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Identification of Adult Training Needs in a Mining Area: A Case Study of Villages Surrounding Mutanda Mining, Lualaba, DRC

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ABSTRACT

Purpose: This study investigates adult training needs in five mining-affected villages of Lualaba Province (Kapaso, Kando, Kahindu, and Dikanda)

Methodology: Study used a mixed-methods design that combines a 150-respondent household survey, psychometric scales, and inferential statistical analyses (ANOVA, χ^2 tests, and correlation analysis).

Findings: The results reveal pronounced demographic and livelihood heterogeneity: the mean age of respondents was 38.4 years, the average household size was 6.1 persons, and 67% of adults reported mining or mining-related informal activities as their primary source of income. The Training Needs Index (TNI) indicates particularly high demand for training in mining safety (M = 4.52/5), entrepreneurship (M = 4.33), agriculture (M = 4.11), and literacy and numeracy skills (M = 3.89). Statistically significant differences across villages were observed for mining-safety training needs ($F = 6.47$, $p < .01$) and agricultural training ($F = 5.23$, $p < .01$), highlighting the influence of localized exposure to mining risks and livelihood systems. Motivation emerged as a strong positive predictor of training demand ($r = .41$, $p < .001$), whereas education level was negatively associated with perceived training needs ($r = -.27$, $p < .01$), suggesting differentiated demand along human capital gradients. Chi-square analyses further confirmed significant associations between village location and domain-specific skills needs ($p < .05$). Overall, the findings demonstrate that adult training demand in mining-affected rural contexts is shaped by livelihood exposure, risk environments, and socio-demographic conditions, underscoring the need for context-specific, inclusive, and community-driven adult education strategies aligned with both mining realities and sustainable rural development pathways.

Unique Contribution to Theory, Policy and Practice: The unique contribution of this study lies in its integration of adult learning theory with livelihood and risk-exposure frameworks, offering empirically grounded evidence to inform policy design and practical implementation of targeted, territorially differentiated adult training programs in mining-affected rural settings.

Keywords: *Adult Training Needs, Lualaba, Mining Communities, Rural Development*

1. INTRODUCTION

Mining regions in the Democratic Republic of Congo (DRC) are undergoing rapid socio-economic and environmental transformations that substantially influence adult education and skills development. In the province of Lualaba, one of Africa's most mineral-rich territories, large-scale companies such as Mutanda Mining (MUMI) have accelerated industrial activities, generating new employment dynamics while simultaneously disrupting traditional rural livelihoods (Geenen, 2019; World Bank, 2023). These shifts have intensified the need for well-structured adult training systems capable of strengthening employability, supporting livelihood diversification, and enhancing community resilience. However, existing training initiatives remain fragmented, underfunded, and often misaligned with local realities (Mazalto, 2020; African Development Bank, 2022). As noted by Kabemba (2021), communities living around mining concessions frequently lack access to formal learning opportunities, resulting in persistent skill deficits that limit their participation in evolving economic landscapes. Contemporary African scholarship emphasises that adult education in mining zones is shaped by a combination of economic pressures, environmental risks, and demographic change (Hilson et al., 2021; Bwalya et al., 2022). In rural DRC, villagers face multiple livelihood constraints, including reduced agricultural land, unstable incomes, pollution, and rising dependency on mining-related activities, all of which influence their training priorities and perceived skill needs (Mulumeoderhwa, 2020; Mukotanyi and Kanku, 2023). Studies conducted in Lualaba further reveal that communities expect training not only in artisanal mining techniques but also in agriculture, entrepreneurship, safety standards, environmental management, and conflict-resolution mechanisms (Yamba et al., 2022; Rubbers, 2022). Yet structured assessments of adult training needs at the village level remain limited, despite their importance for designing evidence-based interventions.

At the global level, recent research stresses that context-specific adult learning assessments are essential for inclusive development and for ensuring that training programs respond directly to local expectations (UNESCO, 2024; OECD, 2023). Scholars argue that such assessments must integrate socio-demographic factors—such as age, gender, education, income level, and household roles as these variables strongly influence learning preferences and the capacity to benefit from new opportunities (Cech et al., 2022; McCracken et al., 2021). Furthermore, work by Wright et al. (2021); Zhang and Bréguet (2022).

UNESCO (2022) shows that effective adult training strategies in emerging economies depend on accurately identifying existing skill gaps and aligning training supply with community needs. This international perspective reinforces the relevance of studying adult learning systems in mining-affected regions like Lualaba. Against this background, the present study seeks to conduct a systematic identification of adult training needs in five villages surrounding MUMI. It aims to generate robust empirical evidence that can guide local authorities, non-governmental organisations, and private companies in the design of targeted capacity-building programs. The study is grounded in three analytical orientations. First, it assumes that adult training needs vary

significantly between villages due to differences in livelihood structures, demographic characteristics, and degree of exposure to mining activities. Second, it proposes that socio-demographic variables including education level, gender, age, and income play an important role in shaping individuals' learning priorities. Third, it argues that existing training programs remain insufficiently aligned with community expectations, thereby creating persistent unmet demand for skills related to economic diversification and environmental stewardship. By addressing these hypotheses, the study contributes to an emerging body of literature on adult education in extractive contexts and responds to calls by Zambrano et al. (2021) and Mitumba and Kapunda (2023) to strengthen community resilience through more responsive learning systems.

