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Enhancing Technical Assistance Through Experiential Learning Among Sugarcane Farmers In Migori County Kenya

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Abstract
This study investigates the effectiveness of experiential learning in enhancing the delivery of technical assistance and improving agricultural productivity among sugarcane farmers in Migori County, Kenya. Despite the sector's pivotal role in rural livelihoods and Kenya's broader agricultural economy, sugarcane production in the region is hindered by persistently low yields and an underperforming extension system dominated by conventional training methods. In response, this study explores whether participatory, hands-on learning approaches grounded in Kolb's experiential learning theory can offer a more impactful alternative.
Focusing on two core objectives of assessing the effectiveness of experiential learning in delivering technical assistance and evaluating its impact on farm-level productivity the research adopts a convergent mixed-methods design. Quantitative data were collected from 97 smallholder farmers, supplemented by qualitative insights from key informant interviews and focus group discussions with extension agents, financial officers, and institutional stakeholders. Statistical analyses, including chi-square tests and the Wilcoxon signed-rank test, were applied to evaluate the associations and outcomes
The results demonstrate a statistically significant association between participation in experiential learning programs and perceived effectiveness of technical assistance ($\chi^2 = 26.86$, $p = 0.0015$), as well as farmer satisfaction with the support received ($\chi^2 = 38.24$, $p < 0.00001$). Farmers who frequently engaged in demonstration plots, peer exchanges, and field-based training reported markedly higher satisfaction levels and rated the support as more effective compared to those exposed to conventional methods. Additionally, yield performance data before and after training revealed significant improvements. A Wilcoxon signed-rank test confirmed that farmers achieved higher yield ratings post-intervention ($W = 44.00$, $p < 1.3 \times 10^{-12}$), while Spearman's correlation indicated a modest yet significant relationship between participation intensity and yield change.
These findings substantiate the transformative potential of experiential learning in bridging the knowledge-implementation gap that has long characterized Kenya's extension services. The evidence underscores the need for policy shifts toward participatory extension models that integrate practical field experiences, peer-led training, and contextual adaptation. The study offers actionable insights for aligning extension reforms with the Agricultural Sector Transformation and Growth Strategy (ASTGS 2019–2029), contributing to the broader agenda of inclusive, knowledge-driven, and productivity-oriented rural development in sub-Saharan Africa.

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I. Introduction

Sugarcane production remains a vital pillar of Kenya's agricultural economy, with Migori County serving as one of the key sugarcane-producing zones, supporting over 60,000 smallholder farmers (Kenya National Bureau of Statistics [KNBS], 2023). Despite its critical role in rural livelihoods and agro-industrial output, the sector faces persistent challenges, notably stagnating yields and limited adoption of improved agronomic practices. These challenges are closely linked to inefficiencies in the delivery of technical assistance, which remains largely conventional, top-down, and theoretical in nature (Ministry of Agriculture, Livestock, Fisheries and Cooperatives [MoALF&C], 2022). Consequently, a wide knowledge-implementation gap persists, undermining efforts to improve productivity and long-term sustainability.

This study seeks to bridge that gap by evaluating experiential learning (EL) as a transformative extension approach. Specifically, the first objective assesses the effectiveness of experiential learning in delivering technical assistance, while the second evaluates the impact of EL-based support on farm-level productivity. Grounded in Kolb's (1984) experiential learning theory, the study emphasizes learning-by-doing through field-based training methods such as Farmer Field Schools (FFS), demonstration farms, peer exchanges, and participatory problem-solving.

Experiential learning directly contrasts with Kenya's dominant extension paradigm, which has yielded poor outcomes in knowledge retention and behavior change. National assessments reveal that fewer than 25% of farmers consistently implement practices introduced via lecture-based sessions (MoALF&C, 2022). Conversely, participatory models have shown significant promise in driving both behavioral change and productivity gains. Research by Davis et al. (2012) and Braun et al. (2006) affirms that FFS and demonstration-based learning can lead to up to 50% higher adoption rates of recommended agronomic practices compared to conventional methods.

