

Research Reports

The Livestock Guru: The Design and Testing of a Tool for Knowledge Transfer among the Poor

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Abstract

The application of ICTs to meet development objectives has increased dramatically in recent years. Nevertheless, there is a little overall evidence regarding the impact of these tools on the poor. Therefore, this article describes the creation and assessment of the Livestock Guru, an interactive multimedia program for poor livestock keepers in India and Bolivia. Learning outcomes were explored among 305 farmers in 17 communities across both nations. The study also compared the impact of the software with more conventional media such as videos and written extension material. The authors found that the uptake of new knowledge was highly related to the specific topic involved. Not surprisingly, the level of challenge to existing beliefs also affected learning. Nonetheless, by utilizing visual cues and referents that supported traditional knowledge frames, the software messages showed greater levels of knowledge than messages delivered by more traditional means.

Introduction

The global debate on poverty and marginalization, until recently, largely excluded the knowledge needs of the poor (Livestock Development Group [LDG], 2003). However, presently there is an increasing recognition of that without urgent redress, the fast-paced, so-called global knowledge society will largely leave the poor behind.

Nevertheless, the self-same communication technologies that have been implicated in the easy access to new knowledge in the North are considered part of the problem in the South. First, the ability of the poor to access such mechanisms of information transfer such as the Internet or computer-based tools is often poor (Mansell & Wehn, 1998; Sciada, 2003). Second, many practitioners are of the opinion that the poor simply lack the ability or interest for the widescale adoption of ICTs and in this manner are not appropriate clients. Studies have illustrated, however, that far from being disenfranchised or disinterested, the poor are actively seeking engagement in this knowledge revolution (World Bank, 2002; Heffernan, 2005). Indeed, many examples now exist of the impact and outcome of engagement of the poor with such communication technologies. India offers many examples of how new technologies can have a tremendous impact on the lives and livelihoods of the poor (World Bank, 2002). Studies in Africa equally, have shown that ICT training initiatives have high uptake and interest by stakeholders (Batchelor et al., 2003).

Overall, however, within the literature the ability of ICTs to transfer

knowledge at the individual level is believed to be low (Schilderman, 2002; Lloyd-Laney, 2003). Indeed, the design of the media and the related content are often considered inappropriate (Lloyd-Laney, 2003; Sciada, 2003; Soeftestad & Sein, 2003). For example, Soeftestad and Sein (2003) argue that “ICTs come out of a western intellectual and scientific tradition and cannot be applied as is to non-western settings.” Nonetheless, such arguments are not new, nor are they particular to ICTs. Historically, the low uptake of both technologies and indeed, wider development projects has been related to the lack of appropriateness (LDG, 2004a). Obviously, the impact of ICTs will depend upon the relevance of the content and design being suited to the individual user.

However, little evidence is available which explores issues in the suitability of ICTs, among the poor (LDG, 2004b). Equally, few studies have explored the outcomes of ICT-based versus more traditional learning. While the general benefits of ICTs are clear—that is, programs can be tailored to meet the learner’s specific requirements and users can follow the material at a customized pace (Mansell & Wehn, 1998), there is little specific evidence regarding learners in a developing country context. Equally, according to cognitive research memory is greater for pictures than for other formats (Reiber, 2000). As such, using a multimedia interface should help learners focus their attention on the material and to commit the information to long-term memory. To date, however, little research has been performed to inform the debate on ICTs and learning among the poor.

To address the issues, the objectives of the article are twofold; first, to examine the immediate learning outcomes of an interactive, multimedia learning program (“The Livestock Guru”) on livestock health and production among resource poor farmers in Bolivia and India. Second, the study will explore the comparative impact of this program with more traditional media, such as educational videos and written extension material.

The livestock sector was chosen for the following reasons. An estimated two-thirds of the 2.2 billion households living on less than \$2/day keep livestock. Thus, a better understanding of livestock-based livelihoods can aid global poverty alleviation goals. Moreover, livestock disease epidemics such as avian influenza and foot and mouth disease (FMD) demonstrate the urgent need for rapid and accurate

communication pathways between decision-makers and the poor. ICTs hold the most promise for “joining up” stakeholder groups, yet the tools have rarely been applied to this end. Hence, at the macrolevel, by exploring learning outcomes, this article will address this gap.