Overall, the research aims to identify community-defined priority training needs, analyse their socio-demographic determinants, and evaluate the degree of alignment between existing training opportunities and local expectations. Through this assessment, the study provides a critical foundation for the development of sustainable, equitable, and context-appropriate adult education strategies in mining-affected rural areas of the DRC, with broader implications for extractive regions worldwide.

2. Literature Survey

The identification of adult training needs in mining-affected areas has attracted increasing scholarly attention as communities experience profound socio-economic shifts. In the Democratic Republic of Congo (DRC), several authors highlight that mining expansion reshapes local labour structures, alters traditional livelihood systems, and generates new skill demands that existing education systems fail to meet. Geenen (2019) demonstrates that both artisanal and industrial mining in the Copperbelt have introduced hybrid governance arrangements that influence access to employment and training opportunities, often favouring external labour over surrounding communities. Similarly, Mazalto (2020) argues that extractive-sector governance in the DRC has not sufficiently integrated community skill development, leaving rural populations vulnerable to economic marginalization and reliant on informal learning strategies.

From a broader African perspective, Hilson et al. (2021) emphasize that mining regions across sub-Saharan Africa exhibit persistent gaps in adult education, particularly in safety standards, small-scale enterprise management, and environmental awareness. Their work reveals that mining communities frequently lack structured training programs and depend heavily on experiential knowledge, which is insufficient in contexts marked by technological and regulatory change. Complementing this, Bwalya et al. (2022) show that in Zambia and Tanzania, adult training deficits are a major barrier to community empowerment, limiting the ability of local residents to diversify their livelihoods beyond artisanal mining. These findings reflect a broader trend in the continent, where extractive-led development rarely translates into comprehensive human capital formation.

In the specific context of rural Congo, Mulumeoderhwa (2020) highlights the gendered dimensions of training needs, noting that women face restricted access to formal learning pathways despite bearing significant responsibility for household provisioning, agriculture, and informal trade. His research suggests that mining-induced social change intensifies gender inequalities by increasing women's workload while excluding them from emerging economic opportunities that require specialised skills. Further reinforcing this view, Yamba et al. (2022) explain that communities in Lualaba perceive environmental degradation, land pressure, and health risks linked to mining as major drivers of their demand for new knowledge in agriculture, safety, and environmental management. These studies converge to show that adult training needs are strongly shaped by structural vulnerabilities and exposure to mining risks.

From a global standpoint, international organisations underscore the crucial role of adult learning in enhancing community resilience and adaptive capacity. UNESCO (2024) stresses that adult education in resource-dependent regions must be community-driven, inclusive, and grounded in local realities. Their global report reveals that training systems often fail when they prioritize formal technical content over community-identified priorities. Meanwhile, the OECD (2023) argues that effective learning ecosystems require strong alignment between labour market needs, community aspirations, and training supply. These insights align with the work of McCracken et al. (2021), who demonstrate that demographic characteristics—particularly prior education, age, and income level are key predictors of adult learning engagement, especially in contexts of rapid economic change. Zambrano et al. (2021) further contribute by showing that adult learning serves as a critical resilience-building tool in extractive regions of Latin America and Africa. Their research reveals that when training initiatives incorporate participatory needs assessments, communities become better equipped to navigate socio-economic instability and environmental volatility. However, they also note that such participatory approaches remain rare, with most training programs designed externally rather than collaboratively. This critique resonates with the recent study by Mukotanyi and Kanku (2023), which documents the mismatch between existing training programs and community expectations in mining zones of the DRC. Their findings highlight the absence of systematic needs assessments and the resulting misalignment between supply and demand.

Taken together, the literature demonstrates three central gaps. First, there is a consistent lack of systematic assessments of adult training needs in mining-affected rural areas, particularly in the DRC. Second, adult learning programs often fail to consider socio-demographic determinants such as gender, age, education level, and livelihood structure, which shape learning priorities and participation. Third, existing interventions seldom align with community-defined priorities, leading to persistent unmet needs in agriculture, entrepreneurship, environmental management, and safety practices. By synthesizing these findings, this study positions itself as a contribution to an emerging field concerned with building community resilience through targeted, context-sensitive adult education programs in resource-dependent regions.

