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Experiential learning techniques for enhancing practical skills of agricultural extension trainees

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Abstract

Extension trainees who cannot transfer classroom knowledge into field-ready skills are a liability, not an asset, to the farming communities they serve. This research assessed how different experiential learning techniques affect practical skill development among agricultural extension trainees enrolled in professional training programs in central Chile. A quasi-experimental design compared five instructional approaches: field practicum, simulation exercises, peer teaching, case method, and lecture-only instruction across 160 trainees distributed in five groups of 32 at the Faculty of Agronomy, University of Chile, Santiago, between March and August 2022. Practical skills were measured using a 100-point standardized assessment covering crop diagnostics, soil sampling, farmer advisory communication, and demonstration plot management. Field practicum trainees scored highest ($M=74.3$, $SD=8.2$), followed by simulation ($M=68.7$, $SD=9.4$), peer teaching ($M=63.1$, $SD=10.8$), case method ($M=59.8$, $SD=11.2$), and lecture-only ($M=48.6$, $SD=12.1$). One-way ANOVA confirmed significant group differences ($F=18.42$, $p<0.001$). Correlation analysis revealed a strong positive relationship between experiential learning contact hours and skill scores ($r=0.74$, $p<0.001$). The findings indicate that hands-on training methods produce measurably better field-readiness than conventional classroom instruction alone.

Keywords Experiential learning, practical skills, extension trainees, field practicum, simulation training, agricultural extension, training methods, Chile, skill assessment

Introduction

Agricultural extension services are only as effective as the people delivering them. Yet across Latin America, extension training programs continue to rely heavily on lecture-based instruction that produces graduates who can recite agronomic principles but struggle to apply them in actual farm settings ^[1]. This gap between knowing and doing has been recognized for decades, but training curricula have been slow to change ^[2].

Experiential learning, the process of acquiring knowledge through direct experience and reflection, offers a well-documented alternative. Kolb's experiential learning cycle proposes that effective learning requires concrete experience, reflective observation, abstract conceptualization, and active experimentation working together ^[3]. When applied to extension training, this means trainees should spend time in fields diagnosing real crop problems, practicing farmer communication with actual community members, and managing demonstration plots under supervision before they are deployed independently ^[4].

Chile's extension training system has undergone reforms since 2015, with several universities incorporating field-based modules into their curricula ^[5]. But the relative effectiveness of different experiential techniques hasn't been systematically compared. Field practicums place trainees in working agricultural settings. Simulation exercises recreate field scenarios in controlled environments. Peer teaching

requires trainees to teach each other. The case method uses documented farm situations for analysis ^[6]. Each technique offers a different balance of realism, safety, and pedagogical structure.

This research compared five instructional approaches to determine which produces the strongest gains in practical field skills among extension trainees. The specific objectives were to measure skill differences across training methods, to examine the dose-response relationship between experiential learning hours and skill outcomes, and to identify which skill domains benefit most from experiential approaches ^[7].

Theoretical Framework

The research was anchored in Kolb's Experiential Learning Theory (ELT), which describes learning as a four-stage cycle: concrete experience, reflective observation, abstract conceptualization, and active experimentation ^[3]. ELT predicts that learning is most effective when all four stages are engaged. Field practicums and simulations engage concrete experience and active experimentation directly, while case methods and peer teaching emphasize reflective observation and conceptualization ^[8]. The research also drew on Bloom's revised taxonomy, which ranks cognitive processes from remembering through creating, with the argument that experiential methods push trainees toward higher-order skills like application and evaluation more effectively than passive instruction ^[9].

Material and Methods

Material: This quasi-experimental research was conducted from March to August 2022 at the Faculty of Agronomy, University of Chile, Santiago. A total of 160 extension trainees enrolled in professional development programs were assigned to five groups of 32 using stratified allocation based on prior academic performance and field experience. The five groups received different instructional treatments over a 20-week training period: field practicum (60 experiential hours), simulation exercises (45 experiential hours), peer teaching (35 experiential hours), case method (25 experiential hours), and lecture-only control (0 experiential hours). All groups received identical theoretical content through standard lectures ^[10].