Materials and Methods

To assess learning outcomes, in total 348 poor livestock keepers in the two study countries were exposed to training material on livestock disease and production using different media. In this manner, differences in knowledge uptake could be evaluated both by content and type of media.

The Design of The Livestock Guru

A cognitive psychology approach which advocates the information processing theory (IP) of learning (Reiber, 2000) was utilized to design the software. Within the IP theory, uptake is believed to be dependent upon the relevance and appropriateness of the learning media to the particular learning style of the individual (Clark and Sugrue, 1995). As such, the IP model explores the interaction of the learner with the information and the interface between attention and memory that produces knowledge (Reiber, 2000). Moreover, uptake is related to the ability of the media to optimize the learners’ attention on the material presented so that the material may be committed to long-term memory (Salomon, 1979; Howe, 1980; Jonassen & Grabowski, 1993; Reiber, 2000).

Therefore, to create the learning content for the program, a baseline survey was carried out with 732 livestock keepers in the Altiplano and Valles of Bolivia (LDG, 2003) and 992 farmers in Tamil Nadu and Pondicherry States in India (LDG, 2002). In the study the prevalence of different diseases were recorded in addition to perceptions regarding the most important diseases and management problems for livestock keepers.

Creating the Visuals

The Tamil language version of the Livestock Guru utilized visual and auditory frames adapted from the local film industry. As such, the introduction to the program used an animation of a popular, local film actor whose previous films included livestock-related themes. Further, both the compositional and denotative meanings of the illustrations were tested with

key informants. As such, the main object signs in each illustration were evaluated for appropriateness and meaning ranging from the style of the buildings and furniture to the dress, jewelry, and hairstyle of the farmers or characters included in the scene.

Conversely, for the “El Promotor,” the Quechua/Spanish language version of the program in Bolivia, the visuals were based upon the spiritual “cosmovision” of Andean culture (Rist, San Martin & Tapia, 1999). The cosmovision dictates how natural resources are perceived and the relationship between nature and knowledge and people’s interactions thereof to derive a livelihood (Genge, 2001). As Genges notes, “[F]ar from being theoretical, it is a strongly lived experience. . . . The senses (sight, smell and taste) are used as a window for direct dialogue with the world.” The layout and design also had to accommodate traditional frames for learning. Learning within the Andean communities has been related to nurturing social relationships (Genge, 2001). Indeed, Genge writes, “[W]ithin Andean cosmology, knowledge is not at the margins of a nurturing process, as much as it is nurturing itself. The space where knowledge is expressed is the *chacra*, the centre of the Andean universe. *Chacra* is a space of “growing plants, raising animals, and making a cultivated field.”

Thus, knowledge, social relationships and nature are intricately intertwined. Therefore, to build on and support Andean cosmology, illustrations maintained strong environmental and cultural referents. For example, specific and identifiable environmental features and symbolism were included in many scenes. Equally, farmers and their animals were placed in scenes with other community members of different ages and genders. Finally, the image of El Promotor was utilized both as the “teacher” external to the learning frame and was also represented within the frame interacting with the farmer or other community members. In this manner, an attempt was made to place El Promotor as a nurturer within *chacra*, or the visual world in which the inhabitants resided (Nielsen & Heffernan, 2006). Thus, while in India the visuals were framed by an external referent from popular culture, i.e., the film actor, in Bolivia, the visuals were framed utilizing internal cultural cues.

Assessing Knowledge Uptake

A “repeated measures” study design was utilized, where participants were tested prior to, and directly

after, exposure to the learning material (Nielsen & Heffernan, 2006). Three disease modules formed the core of the analysis: mastitis, liver fluke (*Fasciola hepatica*), and FMD. Participants were asked to describe the symptoms, cause, treatment, and prevention of the disease, in four open-ended questions. The use of open-ended questions allowed for a more nuanced assessment of the level of understanding of the subject matter and to filter false positives (responses that were purely “lucky guesses”). In this manner, the study could more closely assess uptake of knowledge, rather than simply information recall.