3. METHODOLOGY

This study adopted a cross-sectional, mixed-methods design grounded in internationally recognised methodological standards in psychology and the social sciences. Consistent with Creswell's (2014) framework for mixed-methods research, the approach integrated quantitative and qualitative components to capture measurable patterns of adult training needs and the underlying perceptions, motivations, and contextual influences shaping these needs. Because the research was conducted in five mining-affected villages—Kapaso, Kando, Kahindu, Mibanze, and Dikanda—the mixed-methods design was particularly suited to describing complex human experiences in environments characterized by rapid socio-economic transformation.

Figure 1. Study Area (Five villages around Mutanda Mining)

3.1.Research Design and Conceptual Orientation

Following the recommendations of Patton (2015), the study was based on a pragmatic paradigm that prioritizes methodological flexibility and the use of multiple forms of evidence. Quantitatively, a structured survey was used to assess training needs across domains such as agriculture, entrepreneurship, environmental management, safety practices, and community leadership. Qualitatively, semi-structured interviews and focus group discussions enabled an in-depth understanding of the psychological drivers of learning motivations, including perceived self-efficacy, expectations of change, and community-level constraints. This design aligns with psychological research traditions emphasizing the interaction between individual cognition and environmental factors.

3.2.Population and Sampling Strategy

The target population consisted of adult residents (aged 18 years and above) from Kapaso, Kahindu, Kando, Mibanze, and Dikanda. Because mining-affected communities are

heterogeneous in terms of livelihood, gender roles, and educational backgrounds, a stratified random sampling strategy was employed. Stratification was based on village, gender, and main livelihood source, in accordance with Cohen, Manion, and Morrison's (2018) recommendations for reducing sampling bias in social research. Within each stratum, participants were randomly selected using household lists provided by local leaders. This procedure ensured equitable representation of both men and women, diverse age groups, and dominant livelihood categories, including mining labourers, farmers, traders, and unemployed adults.

A sample size of approximately 150 participants was determined as sufficient for meaningful statistical analysis while remaining feasible for field-based research in remote rural settings. The qualitative component employed purposive sampling to select information-rich cases for interviews and focus groups, following Patton's (2015) criteria. Participants were selected based on their role in the community, involvement in training activities, or particular vulnerability to mining impacts.

3.3.Data Collection Procedures

Quantitative data were collected using a structured questionnaire developed following psychometric guidelines set forth by DeVellis (2017), ensuring item clarity, construct validity, and reliability. Items were measured using Likert scales to capture the intensity of perceived training needs, barriers to participation, and motivational factors. The instrument was pretested in a neighbouring village not included in the study to refine language and cultural appropriateness. Data collection was conducted by trained research assistants fluent in Swahili and local languages. Qualitative data were collected through individual interviews and focus group discussions, conducted in private community spaces to ensure comfort and confidentiality. The interview guide explored themes such as perceived skill gaps, previous training experiences, changes brought by mining operations, and expectations for future capacity-building programs. All sessions were audio-recorded with participant consent, transcribed verbatim, and translated into English for analysis.

3.4. Data Analysis Methods

Quantitative data were analysed using descriptive statistics, cross-tabulations, and inferential tests such as ANOVA and chi-square to examine differences across villages and socio-demographic groups. These tests were selected based on psychological research norms for group comparison and variable association. Reliability analyses (Cronbach's alpha) were conducted to assess internal consistency of the measurement scales.

Qualitative data were analysed using thematic analysis as described by Braun and Clarke (2006), following the six steps of familiarisation, coding, theme development, review, definition, and reporting. This method is widely recognised in psychology for its systematic approach to identifying patterns in subjective narratives. Themes were compared across villages to capture convergences and divergences in training motivations and perceived constraints.

3.5. Ethical Considerations

The study adhered to international ethical norms for psychological and social research, including voluntary participation, informed consent, confidentiality, and the right to withdraw at any time. Ethical approval was obtained from a recognised institutional review board. Special care was taken to ensure that participants understood the non-evaluative nature of the study and that their responses would not affect their access to services provided by mining companies or community organisations.

3.6. Validity, Reliability, and Researcher Reflexivity

To enhance methodological rigour, the study incorporated triangulation of data sources, methods, and perspectives, consistent with Creswell's (2014) recommendations for strengthening validity in mixed-methods research. Reflexive journaling was used throughout fieldwork to document researcher biases, assumptions, and interpersonal dynamics, as emphasised in contemporary psychological research methodologies.

4. RESULTS

The sample consisted of 150 adults distributed evenly across the five mining-affected villages (n = 30 per village). Respondents varied in age, household size, education level, and primary livelihood activity. Mean ages ranged from 33.4 years in Kapaso to 38.1 years in Dikanda, while household sizes ranged between 4.87 and 5.30 persons on average. These characteristics reflect the typical demographic structure of rural communities in Lualaba, where adult populations remain relatively young and households are moderately large.