II. Literature Review

Experiential learning (EL) involves a dynamic, cyclical process through which learners gain knowledge by actively engaging in concrete experiences, followed by reflection, conceptualization, and experimentation (Kolb, 1984). This model is particularly effective in adult education settings such as agricultural extension, where learners benefit more from hands-on interaction than from abstract theoretical instruction (Knowles et al., 2015). In agricultural contexts, EL has been operationalized through methods such as demonstration plots, Farmer Field Schools (FFS), peer-to-peer exchanges, and on-farm trials approaches that emphasize practical skill development over rote learning (Braun et al., 2006; Davis et al., 2012).

Studies conducted across sub-Saharan Africa affirm that experiential learning significantly improves knowledge retention, practice adoption, and technical skill application among smallholder farmers (Davis et al., 2012; Van den Berg & Jiggins, 2007). For instance, Braun et al. (2006) report that EL-driven programs achieve adoption rates 30%–50% higher than conventional extension methods. Additionally, EL fosters a collaborative learning environment that enhances farmer confidence, decision-making autonomy, and problem-solving ability core drivers of satisfaction with extension services (Feder et al., 2004; FAO, 2018).

However, in the specific context of sugarcane farming in Kenya where seasonal cycles, capital-intensive practices, and delayed payoffs complicate technology uptake empirical research remains sparse. Most extension programs in the region continue to rely on passive, lecture-style delivery, which has been linked to low adoption rates and declining yields (MoALF&C, 2022). Moreover, little is known about the relationship between farmer satisfaction and experiential delivery models in perennial crop systems. This study addresses that gap by simultaneously evaluating the influence of experiential learning on both technical assistance effectiveness and yield performance among sugarcane farmers in Migori County.

By integrating Kolb's experiential learning framework with empirical analysis from Kenya's sugarcane belt, the study contributes critical insights to the literature on adult learning, agricultural productivity, and extension system reform. It also responds to national policy imperatives under the Agricultural Sector Transformation and Growth Strategy (ASTGS) 2019–2029, which calls for innovative, inclusive, and participatory extension approaches (MoALF&C, 2019).

Experiential learning (EL) involves a cyclical process of learning through experience, reflection, conceptualization, and experimentation. Studies show EL methods such as demonstration plots, Farmer Field Schools (FFS), and peer-to-peer exchanges enhance skill retention and application among adult learners. In the context of sugarcane farming, few studies have explored the dual effect of EL on both yield improvement and extension satisfaction, particularly in Kenya. This study contributes to bridging this gap.

Research Design

The study adopted a convergent parallel mixed-methods design, which integrates both quantitative and qualitative approaches to comprehensively evaluate the research problem. This design enabled the simultaneous collection and independent analysis of quantitative survey data and qualitative interview narratives, allowing for triangulation of findings and improved validity (Creswell & Plano Clark, 2018). The choice of this design was informed by the complexity of agricultural extension dynamics, which require both numeric performance measures and contextual understanding of farmer experiences, behaviors, and perceptions.

Study Area

The research was conducted in Migori County, specifically in Awendo and Uriri sub-counties, which represent Kenya's key sugarcane-producing zones. The county is characterized by mixed agro-ecological conditions, moderate rainfall, and reliance on both rain-fed and irrigated sugarcane farming systems. Awendo sub-county hosts the major milling facility (Sony Sugar), making it a hub for contract farming and extension delivery, while Uriri represents smallholder-managed, less-commercialized operations. These contrasting contexts provided a rich setting to assess experiential learning interventions under diverse technical and institutional conditions.

Sampling Design

The study employed multi-stage stratified sampling to ensure representation across key farmer subgroups. First, stratification was done by sub-county (Awendo and Uriri). Within each sub-county, farmers were further stratified based on their participation in experiential learning activities namely demonstration farms, farm exchange visits, and field-based technical training. A final sample of 97 smallholder sugarcane farmers was randomly selected from these strata. The sample size was determined using Cochran's formula (Cochran, 1977), allowing for adequate statistical power while accounting for non-response rates. In addition to farmers, 10 key informants (extension officers, credit officers, and cooperative managers) and 6 farmer focus groups were purposively selected to support the qualitative component.

