The Livestock Guru: Fighting Poverty with Knowledge
ZC 0262

LDG

Livestock
Development
Group

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Executive Summary

Access to relevant and appropriate information, on any subject, is generally taken for granted by the world's better-off citizens. However, for the global community of the poor, access to information, and the subsequent knowledge derived, is one of the largest barriers to success in their fight for livelihood security, self-respect and wellbeing. No where is this more apparent than in the livestock sector. Indeed, in a survey of 4,000 poor livestock-keeping households on three continents, farmers ranked the lack of advice regarding livestock production, management and health, as the biggest constraint to their livelihoods [1]. The study also found that the primary knowledge sources of the poor with regard to their livestock were relatives, friends and neighbours. Many poor households recognised that their knowledge pathways were limited and expressed concern over the quality of the advice that they were receiving (ibid).

In today's world of rapid information flows and the so called 'communication revolution' such a problem would not appear intractable. Nevertheless, there are few neutral mechanisms in which information regarding livestock production, health and welfare can be delivered. Poor households are often marginalised from traditional extension delivery and for those households who can access services, large biases exist. First, information is often provided in a blanket fashion, with little account for the differing needs of users. Second, research has demonstrated that even participatory communication pathways favour the more educated and elite [14]. Consequently, a neutral mechanism, which can deliver appropriate and relevant information to the most vulnerable, is urgently required. Nevertheless, it is not only the poor, who are marginalised from information. Livestock development policy makers and planners rarely gain direct access to the needs and demands of their clients.

Therefore, to address these issues, the research created and disseminated the Livestock Guru/ El Promotor an interactive, multi-media, learning platform for poor livestock keepers in India and Bolivia. By creating a multi-lingual programme tailored to the individual user, many of the disadvantages that the illiterate face in traditional learning environments were addressed. Further, by developing a digital forum to detail user preferences and priorities, the programme enables policy makers and planners to obtain specific and timely information regarding the information and knowledge needs of the poor.

To date, the software had been utilised by over 4,680 poor farmers in India, Bolivia and Kenya. During the life of the project, five different language versions of the program were created: Tamil, Oriya, Aymara, Quechua and Swahili. The initial content of the software was based on the demands of 1,724 poor livestock keeping households in India and Bolivia. Further, the study compared the impact of the software in regards to learning outcomes to other more traditional media such as videos and written material. The comparative assessment was performed among 305 individuals in 18 communities in Bolivia and India.

By developing an interactive learning tool, which shares information between policy makers and the poor, the results demonstrate the potential of such tools in the fight for global poverty eradication.

# SECTION I: BACKGROUND, PUPOSE, OUTPUTS AND ACTIVITIES

Background

Knowledge has been declared the 'newest' public good and in the coming decades, it is clear that knowledge generation and management will be one of the largest challenges facing development practitioners. However, until the 1990's, there have been few links made between the knowledge agency of the poor and poverty alleviation. Indeed, the sustainable livelihoods approach, which dominated development theory and practice in recent years, does not include knowledge as a part of the five capital assets important to the poor. Today, however, this oversight is being redressed. It is recognised that knowledge is the key to empowerment and the livelihoods of the poor depend upon effective and sustainable knowledge acquisition [22] [23] [16].

Poor people access knowledge primarily through social networks i.e. friends, relatives and neighbours [24] [16] [20]. Hence, social capital is one of the most important elements of knowledge acquisition and transfer [16] [20]. Indeed, a recent study has demonstrated that livestock-related information is mainly transferred from friends and relatives regardless of the country, production system or income level. [1] Figure 1 offers an example from India [20].