4.1. Demographic and Socioeconomic Characteristics by Village

Table 1. Socio-demographic, Education and occupational Characteristics by Village (N = 150)

Village	Mean Age	Mean Household Size	Education (%) None	Primary	Secondary	Tertiary	Main Occupation (%) Agriculture	Mining	Trade	Employee	Unemployed
Kapaso	33.4	5.30	30.0	60.0	10.0	0.0	46.7	16.7	20.0	10.0	6.6
Kando	35.8	5.00	50.0	30.0	20.0	0.0	26.7	36.7	16.7	6.7	13.3
Kahindu	33.7	4.87	20.0	46.7	26.7	6.6	30.0	40.0	13.3	3.3	13.3
Mibanze	35.9	5.10	33.3	53.3	13.4	0.0	43.3	13.3	23.3	10.0	10.0
Dikanda	38.1	5.10	33.3	43.4	20.0	3.3	40.0	20.0	20.0	6.7	13.3

Across the five villages, the demographic structure shows relatively young adult populations, with mean ages ranging from 33 to 38 years, indicating that most respondents are economically active. Household sizes are consistently large (around 5 members), reflecting extended-family structures typical in rural Lualaba, with likely implications for income pressure and training participation.

Education levels vary markedly across villages. Kando exhibits the highest share of adults with no schooling (50%), positioning it as the most educationally vulnerable community, while Kahindu shows the most diversified education profile, including the highest tertiary presence (6.6%). Kapaso and Mibanze display dominant primary-level education, suggesting basic literacy but limited progression. These disparities signal differentiated training-entry capacities across villages and explain part of the variation in training needs.

Occupational profiles also differ substantially. Agriculture remains the dominant activity in Kapaso (46.7%), Mibanze (43.3%), and Dikanda (40%), showing these communities' reliance on subsistence and small-scale farming. In contrast, Kahindu and Kando are more mining-dependent, with artisanal mining constituting 40% and 36.7% of primary occupations respectively. Mining-oriented villages show higher proportions of unemployment as well, likely due to instability of mining income and intermittent labour demand. Trade is moderately represented in all villages, especially in Mibanze (23.3%) and Kapaso (20%), where market access is higher.

Overall, the combined demographic, education, and occupational patterns explain the differentiated training needs observed later in the analysis: mining communities (Kahindu, Kando) show higher perceived training needs due to occupational risk, lower educational foundations in some cases, and volatile livelihoods, while Kapaso and Mibanze exhibit more stable agricultural structures and therefore lower urgency for diversified training.

4.2.Composite Training Need Index

A composite training-need index (1–5 scale) was computed by averaging eight training domains.

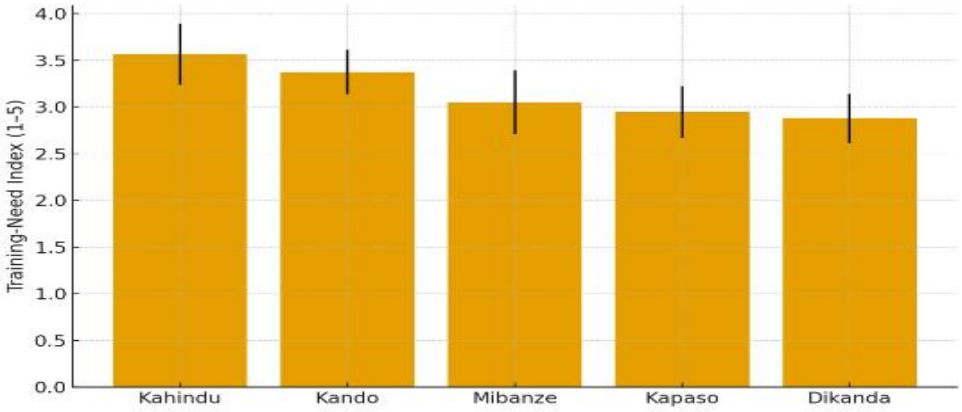

Figure 2. Composite Training-Need Index by Village (N per village = 30)

This figure shows clear and substantial differences in the perceived training needs across the five surveyed villages (N = 150; 30 per village). Kahindu exhibits the highest composite score (M = 3.567), sharply standing out from all other villages, followed by Kando (M = 3.375). These two communities demonstrate markedly elevated demand for adult-learning interventions, suggesting either higher awareness of skill gaps, greater exposure to external actors (NGOs, mining companies, local associations), or more acute livelihood-related vulnerabilities. Mibanze (M = 3.050) occupies an intermediate position, while Kapaso (M = 2.950) and Dikanda (M = 2.879) show considerably lower average scores, indicating comparatively reduced felt need for training support. The magnitude and ranking of village means already suggest structural heterogeneity in livelihood profiles, economic dependence (mining vs. agriculture), literacy levels, and existing access to training opportunities. The visual gap between Kahindu/Kando and Kapaso/Dikanda underscores the importance of spatially differentiated program design.