Responses were then scored based on system informed by Jonassen and Grabowski’s (1993) distinction between the amount and type of knowledge. Although the “amount” is the quantitative measure of knowledge, the “type” of knowledge includes an assessment of the detail and accuracy of both specific information and that related to the wider topic.

Overall, the responses were scored in the following categories with points ranging between +2 to –2 (Nielsen & Heffernan, 2006):

- +2 : accurate responses (AC)
- +1 : accurate but general responses (GE)
- 0 : no responses (NR)
- –1 : incorrect responses (ER)
- –2 : incorrect responses with possible detrimental consequences (ED)

As such, a +2 was given to a correct answer, +1 was applied to a correct answer that lacked specificity to a particular disease (i.e., anorexia offered as a disease symptom). Conversely, on the other side of the scale, –1 was applied to incorrect answers, and –2 to incorrect answers that could lead to detrimental impacts on the animal (i.e., farmers using intranasal laundry powder to treat pneumonia). Finally, a neutral category of 0 was instances where an answer was not offered. Subsequently, a single score for each assessment category (symptoms, cause, treatment, and prevention) prior to and after exposure to the media was given to each participant, using the following formula:

$$\text{Assessment Score} = \Sigma[(AC*2)+(GE*1)-(ER*1)-(ED*2)]$$

To account for the variety of responses possible in each assessment category (e.g., while there are many correct symptoms of a disease there may only

Table 1. Participants by Media and Disease: Bolivia

Media	Mastitis	Liver fluke	FMD
El Promoter	53	16	26
Video	48	29	—
Pamphlets	—	40	—
Total	101	85	26

Table 2. Participants by Media and Disease: India

Media	FMD	Mastitis
Livestock Guru	23	31
Pamphlets	25	32
Video	49	52
Total	97	115

be two correct types of treatment), the data were normalized to support comparisons. Hence, scores in each category were divided by the total number possible, deriving an ultimate score between 0 and 1.

By comparing knowledge scores prior to and after training, any learning that had occurred could be attributed to the specific modules. The overall learning score was derived using the following formula:

$$\text{Learning Score} = \text{Postassessment Score} - \text{Preassessment Score}$$

Finally, a comparative analysis of learning with different media was undertaken using an ANOVA of three variables: media, topic, and time (pre- and post-training).

Media Comparison

The participants were exposed to one of three different media: the multimedia program (Livestock Guru or El Promoter), video, or pamphlets. In Bolivia, three of the previously identified priority livestock diseases were analyzed: FMD, mastitis, and liver fluke (Table 1). Conversely, in India, mastitis and FMD were chosen for further analysis, as liver fluke was not deemed a large problem by farmers in the study areas (Table 2). To explore the effect of media

Table 3. Knowledge Assessment and Learning Scores by Disease Module

	Mastitis (n = 101)	Liver Fluke (n = 85)	FMD (n = 26)
Mean preassessment score	0.10	0.11	0.18
Mean postassessment score	0.43	0.43	0.48

Table 4. Learning Scores Disaggregated by Topic

Learning Scores by Topic	Mastitis (n = 101)	Liver fluke (n = 85)	FMD (n = 26)
Cause	0.26	0.42	0.46
Symptom	0.32	0.21	0.30
Treatment	0.32	0.33	0.23
Prevention	0.44	0.30	0.25

on knowledge uptake, learning scores derived from users of the “El promoter” were compared to scores of participants trained using videos or pamphlets.

The Results

Knowledge Uptake: Bolivia

Table 3 presents the average assessment scores of participants, both prior to and after training in the different disease modules (Nielsen and Heffernan, 2006). As the table illustrates, learning had taken place across all the modules. Indeed, there was a significant difference ($P < 0.001$, $LSD p < 0.05$) in preassessment and postassessment scores for the three disease modules. Within each module, however, knowledge uptake differed in relation to the topic (i.e., disease causation, symptoms, treatment, or prevention, as Table 4 illustrates) (Nielsen and Heffernan, 2006).