Figure 1. *Sources of Livestock Knowledge in India by Income Bracket*
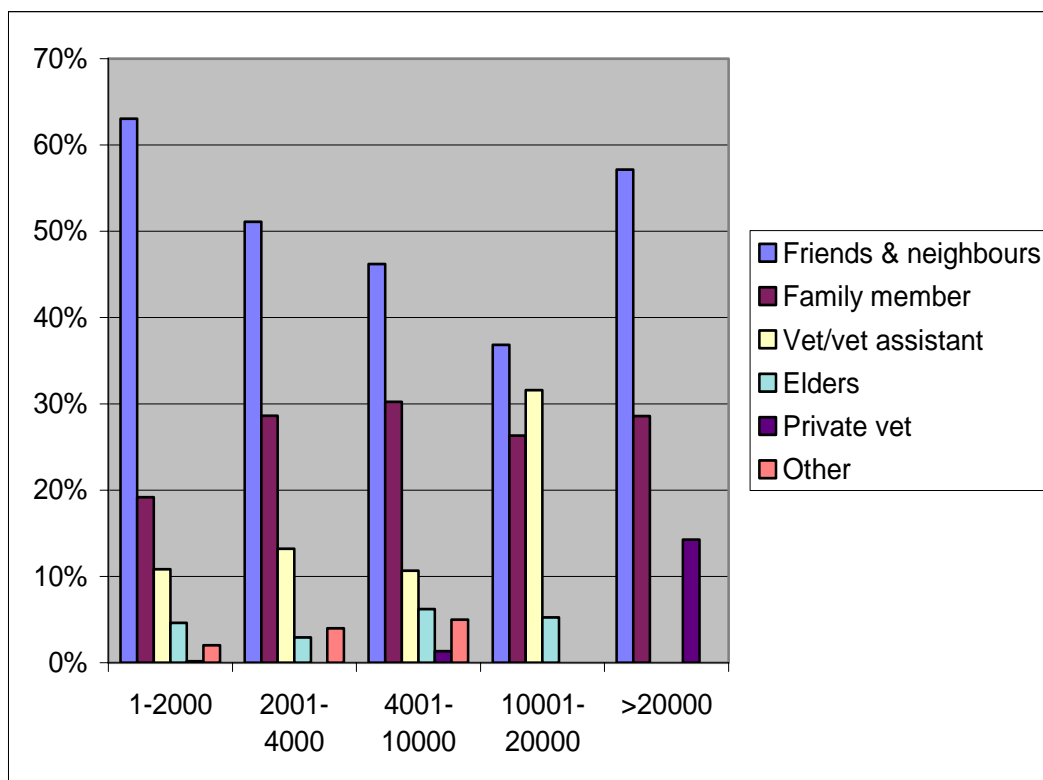
As the figure demonstrates, even in the upper income brackets, friends and relatives are the first source of knowledge among poor livestock keepers. Interestingly, while formal

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[1] The finding has been corroborated in other sectors. Indeed, wider research has demonstrated that poor people access knowledge primarily through social networks i.e. friends, relatives, neighbours (World Bank, 2003, Schilderman, 2002; GLSP 2004). Hence, social capital is one of the most important, albeit widely unexplored, elements of knowledge acquisition and transfer (Schilderman, 2002; LDG,2003).

sources of livestock-related knowledge (private veterinarians) increased for the better off, even these comparatively wealthy households, depended primarily on friends and neighbours for advice. However, many poor livestock keepers expressed concern over the quality of information that they were able to obtain. Indeed, a pair-wise ranking exercise 1,900 farmers in Bolivia and India found that a service provider able to offer 'good advice' was perceived as better than one offering credit or lower cost goods. Thus, the poor both seek and demand livestock-related knowledge and have strong feelings as to the quality of information available (*ibid.*). Responding to this demand for information, however, is problematic. Traditional tools for disseminating knowledge to the poor are recognized to be fraught with biases. Thus, at present, there is increasing interest in alternate forms of knowledge delivery.

Historically, the formal transfer of livestock-related knowledge was the domain of government extension services. However, at the macro-level, formal extension services suffer from a variety of well-known problems: the inability to meet the needs of the most marginalised farmers; a focus on technical solutions that are often inappropriate to all but the most well off; and the lack of resources to support innovation in training. Conversely, at the micro-level, other problems emerge: gender bias in targeting, the delivery of information to groups which are often dominated by the elite, and the overall lack of inclusiveness. Hence, in recent years there has been a move towards delivering information by more participatory mechanisms. However, research has demonstrated that many participatory methods are more, rather than less, exclusionary for those without formal education [25]. Therefore, to enhance knowledge acquisition, in any substantial manner, more neutral mechanisms, which may be utilised by a wider audience, are required.