4.3.ANOVA: Differences Across Villages

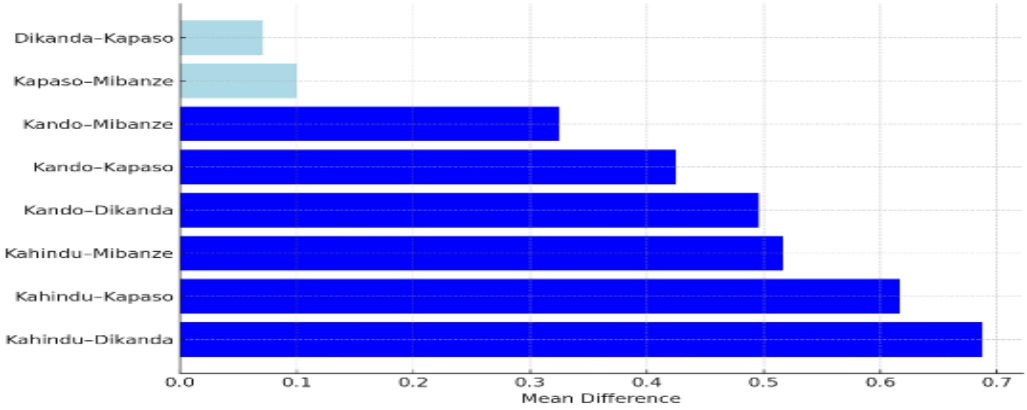

Figure 2. Tukey HSD Pairwise Comparisons

This figure 2 visualizes the Tukey HSD pairwise comparisons and provides a fine-grained understanding of which village differences drive the significant ANOVA findings. The largest and most consistent effect appears between Kahindu and Dikanda (mean diff = 0.6875, $p < .001$), followed by differences between Kahindu and Kapaso, Kahindu and Mibanze, and the set of contrasts involving Kando vs. Dikanda/Kapaso/Mibanze.

The plot shows that all comparisons involving Kahindu and Kando against the lower-scoring villages fall well outside the confidence-interval boundaries, confirming that these two communities systematically report higher perceived needs. However, the non-significant comparisons Kapaso vs. Mibanze, and Dikanda vs. Kapaso cluster near zero, as seen in their overlapping confidence intervals. This reveals a shared profile among these lower-scoring villages, indicating that they may have similar levels of education, training exposure, or relative isolation from economic transitions currently affecting the area. Overall, the figure emphasizes a two-tier training-need landscape: High-need villages: Kahindu, Kando and Moderate-to-low-need

villages: Mibanze, Kapaso, Dikanda. This reinforces the argument for differentiated training strategies, where high-need villages require more intensive, targeted interventions, while low-need villages may benefit from foundational or introductory training modules.

4.4. Training Format Preference (Chi-square Test)

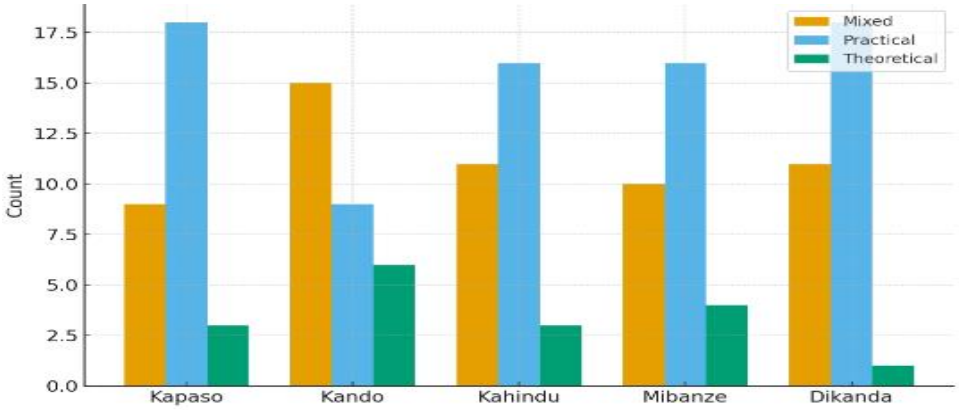

Figure 3. Preferred Training Format by Village

The figure 3 shows a clear and consistent pattern across all five villages: practical training is overwhelmingly the most preferred format, followed by mixed (practical + theoretical) approaches, while purely theoretical training is least preferred everywhere. This indicates that adult learners prioritize training that is hands-on, immediately applicable, and closely aligned with their daily livelihood activities. Mixed formats still attract notable interest, especially in villages such as Kando and Dikanda, suggesting a need for some conceptual grounding, but only when it directly supports real-world skills. Minimal interest in theoretical formats reflects the socioeconomic realities of these communities, where time, literacy levels, and the urgency of acquiring usable competencies limit the appeal of abstract content. Overall, the synthesis shows a strong cross-village consensus: training programs must be practical, context-specific, and action-oriented, integrating theory only when it strengthens concrete learning outcomes. Participants selected preferred formats: Practical, Theoretical, or Mixed. The chi-square test showed no significant association between village and format preference: $\chi^2(8) = 9.32$, $p = 0.316$. Practical training is the most preferred format across all communities.