Overall, there were significant effects of topic in all the disease modules (mastitis and FMD: $P < 0.001$; liver fluke: $P = 0.043$). As Table 4 demonstrates, knowledge uptake in the mastitis module was highest with regard to prevention and lowest

Table 5. Learning Scores Disaggregated by Media

Media Groups	Mastitis (n = 101)	Liver Fluke (n = 85)
El Promoter	0.367	0.326
Video	0.295	0.279
Pamphlets		0.334

with regard to causation while the opposite was found for FMD. The findings may be explained by the type of previous knowledge held by participants. For example, FMD vaccination campaigns are widespread in Bolivia and, as such, vaccination is a well-known prevention strategy, whereas the cause of FMD disease is less well known.

Media Comparison Bolivia

Table 5 presents the learning scores in each disease module disaggregated by media.¹ The results suggest that all of the media groups had a positive effect on learning. Indeed, there was a significant effect of media on learning scores associated with liver fluke ($P = 0.042$). With regard to mastitis,

Table 6. Mean Learning Scores by Disease Module¹

Assessment Scores	FMD (n = 97)	Mastitis (n = 115)
Mean preassessment score	0.13	0.16
Mean postassessment score	0.29	0.37

1. In total, 74 individuals participated in both the FMD and mastitis modules.

however, a significant interaction ($P = 0.004$) was found between media and topic (cause, symptoms, treatment and prevention) over time (pre- and postassessment), as shown in the Figure 1 (Nielsen and Heffernan, 2006).

As Figure 1 shows, there was a clear advantage of training with El Promoter with regard to disease symptoms and prevention. For the other topics, i.e., treatment and cause, the training videos were as effective as El Promoter (Heffernan and Nielsen, 2006). Similar findings were noted with the liver fluke module (Figure 2). As the figure demonstrates, the software program showed enhanced learning outcomes compared to the video for liver fluke symptoms and prevention.

Thus, in Bolivia, learning outcomes for specific topics were influenced by the type of media utilized. The findings suggest that different types of information may require different methods of representation. The following section explores learning outcomes in India.

Media Comparison: India

As Table 6 demonstrates, as in Bolivia, learning occurred in India, across all of the media in both disease modules. Equally, within each disease, there was a difference in learning across the different topics. Interestingly, the greatest learning occurred with

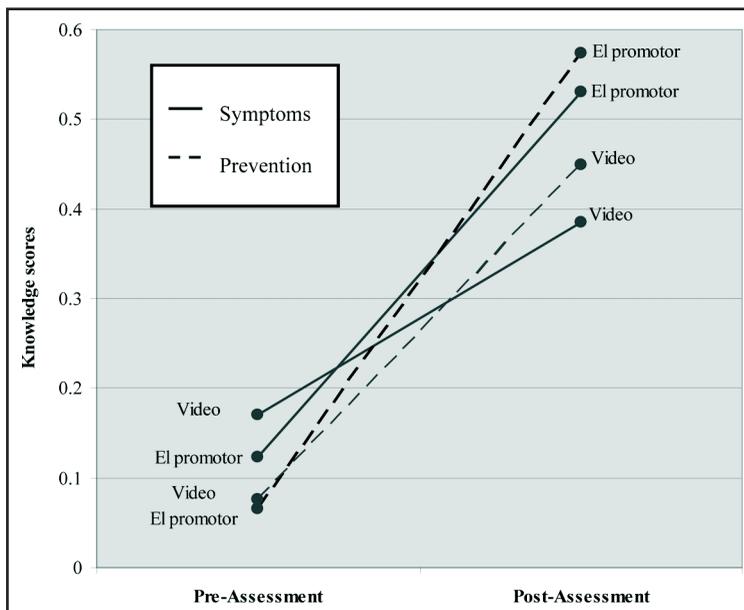


Figure 1. The interaction effect of topic and media before and after exposure to the mastitis training module.

1. Data from the FMD module were not included in this section as this module was only done by one training group (El Promoter).