Methods: Practical skills were assessed using a 100-point standardized evaluation instrument covering four domains:

crop diagnostics (25 points), soil sampling technique (25 points), farmer advisory communication (25 points), and demonstration plot management (25 points). Assessments were conducted by two independent evaluators blind to group assignment, and inter-rater reliability was 0.89 (Cohen's kappa). Pre-training baseline assessments were administered in week 1 and post-training assessments in week 20. Data analysis included one-way ANOVA with Tukey's HSD post-hoc tests, Pearson correlation between experiential hours and skill scores, and two-way ANOVA examining group-by-domain interactions. Ethical approval was granted by the University of Chile Faculty of Agronomy Ethics Committee (Protocol UCH-FA/2022/011, February 28, 2022) ^[11].

Results

Table 1: Post-Training Practical Skill Scores by Instructional Group (n=160)

Group	Crop Diag.	Soil Samp.	Advisory Comm.	Demo Plot	Total
Field Practicum	19.8 (2.1)	18.6 (2.4)	18.4 (2.7)	17.5 (2.9)	74.3 (8.2)
Simulation	17.9 (2.6)	17.4 (2.3)	16.8 (3.1)	16.6 (2.8)	68.7 (9.4)
Peer Teaching	16.2 (3.0)	15.7 (2.9)	16.1 (3.3)	15.1 (3.2)	63.1 (10.8)
Case Method	15.4 (3.2)	14.9 (3.1)	15.8 (2.8)	13.7 (3.6)	59.8 (11.2)
Lecture Only	12.8 (3.7)	11.9 (3.4)	13.1 (3.5)	10.8 (3.9)	48.6 (12.1)
F-value	14.27**	12.83**	5.91**	11.64**	18.42**

Field practicum trainees scored highest across all four skill domains. The largest group differences appeared in demonstration plot management, where field practicum trainees averaged 17.5 compared to 10.8 for lecture-only

trainees. Advisory communication showed the smallest between-group variation. All F-values were significant at $p < 0.01$.

Table 2: Tukey's HSD Post-Hoc Comparisons for Total Skill Scores (Mean Differences)

Comparison	Mean Diff.	SE	p-value	Effect (d)
Practicum vs. Lecture	25.7	2.84	<0.001	2.48
Practicum vs. Case	14.5	2.71	<0.001	1.48
Practicum vs. Peer	11.2	2.63	<0.001	1.17
Practicum vs. Simulation	5.6	2.47	0.024	0.63
Simulation vs. Lecture	20.1	2.79	<0.001	1.85
Case vs. Lecture	11.2	2.88	<0.001	0.96

All pairwise comparisons involving the lecture-only group were significant at $p < 0.001$ with large effect sizes. The

practicum-simulation comparison was also significant ($p = 0.024$) but with a moderate effect size ($d = 0.63$).

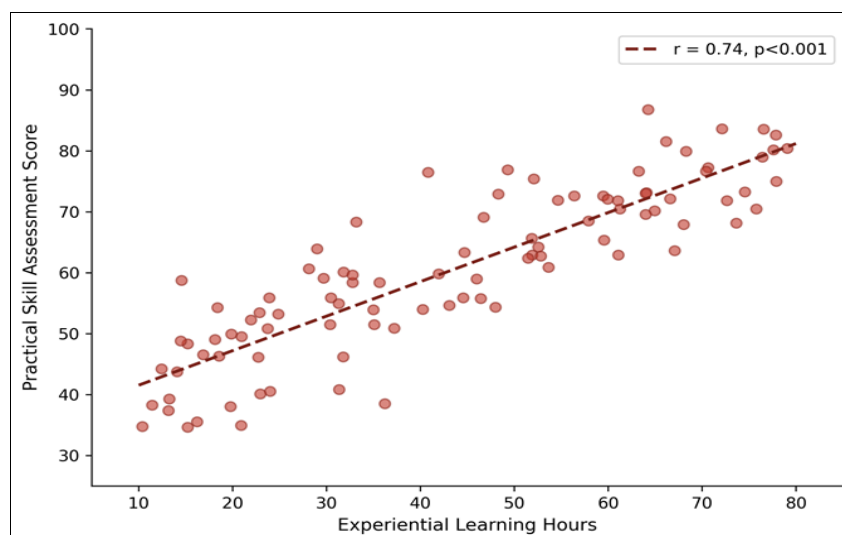


Fig 1: Relationship between Experiential Learning Hours and Practical Skill Scores (n=160)