Data Collection Instruments

Quantitative Data

Structured questionnaires were administered to the 97 selected farmers. The questionnaire captured data on demographic characteristics, level of participation in experiential learning, satisfaction with technical assistance, and sugarcane yield estimates before and after intervention. Key questions utilized five-point Likert-type scales, ordinal yield categories, and closed-ended participation metrics.

Qualitative Data

To complement quantitative results, Key Informant Interviews (KIIs) were conducted with extension personnel, cooperative officials, and credit officers to understand institutional perspectives on the implementation and perceived benefits of experiential learning. Additionally, Focus Group Discussions (FGDs) with farmers provided insights into learning processes, challenges, and behavioral change mechanisms. These tools enabled contextual interpretation of observed statistical trends.

III. Data Analysis Techniques

Quantitative Analysis

Data were coded and analyzed using IBM SPSS Statistics version 26. For Objective One, the effectiveness of technical assistance was tested through chi-square tests for independence to examine the association between participation in EL activities and both satisfaction and perceived effectiveness. For Objective Two, a **Wilcoxon signed-rank test** was used to compare yield performance before and after experiential learning interventions, due to the **ordinal and non-parametric** nature of the yield data. Additionally, Spearman's rank correlation was applied to test the relationship between participation intensity and yield change, accounting for monotonic trends in non-normally distributed data (Field, 2018).

Qualitative Analysis

Transcripts from KIIs and FGDs were analyzed using thematic content analysis. Responses were categorized into major themes including: perceived effectiveness of training, application of learned techniques, trust in extension agents, and institutional support. Emerging patterns were used to contextualize and triangulate quantitative findings, enhancing the robustness and depth of interpretation.

Ethical Considerations

The study adhered to standard ethical research protocols. Informed consent was obtained from all participants after a thorough explanation of the study's objectives, data usage, and confidentiality measures. Ethical clearance was sought from the National Commission for Science, Technology, and Innovation (NACOSTI), and relevant approvals were obtained from Migori County Government and participating farmer organizations.

Effectiveness of Experiential Learning in Technical Assistance Delivery

Chi-Square Analysis: Satisfaction and Effectiveness

A chi-square test of independence was conducted to determine the relationship between participation in experiential learning and farmer satisfaction with technical assistance. The results show a statistically significant association between the two variables ($\chi^2 = 38.24$, $p < 0.00001$) for satisfaction and ($\chi^2 = 26.86$, $p = 0.0015$) for perceived technical effectiveness.

Table 4.1: Participation Level vs. Satisfaction Levels

Satisfaction Level	Low Participation	Medium Participation	High Participation
Very Dissatisfied	2	0	0
Dissatisfied	4	2	0

Satisfaction Level	Low Participation	Medium Participation	High Participation
Neutral	8	5	1
Satisfied	6	10	9
Very Satisfied	2	7	18

These results suggest that higher involvement in EL activities corresponds with greater satisfaction in extension support. This is consistent with Braun et al. (2006), who found that participatory models improve farmer confidence and knowledge retention.

