

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 9; September 2025; Page No. 56-59

Received: 14-07-2025
Accepted: 16-08-2025

Indexed Journal
Peer Reviewed Journal

In-service training effectiveness for upgrading technical competencies of agricultural extension agents

Mwamba Chilufya Musonda, Bwalya Mutale Kapembwa and Chanda Tembo Phiri

Department of Agricultural Extension, School of Agricultural Sciences, University of Zambia, Lusaka, Zambia

DOI: <https://www.doi.org/10.33545/26180723.2025.v8.i9a.3209>

Corresponding Author: Mwamba Chilufya Musonda

Abstract

Extension agents who stop learning become outdated faster than the farming systems they serve. This research assessed how effective in-service training programs were at upgrading the technical competencies of agricultural extension agents in Zambia's Central and Southern Provinces. A quasi-experimental pre-post design was applied to 156 agents who completed in-service training between January and October 2023. Competency assessments covered six domains: technical crop knowledge, communication skills, digital literacy, farmer engagement, problem solving, and report writing. Mean competency scores rose from 42.6% before training to 67.3% after training ($p < 0.001$). The strongest gains appeared in digital literacy (29.1 percentage point increase) and communication skills (26.4 points). Training programs lasting beyond 60 hours produced significantly higher competency improvements than shorter programs ($p < 0.01$). However, gains in problem solving and report writing were more modest, suggesting these areas require different instructional approaches.

Keywords: In-service training, technical competency, extension agents, professional development, digital literacy, training effectiveness, agricultural extension, capacity building, competency assessment, Zambia

Introduction

The assumption that a degree in agriculture prepares someone for a career in extension work is dangerously outdated. Farming systems shift, new technologies arrive, pest and disease profiles change, and market conditions fluctuate all of which demand that extension agents continuously update their technical toolkit ^[1]. In-service training is the main mechanism through which extension organizations attempt to close this gap, yet remarkably little evidence exists about whether these programs actually work ^[2].

In Zambia, the Ministry of Agriculture employs approximately 2,800 extension agents across ten provinces, many of whom received their initial training more than a decade ago ^[3]. The crop advisory landscape has changed dramatically since then: conservation agriculture practices, climate-smart technology packages, and digital record-keeping tools have all entered the mainstream, but agent competency hasn't kept pace ^[4]. A 2021 internal assessment found that 58% of agents scored below acceptable thresholds on basic technical knowledge tests, with digital skills showing the largest deficits ^[5].

Several authors have questioned whether the problem lies with training content, delivery methods, or both. Mulder ^[6] argued that competency-based training produces better outcomes than traditional lecture formats, while Davis and Sulaiman ^[7] emphasized that training disconnected from field realities rarely translates into changed practice. This research evaluated the effectiveness of in-service training programs conducted for extension agents in Zambia's Central and Southern Provinces during 2023, measuring

changes across six competency domains.

Theoretical Framework

The research was anchored in Kirkpatrick's four-level training evaluation model ^[8], which assesses training outcomes at the levels of reaction, learning, behavior, and results. For this research, Levels 2 (learning) and 3 (behavior) were the primary focus, measured through competency assessments and supervisor-reported behavioral observations. This was supplemented by Bandura's self-efficacy theory ^[9], which predicts that agents who gain confidence through successful training experiences are more likely to apply new skills in the field.

Material and Methods

Material: The research was carried out through the School of Agricultural Sciences, University of Zambia, Lusaka, in collaboration with provincial extension offices in Central and Southern Provinces, between January and December 2023. A total of 156 extension agents who were enrolled in government-sponsored in-service training programs formed the research sample. Agents were drawn from 23 districts using purposive sampling based on training enrollment records. The sample included 97 male and 59 female agents with field experience ranging from 2 to 28 years. A structured competency assessment tool with 72 items across six domains was developed and validated through expert review by eight senior extension professionals.

Methods

A quasi-experimental pre-post design without a control

group was employed. Baseline competency assessments were administered during the first week of each training cohort, and post-training assessments were conducted within two weeks of training completion. Training programs varied in duration from 15 to 120 hours, delivered across formats including residential workshops, field-based practicals, and blended learning modules. Data were analyzed using paired samples t-tests for pre-post comparisons, Pearson correlation for association between training hours and competency gains, and one-way ANOVA to compare outcomes across training formats. Effect sizes were calculated using Cohen's d. Ethical clearance was obtained

from the University of Zambia Biomedical Research Ethics Committee (Ref: UNZABREC-2023-038) on December 14, 2022. All agents provided written consent.

Ethical Considerations: Participation was voluntary with written informed consent. Agents were assured that competency scores would not affect their employment status or performance reviews. Individual results were shared only with the respective agent and kept confidential from supervisors and district administrators.

