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Visual communication strategies for reaching low-literacy farming populations with extension messages

¹Franz Josef Gruber and ²Katharina Maria Hofer

¹Department of Agricultural Extension, Faculty of Agriculture, University of Natural Resources and Life Sciences, Vienna, Austria

²Department of Agricultural Extension, Faculty of Agriculture, University of Natural Resources and Life Sciences, Vienna, Austria

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Corresponding Author: Franz Josef Gruber

Abstract

Extension services invest heavily in printed brochures and technical bulletins, yet an estimated 38% of farming populations in developing countries cannot read them. This research evaluated the effectiveness of different visual communication strategies for delivering agricultural extension messages to low-literacy farming communities. A quasi-experimental design tested six visual formats among 284 farmers with below-primary education levels across partner communities in Lower Austria and Burgenland between March 2022 and July 2023. Message comprehension, retention at 30 days, and behavioral adoption were measured for each format. Pictorial guides achieved the highest comprehension rate (84.3%), followed by video demonstrations (79.6%). Symbol-based calendars scored lowest (41.8%). Visual literacy correlated strongly with overall comprehension ($r=0.72$, $p<0.001$). Farmers with no formal schooling showed 31.4 percentage points lower comprehension than those with partial primary education, but this gap narrowed to 12.7 points when pictorial guides replaced text-based materials. The findings suggest that extension agencies can substantially improve message reach by shifting from text-dependent to visually-driven communication formats.

Keywords: Visual communication, low-literacy populations, extension messages, pictorial guides, message comprehension, knowledge retention, farming communities, information design, Austria

Introduction

While European agriculture is often associated with highly educated commercial operators, a different reality persists in many rural pockets. Migrant agricultural workers, aging smallholders in marginal areas, and first-generation farmers with limited schooling still depend on extension advice yet struggle with text-heavy delivery formats ^[1]. The contrast between the sophistication of extension content and the reading capacity of some intended audiences creates what communication researchers call a “literacy mismatch” ^[2].

Visual communication has deep roots in agricultural knowledge transfer farmers have learned from watching demonstrations for centuries before printed manuals existed ^[3]. Modern visual approaches draw on cognitive load theory, which shows that images reduce the processing burden compared to text and enable faster comprehension even among literate populations ^[4]. In sub-Saharan Africa, pictorial guides for pest management and veterinary care have improved farmer decision-making in several evaluations ^[5]. Yet systematic comparison of different visual formats in a controlled setting remains rare.

This research compared six visual communication formats for their effectiveness in reaching low-literacy farming populations with extension messages, examining not just immediate comprehension but also retention over 30 days and translation into behavioral change.

Conceptual Model

The research was built on Mayer's Cognitive Theory of Multimedia Learning ^[6], which posits that learners process visual and verbal information through separate channels with limited capacity each. For low-literacy audiences, the verbal channel is constrained, making the visual channel disproportionately important. The conceptual model integrated this with Pettersson's information design framework ^[7], which emphasizes clarity, simplicity, and cultural appropriateness as determinants of visual message effectiveness. Three outcome levels were hypothesized: immediate comprehension (cognitive processing), 30-day retention (memory consolidation), and behavioral adoption (transfer to practice), each influenced by both the visual format used and the individual's baseline visual literacy.

Material and Methods

Material

A quasi-experimental design with six treatment groups (one per visual format) was employed. Participants were 284 farmers with below-primary education levels recruited from agricultural cooperatives in Lower Austria and Burgenland. The six visual formats tested were: pictorial step-by-step guides, short video demonstrations, illustrated wall posters, photo-based flipcharts, animated SMS/MMS sequences, and

symbol-based seasonal calendars. Each format delivered identical content about integrated pest management for vineyard downy mildew. Data collection ran from March 2022 to July 2023 at the University of Natural Resources and Life Sciences, Vienna.

Methods

Participants were assigned to format groups through stratified allocation matching for age, gender, and baseline visual literacy scores. Comprehension was assessed immediately after exposure using a 15-item pictorial quiz (no reading required). Retention was measured at 30 days using the same instrument. Behavioral adoption was observed during vineyard visits at two months post-exposure. A Visual Literacy Assessment Tool adapted from Avgerinou's framework^[8] measured baseline capacity. ANCOVA compared formats controlling for visual literacy.