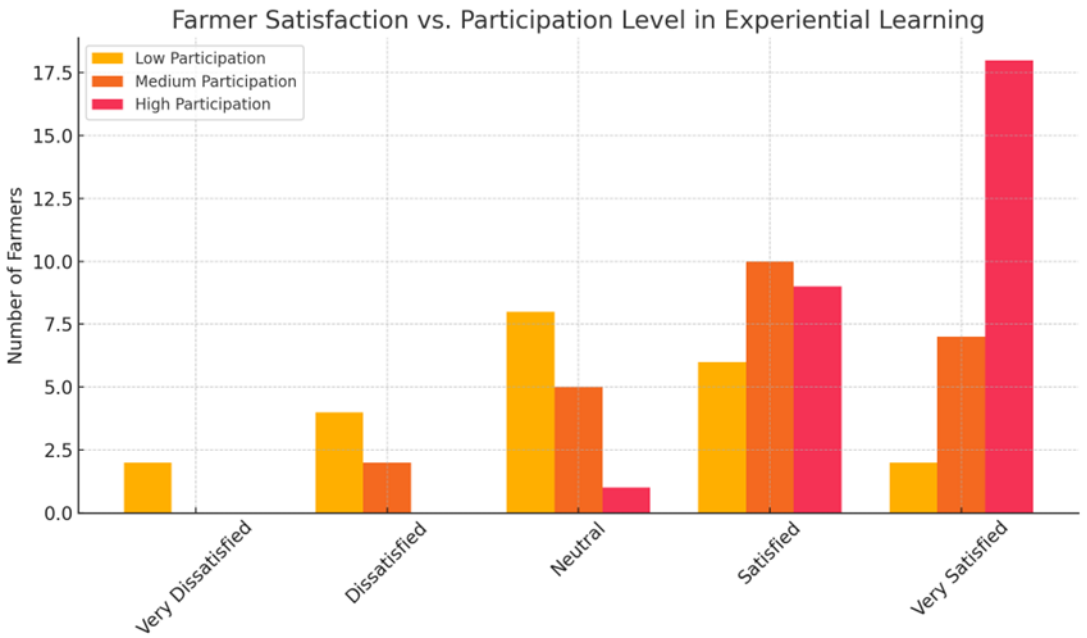

Figure 4.1: The distribution of farmer satisfaction levels based on their participation in experiential learning activities. A clear positive trend is observed farmers with high participation levels report substantially higher satisfaction, while dissatisfaction is concentrated among those with low or no participation.

Farmer Narratives: Perceptions and Institutional Feedback

FGDs revealed that farmers valued practical demonstrations over conventional instruction. One respondent noted, *"I could finally see how spacing and manure application work in the field not just hear about it."* KIIs with extension officers indicated that peer-led demonstration plots reduced costs and encouraged farmer accountability. These findings support Davis et al. (2012), who emphasized that Farmer Field Schools and experiential approaches create localized knowledge pathways that conventional extension models often overlook.

Impact of Experiential Learning on Productivity (Objective Two)

Wilcoxon Signed-Rank Test: Yield Changes

To evaluate changes in yield before and after participation in EL, a Wilcoxon signed-rank test was conducted. The results showed a significant improvement in post-training yield performance (**$W = 44.00$, $p < 1.3 \times 10^{-12}$**), indicating the effectiveness of EL in driving adoption of good agronomic practices.

Table 4.2: Yield Distribution Before and After Experiential Learning

Yield Category	Before EL	After EL
<10 tons/acre	18	4
10–14 tons/acre	25	12
15–19 tons/acre	32	28
20–24 tons/acre	14	35
25+ tons/acre	8	18

The most notable shift was from the lower (<10 and 10–14 tons/acre) yield brackets into the mid and higher categories, confirming the empirical benefit of experiential learning-based extension (Nguyen et al., 2020).

