increased confidence that the different sets of data reflected a shared reality. There is also evidence to indicate that the recorded prevalence may be underestimated. Community members shared that there were instances where boys concealed their participation from the teacher/school official. Hidden participation seems possible when mining is against school regulations or child protection laws. Thus, the personal participation of 78.6% should be considered as a figure reported for the selected mining-affected schools and not as a figure for all boys visiting the mine sites.

These results augment the existing literature that uses a descriptive approach to general participation of mining communities rather than the participation of individual schools. Khagali and Mulinya (2020) revealed the economic significance of mining in Rosterman, and Nyakan (2019) identified a relationship between proximity to mines and boys' educational transition. The present evidence shows that where boys did not drop out of public day secondary schools, there was widespread direct engagement.

4.1.2 Drivers of Participation

A variety of economic, peer, family, and community factors were identified in the data. The top two reasons reported by students were peer influence and quick income, respectively. As indicated by the results, students did not enter mining primarily to pay school fees. Visible examples of wealth, along with the involvement of relatives and friends, and the social status afforded to cash, motorbikes, entertainment, and adult economic roles, also reinforced participation.

Table 2*Selected Drivers of Boys' Participation in Artisanal Gold Mining*

Driver	Student evidence	Supporting stakeholder evidence
Peer influence or pressure	98.8%	75%–86% across community groups
Allure of easy or quick money	89.4%	88.9% of deputy principals
School-age relatives involved in mining	66.5%	Family normalization reported across respondent groups
Search for pocket money or school-related expenses	10.6%	Financial pressure acknowledged by school and community respondents
Parental encouragement or facilitation	Not measured as a student percentage	Reported by 57%–92% across village elders, ward administrators, and mining officials

Table 2 indicates that peer influence outweighed the direct search for school fees. This is in line with the findings of the Ecological Systems Theory, which suggests that the peer group created an immediate social setting, where mining was made reasonable and rewarded. Bronfenbrenner (1979) stressed the importance of a continuous cycle of interaction with individuals and environments. In the study area, boys were exposed to mining by friends, relatives, family members, and the community. Stories of boys or former students acquiring cars, mining equipment, or other material goods cemented the allure of the easy cash. These kinds of examples gave a strong contrast with uncertain examination returns and immediate material successes. The study shows that the pull from status and peer recognition can persist even after earnings are no longer largely going towards school costs, as described by the Economic Pressure Theory, and this impact is felt throughout the boys' schooling experience.

One of the key institutional findings was parental facilitation. Many parents were found to be pressuring and prodding their sons into engaging in mining activities, because boys were considered potential household breadwinners.

Ward administrators and village elders also talked about boys being accompanied by their parents to the mining sites. This pattern weakened the protective role of the family as a barrier to hazardous child labour. In some families, economic hardship contributed to the normalization of mining within family life.

4.1.3 Mining Tasks and the Nature of Participation

Boys' participation was not restricted to light errands. It was alleged that they cleaned ore, broke up rocks, scooped ground ore, carried stones, dug shafts, pumped water for amalgamation and transported the ore. Table 3 lists the most commonly mentioned activities by village elders, ward administrators and mining officials.

Table 3

Activities Performed by School-Going Boys at Mining Sites

Activity	Combined frequency	Percentage
Washing ore	37	94.9%
Crushing or operating crushers	35	89.7%
Scraping ground or extracting gold-bearing material	35	89.7%
Carrying stones or ore	34	87.2%
Digging shafts	31	79.5%
Mopping or recovering gold	27	69.2%
Drying soil or ore	26	66.7%
Transporting ore or materials	23	59.0%
Pumping water from shafts	22	56.4%
Applying mercury during amalgamation	20	51.3%

Note: Multiple responses were permitted. The combined respondent base was reported as village elders, ward administrators, and mining officials.

Tasks listed in Table 3 reflect sustained physical exertion and exposure to risk, including injury from shaft digging and heavy carrying and chemical exposure from handling mercury. These tasks require time and recuperation and therefore compete with regular study. The findings move boys' mining from being portrayed as benign family labour to being understood as hazardous child labour in an active mining economy. The use of mining income also indicated a shift from temporary coping to an alternative way of life. Ward administrators reported spending on basic needs, motorbikes, leisure, alcohol, drugs, and other social activities. These patterns show that mining income served different purposes. While some earnings supported household survival, others reinforced the social visibility and allure of mining and could attract more boys into the activity.

4.2 Integrated Interpretation

The prevalence results can best be seen as the interaction of systems. Boys' earnings had value for households as a result of economic pressures. Peer groups made mining seem normal and a way to make a lot of money. Families sometimes actively facilitated participation. Local mine sites provided work opportunities, and weak enforcement meant that loss of work was less likely. The outcome was an interacting system, where mining was in direct competition with schooling. The evidence substantiates the household-survival case of Basu and Van (1998), and also highlights the limitations of the poverty-only explanation. If poverty were the sole causal factor, it would be expected that participation would subside after the basic needs of the population were met. However, visible consumption, status-seeking, and peer pressure kept interest alive. The ecological approach, on the other hand, offers a more comprehensive explanation as it establishes a linkage between household need and peer culture, community expectations, local institutions, and enforcement conditions.

The study provides relevant county-level evidence focused specifically on boys in public day secondary schools. It distinguishes between the occurrence of mining and personal involvement, identifies key drivers, and documents the activities performed. The use of multiple respondent categories further confirms that the issue is not only statistically prevalent but also socially embedded.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

Boys' engagement in artisanal gold mining was widespread in the selected mining-affected areas of Kakamega County. The vast majority of student respondents lived in areas with mining activity, and over three-quarters reported personal involvement. The pattern was confirmed independently by the school staff and the community stakeholders. The high percentage of agreement between data sources demonstrates that participation was expected, accepted, and frequent as part of the educational context, not extraordinary.

Peer influence, the prospect of immediate income, household poverty, family facilitation and community acceptance explain the participation. Boys tended to be involved in physically demanding and risky occupations and mining income was sometimes used for consumption that further strengthened disengagement from school. The results thus reveal that simply tackling a problem within school boundaries cannot, by itself, resolve the socio-economic and ecological conditions that perpetuate the behaviour.

5.2 Recommendations

Coordinated controls at mine sites by the Ministry of Labour, Ministry of Education, county authorities, local administrators, and child-protection agencies should be employed to prevent the entry of children under the age of 18, and to identify boys who are in school but employed on hazardous tasks. Age-verification protocols, regular auditing, and effective back-referral procedures to schools should be used for enforcement. These measures should be regular rather than occasional to reduce the return of child participation after inspectors leave. Early-warning systems should be established in the schools, including attendance monitoring, guidance/counselling, parent conferences and follow-up for boys who may reside in the vicinity of active mine sites. There is a need for a clear reporting system from teachers to chiefs, children's officers and probation and social-service staff. The situation following disclosure should be supportive and reintegrating in order to avoid stigmatising or driving boys further towards going to mines.

Communities should be sensitised to the long-term educational costs of short-term mining earnings, and the status quo of boys as breadwinners should be questioned. Sustained dialogue should ensue instead of one-off campaigns with parents, village elders, faith leaders, mining associations and former students. Messages should also address peer status and visible consumption as factors attracting boys to mining. Lastly, poverty reduction and livelihood programmes should include viable alternative livelihood options for families that rely on the labour of boys. School retention should be tied to the provision of bursaries, social protection, adult livelihood support and youth skills pathways. Future evaluations should track boys over time to determine whether reduced mining involvement is accompanied by improved attendance, completion, and academic achievement.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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