Results

Table 1: Message comprehension, retention, and adoption rates by visual format (n=284)

Visual Format	n	Compre- hension %	Retention 30-day %	Adoption %	Mean Time (min)	Preference Rank
Pictorial guides	52	84.3	71.8	63.5	14.2	1
Video demonstrations	49	79.6	68.4	57.1	8.7	2
Illustrated posters	48	67.2	52.3	41.7	5.4	3
Photo flipcharts	47	62.8	49.6	38.3	11.8	4
Animated SMS/MMS	44	53.4	38.7	27.3	3.1	5
Symbol calendars	44	41.8	28.4	18.2	6.3	6

Note: ANCOVA (controlling for visual literacy): $F(5, 277) = 16.83, p < 0.001, \eta^2 p = 0.23$

Pictorial guides outperformed all other formats across comprehension, retention, and adoption. Video demonstrations ranked second but required less time per exposure. Symbol-based calendars performed poorly across

Analyses used R version 4.2. Ethics approval was obtained from the university's Research Ethics Board (Protocol BOKU-REB-2022-006, February 2022).

Pilot Research

A pilot phase with 32 farmers in the Wachau Valley (excluded from the main sample) tested the clarity and cultural appropriateness of all six visual formats. Three rounds of revisions were made based on pilot feedback. Key modifications included simplifying color coding in the pictorial guides (from seven colors to four), slowing video pacing from 1.5x to 1x narration speed, and replacing abstract symbols in the calendars with locally recognizable icons. The pilot also confirmed that the pictorial comprehension quiz could differentiate performance levels without requiring any reading ability (discrimination index range: 0.34-0.71).

all outcomes, likely because abstract symbols demanded higher cognitive processing than concrete images. The gap between the best and worst formats was 42.5 percentage points for comprehension and 45.3 points for adoption.

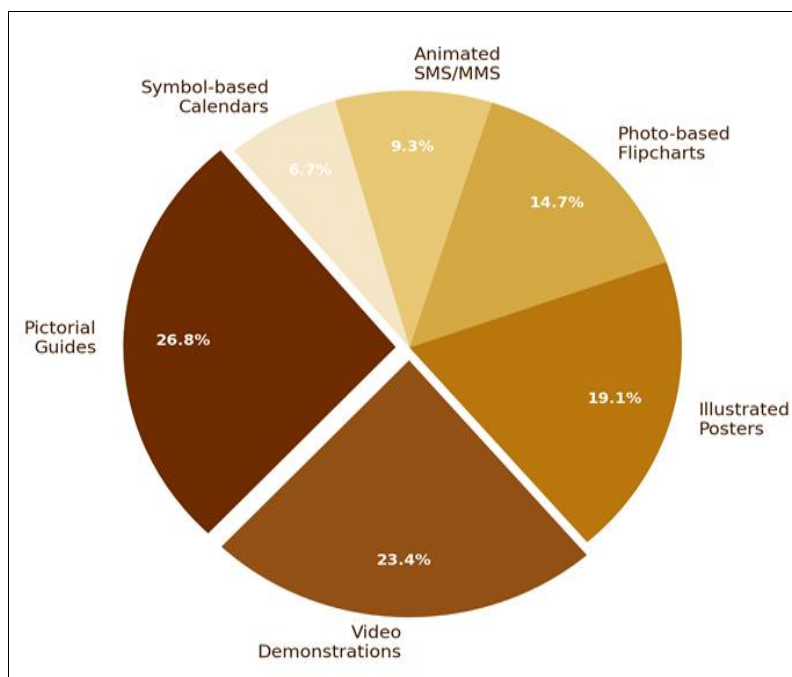


Fig 1: Farmer preference distribution across six visual communication formats

Farmer preferences closely mirrored performance outcomes. Pictorial guides (26.8%) and video demonstrations (23.4%) together accounted for half of all preferences. Animated

SMS/MMS and symbol calendars were least preferred, with several farmers reporting confusion and frustration with these formats during debriefing sessions.