To address this need, development practitioners have turned to ICTs as potential methods to enhance the knowledge acquisition of the poor. The link between ICTs and poverty alleviation at the macro-level has been well defined [26]. Indeed, countries with high levels of ICT indicators (internet hosts/1000 persons; telephone lines/1000 persons; TV and PC ownership) have correspondingly low rankings on the UN's Human Development Index (*ibid*). Nevertheless, certain sectors lag behind in the adoption of ICTs for development. Indeed, livestock development practitioners appear to be slow in exploiting this potential avenue for aiding the poor. Part of the problem is that at the micro-level, the relationship between poverty alleviation and ICTs is less than clear. Equally, practitioner bias appears to be a problem, with the often stated assumption that the poor lack the ability or interest for the wide-scale adoption of ICTs. However, studies have demonstrated that in many countries the poor are both aware of, and desire greater engagement in, the IT revolution [24]. Indeed, India is one example of how, if given appropriate access, new technologies can have a tremendous impact on the lives and livelihoods of the poor [24].

Little is known, however, regarding the learning outcomes of ICTs in a development context. Equally, little research has been evaluates the comparative advantages or disadvantages to existing methods of knowledge transfer. Therefore, a key objective of the Livestock Guru project was to create and disseminate a demand-led means of information transfer and to explore the impact and uptake of information provided in this manner.

Nevertheless, problems with knowledge acquisition are not only the domain of the poor. Decision makers in development often suffer from the lack of appropriate, relevant and timely information. Communication pathways are often horizontal with few vertical mechanisms which enable the needs and demands of the individual clients to be known. Thus, development practitioners need new ways to be informed by, and share information with the poor. It is here that ICTs also have a pivotal role. As Batchelor et al., [27] notes:

> [ICTs are]…"disintermediate"… [by providing] the poor with more direct access to information. Potentially this removal of the "middle man" in transactions (both information and economic transactions) would credit the ICT activity with enough value to ensure its sustainability.

In this manner, ICTs can be effective at removing the traditional institutional barriers to effective communication between clients and decision makers. In no other field of work is the divide as great between the consumers (the clients of development) and the implementers. Policy makers generally never meet their clients and obtain information regarding their needs only through secondary sources. As such, the development and delivery of the Livestock Guru will aid act as a new and innovative pathway for the sharing of information between the consumers and providers of development policy and practice.

Project Purpose

The purpose of the project is threefold:

1. To create and disseminate a multi-media, action learning program regarding livestock production and health for resource poor farmers in Bolivia and India.

2. To assess the learning outcomes of the software in comparison to more traditional media such as videos and written extension material.

3. To develop a tool, which transmits the demands of the poor to decision-makers.

Outputs and Activities

The original activities as detailed in the project proposal are as follows:

Activities for Output 1: Creation of Livestock Guru/El Promotor software programme.

a. A literature review of the use of ICTs in development with a particular focus on livestock applications.

   A literature review was performed at project start-up. A synthesis of key arguments is available on pg 10 and 11 of this report.

b. A client assessment of the specific livestock production, health and management knowledge needs performed in India and Bolivia.

A base-line survey was performed among 1,792 individuals in Bolivia and India.

c. Further development of the Guru and El Promotor Software:

- Creation of visual and verbal tags for subsequent measurement of user uptake.
- Addition of a database which logs user times and preferences of farmers to evaluate farmer demand.
- Enhancement of the multi-media format to increase the interaction levels of the illiterate.
- Creation of multi-media protocols to address animal husbandry and production and welfare issues.
- Addition of touch screen technology.
- Creation of user screens to log priority information and repeatability.
- Broadening the content to include the species of most important to the poorest households e.g. guinea pigs, poultry, rabbits, llamas and smallstock.
- Development of a database which logs user times and preferences of farmers.

In addition to these activities, the project also created a GIS component to detail user position for decision-makers.

Equally, in addition to the software in India and Bolivia, the research also developed a Swahili version for urban and peri-urban livestock keepers which was field tested in September, 2005

Finally, given the large response from children regarding the program, the project devised El Ganadero, a gaming software to teach children about Guinea Pig husbandry in Bolivia.

Activities for Output 2: An assessment of the issues and constraints to uptake of the Livestock Guru/El Promotor.

a. Design Elements:

- Testing gender acceptability of the production, management and welfare components to enable the product to respond to the differing needs of women clients.
- Broadening the production/health and welfare content to include the species of most important to the poorest households such as guinea pigs, rabbits, and llamas and smallstock.
- Exploration of institutional level constraints and access points at the community and institution level.

In addition to the above activities, specific visual referents were tested for user preferences and suitability. As such, a range of pictorial styles were initially tested among a sub-group of the overall study group. In total, 40 households in Bolivia participated in the visual testing portion of the study. Conversely, in India, visual testing was performed with a range of key informants.

b. Learning Assessment:

- The uptake of messages to both groups and individuals were assessed via embedded 'learning tags' in the software programme.
- Individual user screens were created to log priority information and user IDs.
- Farmers and technical staff will were according to current education protocols for learning assessments.