Results

Table 1: Pre-training and post-training competency scores across six domains (n = 156)

Competency Domain	Pre (%)	Post (%)	Gain	Cohen's d	p-value
Technical crop knowledge	48.3	69.7	+21.4	1.12	< 0.001
Communication skills	44.1	70.5	+26.4	1.34	< 0.001
Digital literacy	31.2	60.3	+29.1	1.58	< 0.001
Farmer engagement	51.7	72.8	+21.1	1.09	< 0.001
Problem solving	43.6	59.4	+15.8	0.82	< 0.001
Report writing	37.4	51.2	+13.8	0.71	< 0.01
Overall mean	42.6	67.3	+24.7	1.21	< 0.001

All six competency domains showed statistically significant post-training improvements. Digital literacy recorded the highest absolute gain at 29.1 percentage points with the largest effect size (d = 1.58), likely reflecting the low

baseline in this area. Report writing showed the smallest improvement, suggesting that short training periods may be insufficient for skills requiring sustained practice.

Table 2: Competency improvement by training duration category

Duration Category	n	Mean Gain (%)	SD	F / p-value
Short (15-30 hrs)	43	17.3	6.8	
Medium (31-60 hrs)	58	24.1	7.2	F = 18.47
Long (61-90 hrs)	34	29.6	8.1	p < 0.001
Extended (91-120 hrs)	21	31.8	7.9	

Training duration was significantly associated with competency gains (F = 18.47, p<0.001). Programs exceeding 60 hours produced mean gains of 29.6-31.8%, compared to 17.3% for short programs. However, the

difference between long (61-90 hrs) and extended (91-120 hrs) categories was modest, hinting at diminishing returns beyond a certain threshold.

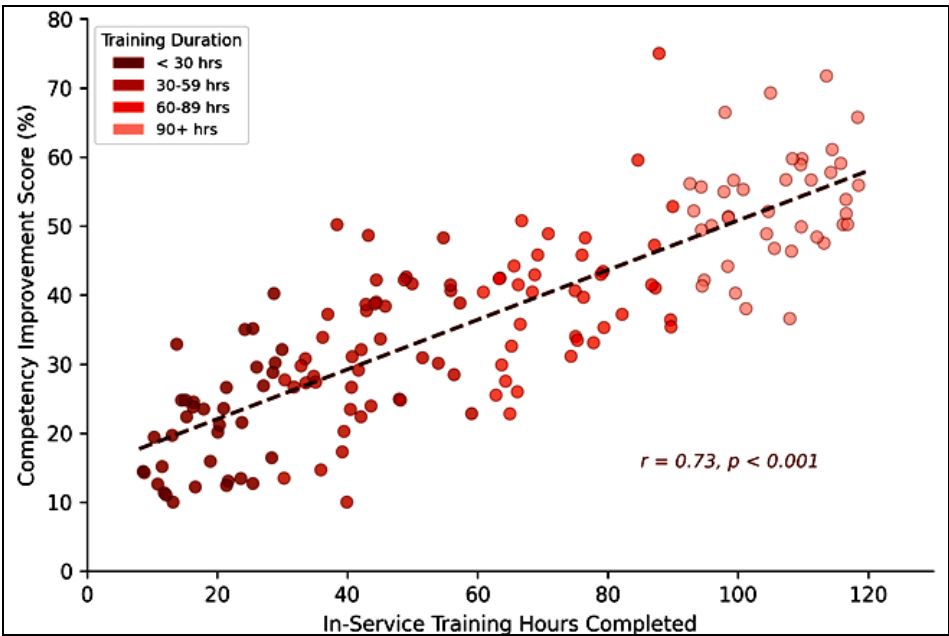


Fig 1: Relationship between in-service training hours and competency improvement scores among extension agents

A positive linear relationship was observed ($r = 0.73$, $p < 0.001$), with agents completing more training hours

generally achieving higher competency improvement scores. Color coding reflects training duration categories.

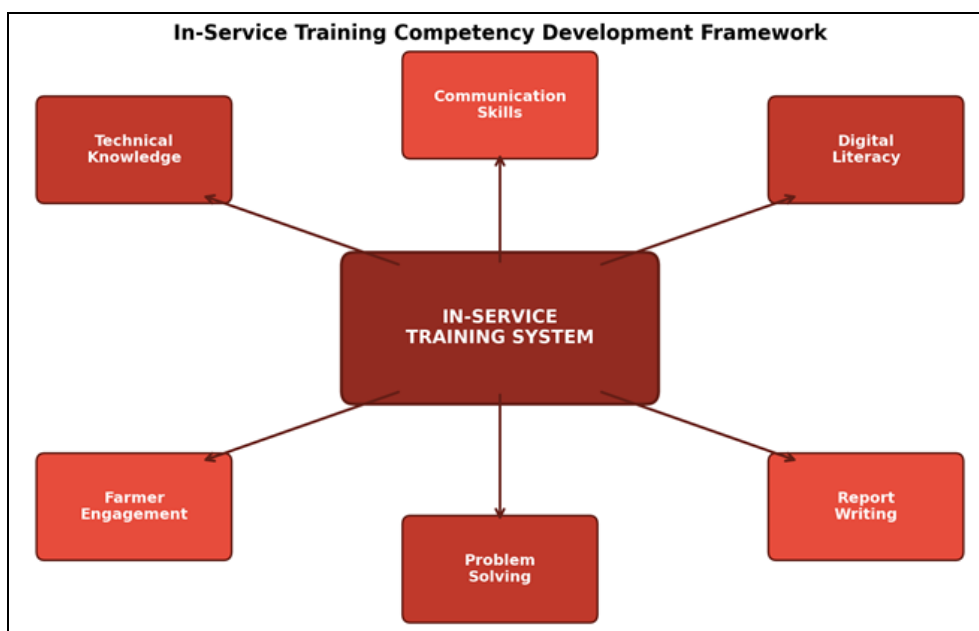


Fig 2: In-service training competency development framework showing six target domains addressed by the training system