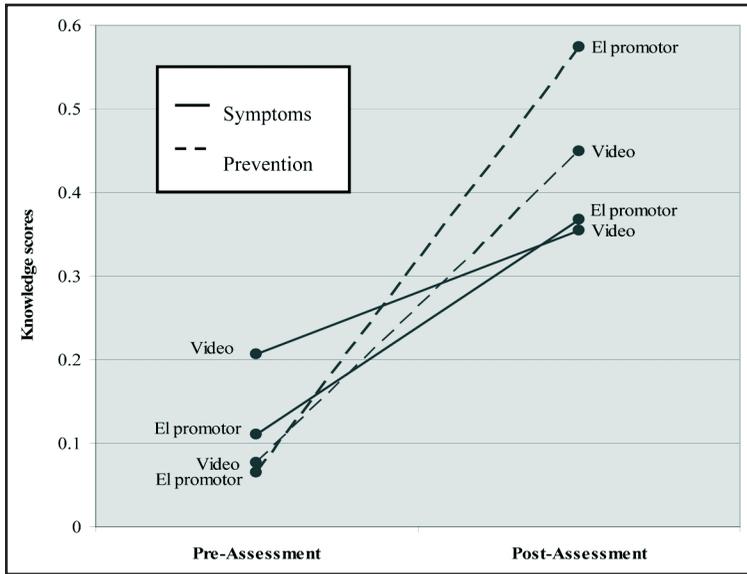


Figure 2. The interaction effect of media before and after exposure to the liver fluke training module: symptoms and prevention (Bolivia).

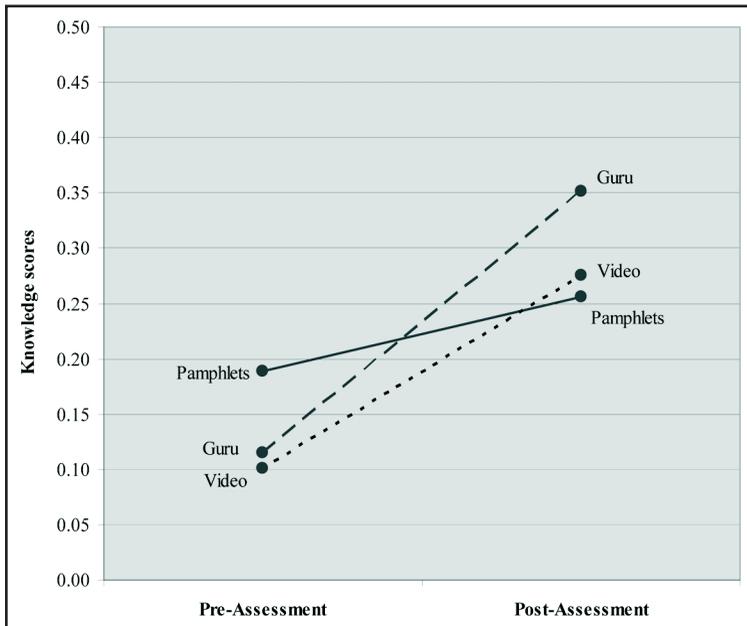


Figure 3. The interaction effect of media before and after exposure to the FMD training module (India).

regard to symptoms of FMD (Table 7). While most farmers could outline symptoms, they often described signs associated with a very advanced clinical condition. Hence, the uptake can be attributed to better recognition of the early signs of FMD in cat-

tle. Conversely, individuals were more conversant with the symptoms of mastitis but less knowledgeable about causes, treatment and prevention.

When the modules were disaggregated by media, overall, the Livestock Guru showed the greatest impact on learning outcomes across both disease modules (Table 8). Nevertheless, the ANOVA revealed differences in the interaction of media and topic between the two disease modules. For example, the analysis of variance for FMD demonstrates an overall effect of media on knowledge uptake ($P = 0.004$). Nevertheless, there was not a significant effect of topic ($P = 0.222$), nor was there a significant interaction between media and topic ($P = 0.685$). The results were similar for mastitis, although the analysis of variance demonstrated the overall effect of media ($P < 0.000$). However, there was a significant effect of topic on knowledge uptake ($P < 0.001$). Indeed, while knowledge on treatment and symptoms improved the least, knowledge regarding cause and prevention improved the most, as Table 9 demonstrates.