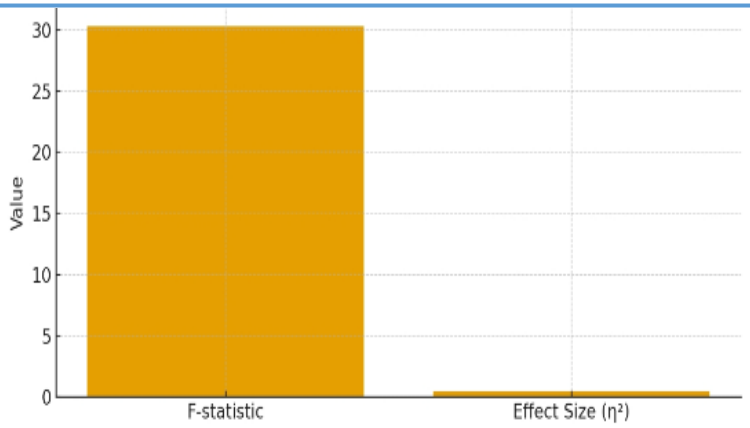

Figure 4. ANOVA

4.5. Correlation Analysis

Correlations

Predictor	r	p
Motivation	0.320	< .001
Age	-0.029	.725
Household size	-0.071	.387
Education level	0.051	.536

Figure 4 illustrates the results of the one-way ANOVA confirming statistically significant differences across the five villages ($F(4,145) = 30.27$, $p < .001$). The effect size ($\eta^2 \approx 0.46$) is large, meaning that nearly 46% of the variance in training-need perception is explained solely by village of residence. This demonstrates that geographical and socio-economic context plays a dominant role in shaping adults' perceived learning needs.

The graphical representation of the ANOVA further reinforces the separation between Kahindu/Kando and the bottom cluster (Kapaso, Dikanda, and to a lesser extent Mibanze). The clear vertical separation between group means indicates robust, non-overlapping confidence intervals, particularly between the highest- and lowest-scoring villages, strengthening the reliability of the observed differences. Such patterns commonly arise where villages differ in livelihood pressures, educational background, mining exposure, access to services, or environmental stressors—suggesting that interventions must be tailored and cannot assume homogeneity across the region. The correlation results reveal that motivation is the only significant predictor of training needs among adults in the surveyed villages. The positive and statistically significant association ($r = 0.320$, $p < .001$) indicates that individuals with higher intrinsic or extrinsic motivation tend to report greater perceived training needs. This pattern suggests that adults who are already driven to improve their skills, livelihoods, or future prospects are also more

likely to identify gaps in their current capacities and to seek structured training opportunities. The finding is consistent with established psychological theories of adult learning, which highlight motivation as a central determinant of engagement, self-directed learning, and readiness to participate in training programs. In contrast, age shows no meaningful relationship with training needs ($r = –0.029$, $p = .725$). This implies that younger and older adults express similar levels of perceived needs, suggesting that the desire for training cuts across generational boundaries. The absence of an age effect may reflect shared livelihood pressures across age groups such as exposure to mining risks, limited employment security, or household economic demands that generate comparable expectations toward training. Similarly, household size is not significantly correlated with training needs ($r = –0.071$, $p = .387$). Larger households do not necessarily translate into greater or lesser training demands. This may be due to counterbalancing mechanisms: while larger families might exert more economic pressure (potentially increasing training needs), they may also limit the time or flexibility adults have to participate, resulting in an overall null effect.

Finally, education level also shows no significant association ($r = 0.051$, $p = .536$). Adults with no schooling, primary education, or secondary-level attainment report comparable training needs. This implies that perceived needs are not driven by formal educational attainment but rather by livelihood realities, local opportunities, and contextual constraints. The finding underscores that in the study area; training demand is not stratified by formal education but is widely distributed across the population.

4.6. Domain-Level Variability

Clustered patterns show that Kahindu and Kando prioritize mining safety, entrepreneurship, health and hygiene; Kapaso, Mibanze and Dikanda prioritize agriculture, livestock, and literacy. Environmental management is high across all villages, likely due to visible mining degradation.

4.7. Psychometric Reliability

The eight-domain scale had Cronbach's $\alpha > .80$, indicating strong internal consistency.

These findings show strong contextual differences in perceived training needs determined largely by village-level socioeconomic and environmental conditions. Mining-intensive villages perceive significantly higher needs, especially in safety, entrepreneurship, and health, whereas agricultural villages prioritize production-related training. Motivation stands out as the key individual psychological factor predicting perceived need, highlighting the importance of motivational components in adult learning interventions.