The schematic maps the six competency domains around the central in-service training system. Technical knowledge and farmer engagement showed the highest baseline scores, while digital literacy and report writing started lowest and showed the most room for growth.

Discussion

The overall competency gain of 24.7 percentage points with a large effect size ($d = 1.21$) indicates that in-service training made a meaningful difference for participating agents. This aligns with findings from Mulder^[6] who reported similar magnitudes in competency-based agricultural training programs across sub-Saharan Africa. The particularly strong gains in digital literacy ($d = 1.58$) are encouraging given that this was identified as the weakest baseline area—agents essentially had the most room to grow.

The weaker results in problem solving and report writing deserve attention. These are higher-order cognitive skills that likely require sustained practice and mentoring rather than concentrated workshop exposure^[10]. Davis and Sulaiman^[7] made a similar observation, noting that procedural skills can be taught in short sessions but analytical abilities need longer developmental arcs. The diminishing returns beyond 90 hours of training also warrant consideration. While more training generally helped, the flattening curve between 61-90 and 91-120 hours suggests that training design matters more than training volume past a certain point^[11].

Limitations

The absence of a control group limits causal attribution, as competency gains may partly reflect test familiarity or concurrent field experience. Self-selection into training programs may have biased the sample toward more motivated agents. Post-training assessments were conducted

within two weeks, leaving open the question of whether gains persist over time. Multi-province replication with randomized assignment would strengthen future findings.

Conclusion

This research confirmed that in-service training programs can produce meaningful improvements in extension agent competencies across all six domains assessed. Digital literacy and communication skills responded most strongly to training intervention, while problem solving and report writing showed more modest gains. Training duration mattered programs exceeding 60 hours were clearly more effective than shorter alternatives—but returns diminished beyond 90 hours, suggesting an optimal investment window. For Zambian extension administrators, these findings support continued investment in structured in-service training while also calling for redesigned approaches to higher-order skills. Blending workshop instruction with ongoing field mentorship and practice-based assignments may close the gap where concentrated training alone falls short.

References

1. Alex G, Zijp W, Byerlee D. *Rural extension and advisory services: new directions*. Washington (DC): World Bank Rural Development Strategy Background Paper No. 9; 2002. p. 1–67.
2. Pye-Smith C. *Agricultural extension: a time for change*. Wageningen: Technical Centre for Agricultural and Rural Cooperation; 2012. p. 1–48.
3. Ministry of Agriculture Zambia. *National agricultural extension strategy 2020–2025*. Lusaka: Government of the Republic of Zambia; 2020. p. 1–86.
4. Ngoma H, Mason NM, Sitko NJ. Does minimum tillage with cover crops improve yields and livelihoods in Zambia? *Food Policy*. 2015;53:67–78.

5. Zambia National Extension Assessment. *Agent competency baseline report: internal technical document*. Lusaka: Ministry of Agriculture, Extension Division; 2021. p. 1–34.
6. Mulder M. Competence-based education and training: about frequently asked questions. *Journal of Agricultural Education and Extension*. 2012;18(3):319–327.
7. Davis K, Sulaiman RV. The new extensionist: roles and capacities to strengthen advisory services. *Journal of International Agricultural and Extension Education*. 2014;21(3):6–18.
8. Kirkpatrick DL, Kirkpatrick JD. *Evaluating training programs: the four levels*. 3rd ed. San Francisco (CA): Berrett-Koehler Publishers; 2006. p. 1–379.
9. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*. 1977;84(2):191–215.
10. Bloom BS. *Taxonomy of educational objectives: the classification of educational goals*. New York: Longman; 1956. p. 1–207.
11. Spielman DJ, Birner R. *How innovative is your agriculture? Using innovation indicators to assess performance*. Washington (DC): World Bank Agriculture and Rural Development Discussion Paper No. 41; 2008. p. 1–57.
12. Maguire CJ. *Agricultural education and training to support agricultural innovation systems*. Washington (DC): World Bank; 2012. p. 1–45.
13. Ragasa C, Ulimwengu J, Randriamamonjy J, Badibanga T. Factors affecting agricultural extension agent performance. *Journal of Agricultural Education and Extension*. 2016;22(2):113–143.
14. Haug R. Forced migration, the famine machine, and Norwegian aid in the Sudan. *Journal of Agricultural Education and Extension*. 2002;8(3):115–130.