Conclusions

The study demonstrated that ICTs can enhance the learning outcomes of the poor. Further, learning can be significantly enhanced through the use of appropriate multimedia programs as compared to more traditional media.

Indeed, the study found that postassessment scores were significantly higher than preassessment scores, which suggest that significant knowledge uptake occurred with use of the software program.

The ANOVA analysis of the different media dem-

Table 7. Learning Scores Disaggregated by Topic

Learning Scores by Topic	FMD (n = 97)	Mastitis (n = 115)
Cause	0.12	0.26
Symptoms	0.22	0.10
Treatment	0.17	0.22
Prevention	0.11	0.27

Table 8. Learning Scores Disaggregated by Media

Media Groups	FMD (n = 97)	Mastitis (n = 115)
Guru	0.25	0.38
Pamphlets	0.05	0.13
Video	0.17	0.16

Table 9. Pre- and Postassessment Scores by Media for Mastitis (India)

	Mean Scores	Cause	Symptoms	Treatment	Prevention
Livestock guru:	Pre	-0.12	0.23	0.06	-0.08
	Post	0.32	0.47	0.49	0.43
Pamphlet:	Pre	0.09	0.36	0.22	0.10
	Post	0.24	0.38	0.41	0.25
Video:	Pre	0.12	0.28	0.35	0.02
	Post	0.34	0.34	0.46	0.32

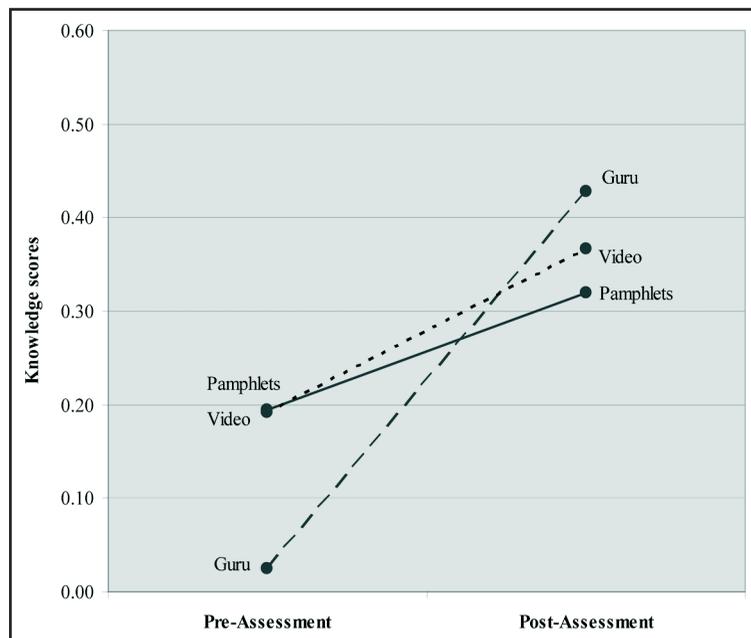


Figure 4. The interaction effect of media before and after exposure to the mastitis training module (India)

onstrated that uptake was related to both the media type and the specific topic. Indeed, particular topic areas had better uptake using El Promotor, while in other topics the ICT showed no significant advantage. Similar findings were noted with the program in India, with the mastitis module.

Indeed, in both Bolivia and India there was a significant interaction effect between the content and the media. As such, certain types of information appear to be better suited to particular modes or methods of presentation. It appears that ICTs had a greater effect in transferring instructional versus descriptive information to the poor. The finding becomes very important when considering the behavioral messaging requirements of global zoonotics such as avian influenza. Tools with the

ability to transfer instructional messages to alter or change farmer behavior are particularly vital.

The study further demonstrated the need for ICTs to account for the visual parameters of learning. As such, greater attention should be paid to the specific cultural referents of the user group involved, particularly those with lower levels of education. Thus, there is an urgent need for policy makers and practitioners to better understand the design elements required to enhance knowledge uptake by the poor utilizing ICTs. ■

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