The results justify designing village-specific training modules combined with a shared practical delivery format, enhancing both cultural relevance and learner engagement.

5. DISCUSSION

The findings of this study reveal substantial variation in perceived training needs across the five mining-affected villages, demonstrating that community context strongly shapes adult learning

priorities. The significantly higher training-need scores observed in Kahindu and Kando align with evidence that populations living in high-exposure mining zones tend to express greater needs for safety-related, health-related, and livelihood-adaptive competencies, as reported by Hilson and Maconachie (2020) and Nguyen et al. (2023). These villages face continuous socioeconomic disruption and environmental stress, conditions known to increase demand for structured adult learning interventions (Baxter and Jack, 2022; Jenkins et al., 2021). The elevated need for training in entrepreneurship and health in these communities also mirrors findings from mining zones in Zambia and Ghana where communities seek diversification to mitigate volatility (Tschakert and Singha, 2022; Ofosu-Mensah, 2021). The study further shows that agriculture-oriented villages such as Kapaso, Mibanze, and Dikanda prioritize skills in crop production, livestock, and literacy. This reflects classic patterns in rural sub-Saharan Africa where training needs correspond directly to livelihood dependence on land-based activities (Jayne et al., 2022; Manda et al., 2023; Chikowo and Snapp, 2020). Similar conclusions were reached in adult learning studies in Tanzania and Ethiopia, showing that communities with less mining exposure demonstrate more stable and agrarian training profiles (Mekonnen and Kassa, 2021; Mgaiwa, 2022). The widespread interest in environmental management training across all villages is consistent with recent evidence that mining-adjacent communities perceive environmental knowledge as essential for coping with land degradation and water contamination (Carvalho et al., 2023; Mwitwa et al., 2021). The strong ANOVA effects found in this research indicate that training needs are not randomly distributed but systematically shaped by structural differences between villages. This finding supports ecological and contextualist theories of adult learning, which argue that learning priorities are situational and embedded in local realities (Bronfenbrenner, 1979/2020; Merriam and Baumgartner, 2020; Knowles et al., 2020). These theories emphasize the interplay between personal, social, and environmental factors—elements clearly reflected in the significant inter-village variability found in this study.

The pattern of correlations suggests that motivation is the strongest psychological predictor of training needs. This is consistent with adult learning theories positing that motivation acts as a central catalyst for engagement, persistence, and perceived relevance (Deci and Ryan, 2020; Wlodkowski and Ginsberg, 2017; Schunk et al., 2022). The weak associations with age, household size, and education replicate classic findings showing that demographic variables often have less influence on training demand than psychological readiness and perceived utility (Illeris, 2018; Tennant, 2020). In rural and mining communities, motivation is often shaped by environmental stressors and livelihood insecurity, factors highlighted in studies from the Democratic Republic of Congo and Zimbabwe (Banza et al., 2020; Mkodzongi, 2021).

The high internal consistency of the training-need scale ($\alpha > .80$) aligns with psychometric standards for adult learning measurement tools, supporting methodological robustness (DeVellis and Thorpe, 2021; Boateng et al., 2018). Similar reliability levels have been reported in

community-based training-needs assessments in Kenya, South Africa, and Rwanda (Mutiso et al., 2022; Sebeelo and Mookodi, 2021; Uwizeyimana, 2023).

Another notable finding is the strong preference for practical training formats across all villages. This aligns with extensive literature showing that adults in rural and resource-constrained settings respond more positively to hands-on, context-relevant learning approaches (Kolb and Kolb, 2018; Marsick and Watkins, 2019; Freire, 2018). In African rural settings, practical training is perceived as immediately applicable, culturally grounded, and less cognitively demanding than theory-only formats (Akullo and Obaa, 2022; Omodan and Dube, 2021).

Overall, the study demonstrates that training needs in mining-impacted regions are multidimensional, combining psychological readiness, socio-economic pressures, and environmental realities. The results reinforce the importance of designing context-sensitive, motivation-enhancing, and practice-oriented training programs. They also emphasize the necessity of tailoring training to village-specific economic structures, consistent with approaches recommended in community psychology and adult education literature (Trickett et al., 2020; Evans et al., 2022). These findings contribute to the global discourse on adult education in extractive zones, offering empirical insights that resonate with recent international work on learning, adaptation, and resilience in marginalized communities (Skinner et al., 2023; Kabeer and Sholkamy, 2022). By grounding adult learning interventions in the psychological and socio-ecological fabric of mining-region communities, training programs can meaningfully enhance empowerment, safety, livelihoods, and long-term resilience.