All of the above activities were performed in both India and Bolivia. The results of the learning assessment offered in Section II of the report.

Activities for Output 3: A mechanism to enable to the knowledge demands of the poor to inform decision-makers.

- Formal and informal dissemination mechanisms utilised to detail the results of the livestock guru at the institutional and individual level.
- Testing of uptake of information by policy makers

Stakeholder meetings have been held with both partner and non-partner representatives from government, NGO and CBOs in India and Bolivia regarding the impact and outputs of the software program. Presently, there is a large demand from organisations to participate in the research program and indeed, to scale-up the program.

Contribution of Outputs

As mentioned above, the study will directly contribute to DFID's ability to meet the Millennium Development Goals. Indeed, support for the use of ICTs is a key strategy within the framework of the MDGs, consequently, the results of the study will be instrumental in supporting this objective. At present, the Livestock Guru has been distributed in milk co-operatives, Village Knowledge Centres, Panchyat and local government and non-government training centres and schools within the target countries. As such, the promotion pathways are well defined at both the field and institutional level.

Over the course of the project, the project team has created highly successful partnerships in the development, testing and dissemination of the Livestock Guru. Current project partners include:

- MS Swaminathan Research Foundation, Chennai, India
- Arupa Anand Research Mission, Bhupaneswar, Orissa
- Servicios Múltiples de Tecnologías Apropiadas (SEMTA), La Paz, Bolivia
- Programme de Desarrollo Lechero del Altiplano (PDLA), El Alto, Bolivia
- FDTA, Altiplano, Oruro, Bolivia

Due to farmer demand, project partners have requested that activities are scaled-up to include additional communities presently outside the study area. Further, a number of community leaders in Bolivia and India have approached the study team to express their desire to participate in present and future activities. In Kenya, the University of Nairobi with community-based partners in the slums and peri-urban areas of Nairobi are keen to implement the program among identified communities. As such, the products produced by the research are ready for dissemination across the countries involved.

Nevertheless, research regarding learning outcomes and ICTs, across all sectors, is in its nascent stages. Indeed, the results of the project have illustrated the importance of this topic as a researchable constraint. However, future funding of the research is unclear with the ending of the LPP Program. Consequently, how the project team will be able to meet the demand for the Livestock Guru is currently unknown.

Dissemination and Public Engagement Activities:

- Demonstration USDA Ministerial Conference on Agricultural Technology, Sacremento, CA. June, 2003
- Presentation and demonstration Rajiv Ghandi College of Veterinary and Animal Science Workshop on Knowledge Transfer, March 12-15th, 2004
- Demonstration and presentation, Northwest University of Agriculture and Forestry, Yangling, China; British Council, 8th February, 2005, Beijing, China.
- Presented paper on El Promotor, National Workshop on Livestock and Poverty, June 29th-30th, 2005, Cochabamba, Bolivia.
- International Workshop on Improving the Wellbeing of Resource Poor Communities, September 12th-15th, 2005, Howick, South Africa.
- Presentation and Demonstration Livestock Guru, Gatsby Foundation Workshop on Technology Transfer in Africa. September 21, 2005, London.
- Paper at Development Studies Association Annual Conference: Connecting People and Places September 9-10th, 2005
- Paper submitted to International Conference on ICTs and Development, Berkeley, CA May, 2006

Finally, the project has been involved in a number of public engagement activities:

- The Livestock Guru was launched to over 1,000 households in Orissa India in May, 2005 (see www.livestockdevelopment.org/gurulaunch).
- The El Promotor was launched to a study area of over 5,000 households in July, 2005.

- The Livestock Guru was written up in local newspapers in India in Tamil Nadu State.
- Due to the popularity of the programme with farmers, the project has been invited to be part of the National Virtual Academy (NVA) Project partnered with the Government of India. The aim of the NVA project is to network 600,000 villages by 2007.
- The Guru was the subject of a Meridian Tonight News Program (www.livestockdevelopment.org/news.htm)
- The Guru was written up on the BBC Berkshire website.

Publications:

Nielsen L. and Heffernan, C. (2005). *New Tools to Connect People and Places: The impact of ICTs on learning among resource poor farmers in Bolivia*. Submitted JID.