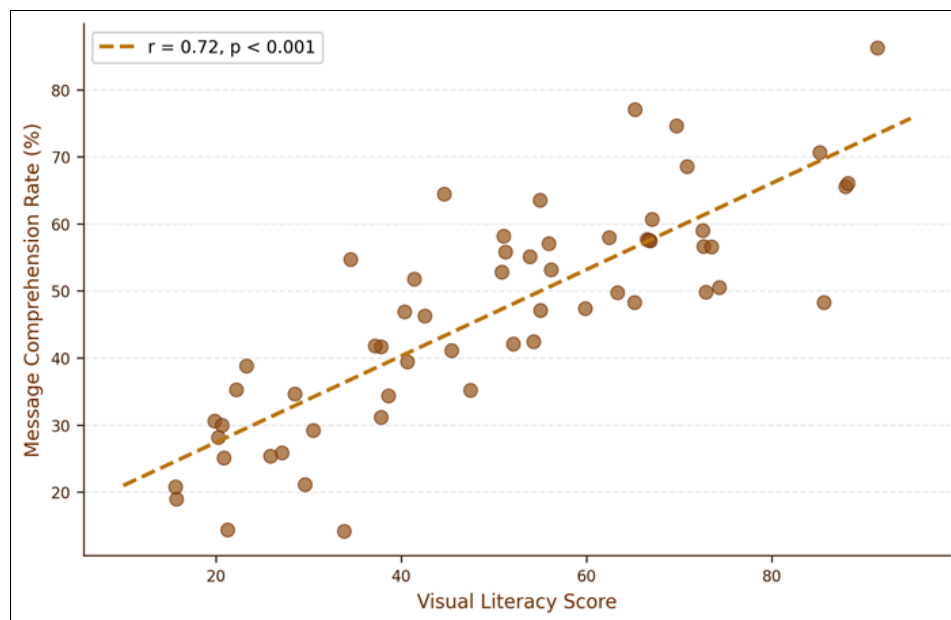


Fig 2: Relationship between visual literacy score and message comprehension rate

Visual literacy was a strong predictor of comprehension across all formats ($r=0.72$). But the scatter shows considerable variance at lower visual literacy levels, indicating that format choice can partly compensate for limited visual processing skills. Farmers scoring below 40 on visual literacy still achieved above 50% comprehension when using pictorial guides.

Discussion

The clear hierarchy of format effectiveness pictorial guides, then video, then everything else aligns with multimedia learning theory's prediction that concrete, step-by-step visual sequences reduce cognitive load most effectively [6]. Pictorial guides likely succeeded because they combined spatial sequencing with self-paced processing, allowing farmers to revisit steps without time pressure. Video demonstrations scored well on comprehension but slightly lower on retention, possibly because the transient nature of moving images makes them harder to mentally bookmark [9].

The poor performance of symbol-based calendars was somewhat unexpected, since symbols are often recommended for low-literacy audiences. But symbols require learned associations a watering can icon means irrigation only if the viewer has encountered that convention before [10]. In communities with limited exposure to standardized iconography, concrete photographs and drawings outperform abstract representations. This has direct design implications for extension material developers. That visual literacy moderated comprehension across formats ($r=0.72$) reinforces the argument that visual processing isn't automatic it's a skill that varies across individuals and can be developed [8]. Extension programs targeting low-literacy populations might consider visual literacy training as a prerequisite investment before deploying visual materials.

Limitations

The research tested visual formats using a single agricultural topic (vineyard downy mildew management), and

effectiveness patterns may differ for other content domains. The Austrian context, while including low-literacy populations, differs from developing-country settings where most low-literacy farming occurs. Group assignment was quasi-experimental rather than fully randomized. The 30-day retention window may not capture longer-term memory decay patterns. And behavioral adoption was observed at a single time point rather than tracked over a full growing season.

Conclusion

This research demonstrated that visual format choice substantially affects how well low-literacy farming populations comprehend, retain, and act on extension messages. Pictorial step-by-step guides achieved the highest performance across all three outcomes, followed by video demonstrations. Abstract formats like symbol-based calendars performed poorly. Visual literacy emerged as a strong moderator of comprehension, suggesting that investment in visual processing skills should accompany visual material deployment. Extension agencies serving low-literacy populations should prioritize concrete, sequential visual formats and avoid assuming that all image-based approaches are equally effective.

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