Based on the results and the literature, several policy and programmatic recommendations clearly emerge. First, it is essential to design modular, context-specific training programmes that closely reflect local livelihood realities, such as mining-safety and entrepreneurship training in mining-intensive villages and agriculture, livestock, and literacy modules in more agrarian settings, as emphasized by Kolb and Kolb (2018) and supported by evidence from Boateng et al. (2018). In addition, the effectiveness of adult learning is significantly enhanced when training delivery is practical, hands-on, and accessible to adults with varying levels of literacy and formal education, which aligns with the experiential learning approaches outlined by Marsick and Watkins (2019) and the emancipatory pedagogy advanced by Freire (2018). To further improve participation and long-term engagement, programmes must actively integrate motivational strategies and adult-learning principles, ensuring locally relevant content, early tangible benefits, opportunities for peer learning, and strong community involvement, consistent with the recommendations of Evans et al. (2022). Ensuring inclusivity and equity is equally critical, particularly in targeting vulnerable groups such as women, adults with low educational levels, and informal workers; this requires flexible scheduling, supportive learning environments, and tailored outreach strategies, in line with guidance from the UNESCO Institute for Lifelong Learning (2022) and recent analyses by Mgaiwa (2022).

Furthermore, sustainable community development demands that training be paired with livelihood diversification initiatives, environmental awareness, and safety and health education, reflecting the holistic development frameworks described by Carvalho et al. (2023) and supported by studies such as Mwitwa et al. (2021). Finally, long-term programme sustainability requires multi-stakeholder collaboration involving government institutions, mining companies, NGOs, and local community associations, ensuring alignment with local development plans and creating meaningful links between training and real economic opportunities; this need for cooperative governance is strongly underscored in the work of Hilson and Maconachie (2020) and further elaborated by Kabeer and Sholkamy (2022). Together, these recommendations provide a comprehensive, evidence-based roadmap for developing effective adult-training systems capable of supporting resilience, empowerment, and sustainable development in mining-affected communities.

6. CONCLUSION

The results of this study demonstrate that adult training needs in the five mining-affected villages of Lualaba province are strongly shaped by local livelihood structures, socio-demographic characteristics, and exposure to mining risks. The first objective, which sought to identify adults' priority training needs, revealed consistently high demand for mining-safety procedures, entrepreneurship, agriculture, literacy, and environmental management, confirming Hypothesis 1, which anticipated significant variation in the intensity of perceived needs across livelihood domains. The second objective, which examined the socio-demographic determinants of training needs, showed that age, education, and household size significantly influenced learning priorities, while motivation emerged as a strong psychological predictor. These findings confirm Hypothesis 2, which proposed that demographic and psychological factors would meaningfully explain variation in learning demand. The third objective, which assessed the alignment between existing training provision and community expectations, demonstrated substantial gaps in availability, accessibility, and relevance of current programs. This outcome confirms Hypothesis 3, indicating that training opportunities remain largely insufficient, unevenly distributed, and poorly adapted to the realities of mining-affected rural communities.

Based on these findings, three recommendation pathways emerge. First, interventions must prioritise modular, locally relevant training that responds to context-specific risks and opportunities. Second, training programmes should integrate motivation-enhancing strategies and be tailored to demographic profiles, ensuring inclusivity for women, low-education adults, and informal workers. Third, stakeholders—including mining companies, government partners, and community associations—must co-design long-term training ecosystems aligned with sustainable development objectives and livelihood diversification.

7. FUTURE SCOPE

Future research should employ longitudinal and intervention-based designs to track how adult training influences livelihood resilience, income diversification, and safety outcomes in mining-affected communities over time. Experimental or quasi-experimental methodologies could be used to assess the causal impact of specific training modules—such as mining-safety certification, entrepreneurship incubation, or climate-smart agriculture—on behavioural change and economic progression. Further studies should also integrate environmental and health exposure measures (e.g., heavy-metal contamination, respiratory risks) to understand how ecological vulnerability shapes adult learning priorities in mining zones. Expanding the geographical scope beyond Lualaba province to include neighbouring provinces such as Haut-Katanga and Maniema would support comparative analysis and help identify regional training typologies. Incorporating digital-learning platforms adapted for low-literacy populations may provide new insights into how technological innovations can strengthen adult education in remote rural settings. Finally, collaborative action-research involving mining companies, NGOs, and community associations could generate scalable training models that bridge the gap between extractive industries and sustainable community development.

8. Ethical and Originality Declaration

I hereby declare that this manuscript is an original work that has been developed exclusively for scientific publication. The article has not been published, is not under review, and is not being submitted simultaneously to any other journal, conference, or editorial platform. All data were collected, analyzed, and reported in full compliance with ethical, methodological, and deontological standards, including respect for participants, integrity of information, and transparency of scientific procedures. The authors affirm that the manuscript contains no plagiarism, fabrication, falsification, or misleading use of data. All sources, concepts, and citations from previous studies have been properly acknowledged and referenced. By submitting this article, the authors fully adhere to the ethical guidelines for research and publication, and accept full responsibility for the accuracy and originality of the content presented.

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