Heffernan, C. and Nielsen, L. (2005). *The Livestock Guru: Transmitting demand-led information between decision-makers and the poor*. Conference Proceedings Smallstock Production among Resource Poor Farmers. Howick, South Africa, September 12-16th , 2005

Heffernan, C and Nielsen, L. (2005). *The Livestock Guru: Exploring the learning outcomes from ICTs.* Submitted IEEE.

SECTION II: KEY FINDINGS

The Livestock Guru: Transmitting demand-led information to decision-makers and the poor

Abstract—The use of ICTs in development has increased rapidly in recent years, however, there is a dearth of evidence regarding the learning outcomes of many of these tools. Therefore, the following report describes the development and testing of the Livestock Guru, a multi-media, interactive programme for poor livestock keepers in India and Bolivia. Learning outcomes were explored among 305 farmers in 17 communities across the two countries. The study also compared the impact of the software with more conventional media such as learning videos and written extension material. The authors found that the uptake of new knowledge was frequently dependent upon the specific topic involved. Not surprisingly, the level of challenge to existing beliefs also impacted learning levels. Nonetheless, by utilising visual referents which supported traditional knowledge frames, the software showed greater levels of uptake than more traditional forms of information delivery.

I. Introduction

In a wide-scale study of poor livestock keepers on three continents, participants reported the largest constraint to livelihoods as access to appropriate information about the livestock in their care [1]. Hence, it may be argued that at the most fundamental level, service providers, researchers, policy makers and practitioners within the livestock sector are not meeting the needs of the poor.

In defence of the aforementioned actors, however, knowledge and information management is presently one of the most challenging areas of development. At the global level, the disparities in the access to knowledge have never been greater in the history of mankind. Indeed, the world is currently polarized between an explosion of new information generated by communication technologies in the North and the lack of access to basic information for many in the South. Described as the 'knowledge gap' the widening chasm in both the generation and access to information is predicted to increase exponentially in the coming decades. Indeed, it has been estimated that the growth in storage media (print, film, magnetic and optical) and information flows (through telephone, radio, TV, the internet) is 30% per year [2]. At this rate, development practitioners, policy makers and even the research community will be unable to synthesize, in any meaningful way, their own products.

However, these self-same communication technologies that have been implicated in the knowledge implosion in the North are part of the problem, with regard to access, in the South. First, the ability of the poor to access the means of information transfer such as the internet or computer-based tools is often questioned [3] [4]. Second, practitioner bias appears to be a problem, with the often stated assumption that the poor lack the ability or interest for the wide-scale adoption of ICTs. However, studies have demonstrated that in many countries the poor are both aware of, and desire greater engagement in, the IT revolution [5] [6]. Indeed, India is one example of how, if given appropriate access, new technologies can have a tremendous impact on the lives and

livelihoods of the poor [5]. Equally, in Africa, studies have shown that ICT training initiatives have high uptake and interest by stakeholders [7].

Overall, however, within the literature the ability of ICTs to transfer knowledge at the individual level is believed to be low [15] [16]. Indeed, the design of the media and the related content are often considered inappropriate [15] [17] [18]. For example, Soeftestad & Sein [18] 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 [19]. Obviously, the impact of ICTs will depend upon the relevance of the content and design being suited to the individual user.

Nonetheless, little evidence is available which explores issues in the suitability of ICTs, among the poor [20]. Equally, few studies have explored the comparative impact of ICTs vs. more traditional training material. The general benefits of ICTs in relation to learning are clear i.e. programmes can be tailored to meet the learner's specific requirements and users can follow the material at a customized pace [3]. Equally, according to cognitive research memory is greater for pictures than for other formats [8]. As such, using a multimedia interface also helps learners focus their attention on the material and to commit the information to long-term memory. Nevertheless, there is little specific evidence regarding learners in a developing country context.

Therefore, to address these issues, the objectives of the following paper are twofold; first, to examine the immediate learning outcomes of an interactive, multi-media learning programme ('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 programme with more traditional media, such as educational videos and written extension material.

II. Materials and Methods

To assess learning outcomes, in total 305 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 measured depending upon the content as well as the media used for training.

2.1 The Approach to Software Development

The design of the software programme was based on a cognitive psychology approach which advocates the information processing theory (IP) of learning [8]. IP is a reciprocal model in which uptake is believed to be dependent upon the appropriateness of the learning media to the learning style of the individual and the relevance of the learning material to the learner [9]. As such, the IP model identifies how the learner interacts with information, through attention and memory, to produce knowledge [8]. 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 [10] [11] [12] [8].