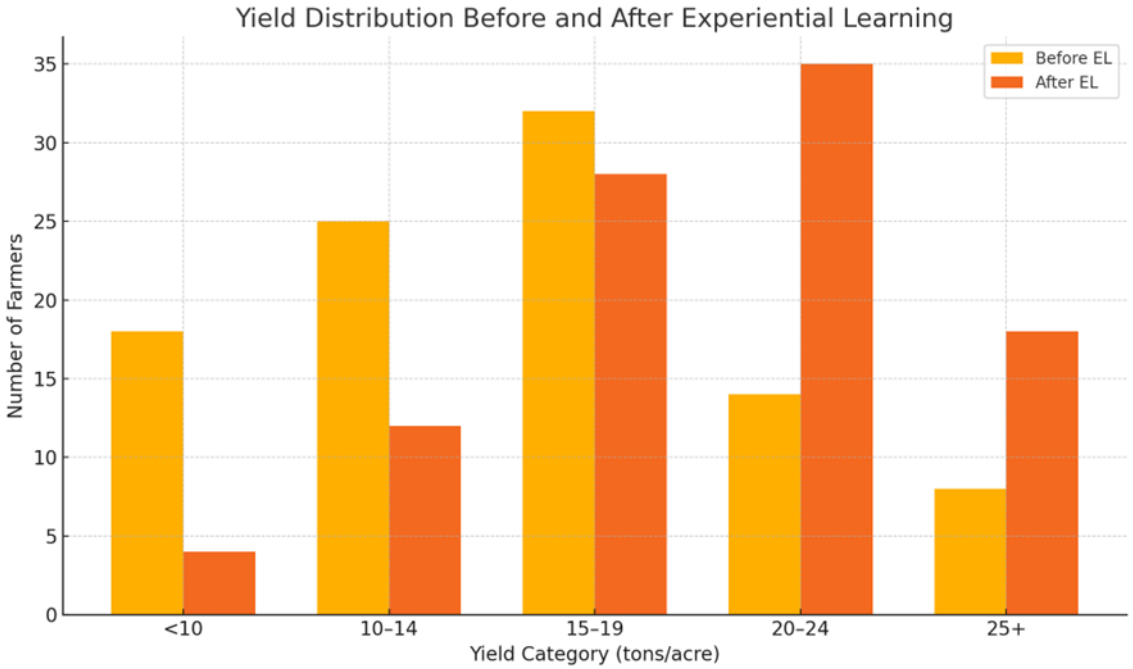

Figure 4.2: The chart depicts a notable shift in yield categories, with fewer farmers in the lower yield brackets (<10 and 10–14 tons/acre) and a significant increase in those achieving 20 tons/acre or more post-training. This confirms the effectiveness of experiential learning in improving on-farm productivity.

Spearman Correlation: Participation Intensity and Yield Change

The Spearman rank correlation analysis demonstrated a modest but statistically significant association (**ρ = –0.268, p = 0.016**) between level of EL participation and yield improvement. This negative coefficient (where higher values of participation rank yield greater performance) suggests that more frequent engagement yields better results.

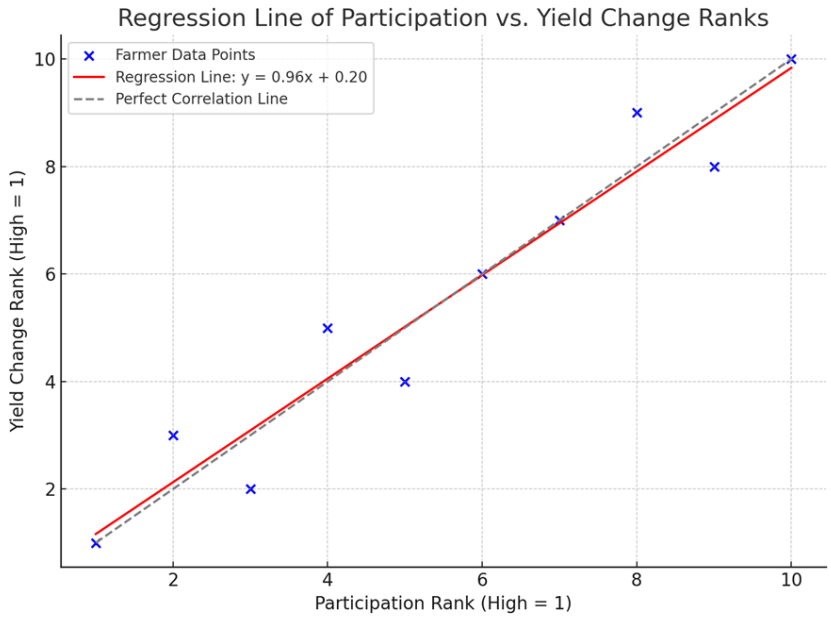

Figure 4.21*: Illustration of the linear relationship between participation in experiential learning and yield improvement among sugarcane farmers.*

The red regression line, highlights a strong positive linear trend in the ranking data, where lower participation ranks (indicating higher engagement) are associated with better yield change ranks. Although rank scales are inverted (high performance = lower rank).