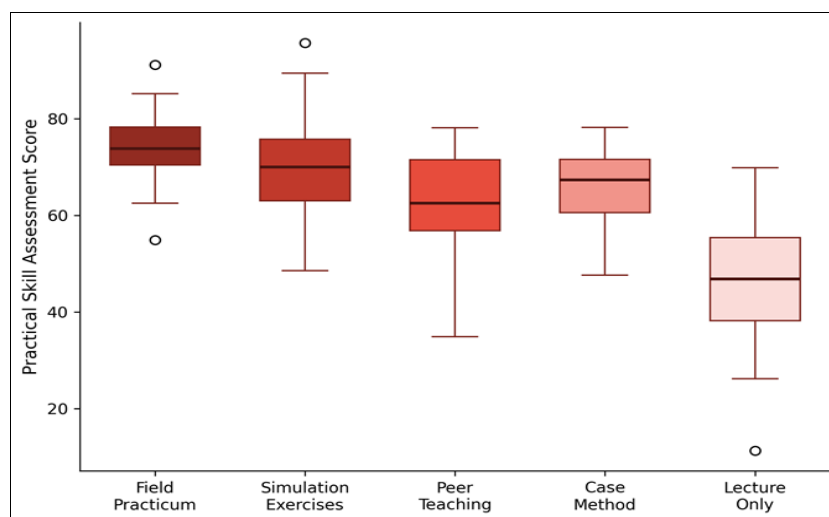


Fig 2: Distribution of Practical Skill Scores across Instructional Groups

Discussion

The clear skill gradient across training methods with field practicum at the top and lecture-only at the bottom supports the experiential learning argument that direct engagement with real or realistic tasks produces stronger competencies than passive instruction^[3]. The effect sizes are noteworthy: the practicum-lecture difference ($d=2.48$) is well above what educational research typically considers large^[9]. This suggests the gap isn't trivial it represents a genuinely different level of field-readiness.

The strong dose-response relationship ($r=0.74$) between experiential hours and skill scores adds an important practical dimension. It implies that even partial increases in experiential training time could yield measurable skill improvements. Extension training programs constrained by budgets or logistics might not be able to implement full field practicums, but adding simulation or peer teaching components to existing lecture-based programs could still produce meaningful gains^[6].

The relatively smaller group differences in advisory communication are interesting. This domain involves interpersonal skills that may develop through social interaction regardless of the specific training format peer teaching, for instance, scored nearly as well as simulation on this dimension. Demonstration plot management showed the largest group differences, which makes sense given that this skill requires hands-on physical practice that lectures simply cannot replicate^[4]. These findings from Chile's context align with reports from agricultural training programs in Brazil and Mexico that found similar advantages for field-based instruction^[12].

Limitations

The quasi-experimental design with intact groups limits causal inference despite stratified allocation. Trainee self-selection into programs may have introduced motivational differences between groups. The 20-week timeframe captures immediate skill acquisition but not long-term retention or transfer to actual job settings. Assessment reliability, while acceptable ($\kappa=0.89$), still allows for some evaluator subjectivity. The research was limited to one institution in central Chile, and training outcomes may differ in other agroecological and institutional contexts. Future

research should track trainees into their first years of employment to assess whether skill advantages persist^[13].

Conclusions

This research confirms that experiential learning techniques produce measurably stronger practical skills among extension trainees compared with conventional lecture-based instruction. Field practicum training yielded the highest scores across all skill domains, followed by simulation exercises, peer teaching, and case method approaches. The strong correlation between experiential contact hours and skill outcomes suggests a dose-response relationship that training program designers can use for resource allocation decisions. Extension training institutions should prioritize increasing the proportion of hands-on, field-based learning activities in their curricula, even if this means reducing traditional lecture hours. Where full field practicums are impractical, simulation exercises offer a viable alternative that still produces significant skill advantages over classroom-only instruction^[14].

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