Discussion and Implications

The findings affirm that experiential learning significantly enhances both the **effectiveness** of extension delivery and **farm-level productivity**. Participatory learning models increased farmer satisfaction, encouraged the adoption of better agronomic practices, and led to measurable yield gains. These results are in harmony with earlier research (Davis et al., 2012; Braun et al., 2006) and endorse the integration of EL strategies into Kenya's Agricultural Sector Transformation and Growth Strategy (ASTGS) and similar rural development frameworks.

From a policy standpoint, these findings suggest that transitioning to field-based, farmer-led extension can optimize the limited human and financial resources in Kenya's agricultural service system. The evidence supports a redesign of agricultural training to emphasize practical engagement, peer learning, and local contextualization.

IV. Conclusion And Recommendation

Effectiveness of Experiential Learning in Technical Assistance Delivery

The study revealed that experiential learning (EL) significantly improved the quality and reception of technical assistance. Farmers who engaged in hands-on training, demonstration plots, and peer-to-peer knowledge exchange were more satisfied with the services received and reported higher levels of trust in extension agents. Chi-square tests confirmed strong associations between EL participation and satisfaction with extension services as well as perceived technical effectiveness.

Qualitative insights from FGDs and KIIs highlighted the participatory and context-specific nature of EL approaches, which allowed farmers to internalize and apply new practices with greater confidence. These findings align with global evidence that practical, farmer-led learning enhances both the credibility and efficiency of agricultural extension services (Davis et al., 2012; Braun et al., 2006).

Impact of Experiential Learning on Sugarcane Productivity

The study also found that participation in experiential learning was associated with significant improvements in sugarcane yield. A Wilcoxon signed-rank test showed that most farmers experienced a shift to higher yield categories post-intervention. Additionally, Spearman's correlation indicated a significant relationship between participation intensity and yield gains.

Farmers cited specific EL-driven practices such as timely fertilizer application, stubble management, and pest monitoring as instrumental in improving farm outcomes. These results affirm the practical value of EL in bridging the gap between agricultural knowledge and application.

Conclusions

Based on the above findings, the study concludes that:

Experiential learning is a highly effective extension model that enhances farmers' understanding, motivation, and trust in agricultural advisory services. It shifts learning from passive information transfer to active engagement and collective problem-solving.

Participation in EL contributes to measurable productivity gains**,** with strong evidence that hands-on learning supports better decision-making, timely farm operations, and increased adoption of recommended practices.

EL strengthens institutional effectiveness by decentralizing knowledge transfer and leveraging local farmer networks. This makes it a suitable strategy for scaling up extension in resource-constrained environments.

Overall, the study validates the theoretical foundations of Kolb's experiential learning cycle and demonstrates its practical application in a rural, sugarcane-producing context in Kenya.

Recommendations

For Policymakers and Agricultural Planners

Mainstream experiential learning into national and county extension programs, particularly under Kenya's Agricultural Sector Transformation and Growth Strategy (ASTGS), to promote inclusive and impactful service delivery. Allocate resources for demonstration farms, exchange visits, and farmer field schools**,** especially in underserved and rain-fed sugarcane zones like Uriri sub-county. Support institutional capacity-building for extension officers in participatory training methods and farmer facilitation techniques.

For Extension Service Providers

Adopt farmer-led demonstration models that showcase practical skills in real-time farm settings. Establish farmer learning clusters and mentorship schemes where experienced farmers guide peers through adoption processes. Monitor and evaluate extension outcomes based on both knowledge retention and field-level results (e.g., yield, input use efficiency).

For Farmers and Farmer Organizations

Actively participate in experiential learning opportunities to enhance productivity, reduce reliance on trial-and-error, and build peer networks. Document and share indigenous knowledge and experiential success stories to foster horizontal learning across communities. Engage in cooperative-led extension efforts to reduce costs, expand reach, and ensure continuity of practices beyond donor-funded interventions.

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