Therefore, to create the learning content for the programme, a baseline survey was carried out with 732 livestock keepers in the Altiplano and Valles of Bolivia [1] and 992 farmers in Tamil Nadu and Pondicherry States in India [21]. 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. Appropriate content, however, is only part of the overall design issues relating to ICTs. The tools also have to suit the learning styles of the users. Therefore, the design of the user interface was based upon the visual and oral didactic of the target population.

2.2 Designing the Interface: El Promotor

Prior to building the programme, visual referents were tested for preferences and suitability. As such, a range of pictorial styles were initially tested among a sub-group of the overall study. In total, 40 households participated in the visual testing portion of the study. The results indicated a strong preference for more realistic and less stylised images. Indeed, informants noted that cartoon images were suitable only for children and could potentially cause offence. Equally, the majority of participants preferred images which depicted obese animals and people. When asked to explain their choices, many individuals equated bodyweight with wellbeing and subsequently, the happiness of the animal or person involved.

Further, the study explored the specific visual characteristics associated with both knowledge of livestock keeping and trustworthiness. As such, a variety of El Promotor characters were tested for suitability with regard to these key criteria. A depiction was chosen which best represented these features as decided by the majority of study participants.

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 [13]. The cosmovision dictates how natural resources are perceived and the relationship between nature and knowledge and people's interactions thereof to derive a livelihood [14]. Indeed as the author notes:

…far 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 [14]. Indeed, as the author notes:

…within 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 framed 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 utilised both as the 'teacher' external to the learning frame and was also represented within the scene interacting with the farmer and/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.

2.3 Designing the Interface: The Livestock Guru

The Tamil language version of the Livestock Guru utilised visual and auditory frames adopted from the local film industry. As such, the introduction to the program used an animation a popular, local film actor whose previous films included livestock-related themes. Further, both the compositional and denotative meaning of the illustrations was 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, jewellery and hairstyle of the farmers or characters included in the scene.

Thus, in India the visuals were framed by an external referent from popular culture i.e. the film actor, whereas in Bolivia, the visuals were framed utilising internal cultural cues.

2.4 The Theoretical Underpinning

According to cognitive research, memory is greater for pictures than for other formats [8]. Moreover, it has been shown that illustrations used in learning programmes produce greater retention and recall when compared with those based only on text [28]. Further, as illiterate people rely primarily on audio-visual stimuli for information transfer, a multimedia platform using voice, music and both still and animated images was chosen for El Promotor.

While the programme did utilise animated images, at present, evidence relating to the impact and uptake of animated vs. static images is unclear [29] [28]. For example, Reiber [8] noted that:

Animation makes the cognitive task more concrete and spontaneous by providing the motion and trajectory attributes directly to the learner.

While Schnotz [29] suggested that animated pictures can have both beneficial and inhibiting functions in the process of learning. Conversely, Lewalter [28] concluded there was 'a lack of superiority of dynamic visuals on learning outcome when compared

with static visuals.' To account for these issues, animation was used occasionally throughout the programme to either enhance meaning or reduce the level of abstraction through a visualisation of procedural instructions. As such, animated scenes were

particularly used when describing the treatment of animals or specific desired husbandry or management changes.

Nonetheless, the layout and design also had to accommodate traditional frames for learning. Learning, within the Andean communities has been related to nurturing social relationships [14]. Indeed, as the author notes:

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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 framed 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 utilised both as the 'teacher' external to the learning frame and was also represented within the scene interacting with the farmer and/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.

2.5 Assessing Knowledge Uptake

A 'repeated measures' study design was implemented, where each participant was tested prior to, and directly after, exposure to the learning material. Three disease modules formed the core of the analysis: Mastitis, Liver fluke and Foot and Mouth Disease. Participants were asked to describe the symptoms, cause, treatment and prevention of the disease, in four open-ended questions. Open-ended questions were used to allow for a more nuanced testing of 'understanding' of the subject matter and to filter false positives (answers that were purely 'lucky guesses'). Hence, the study could more closely assess uptake of knowledge, rather than information.

Responses were then scored. The study devised a scoring system based on Jonassen and Grabowski's [12] distinction between the amount and type of knowledge. While amount is the quantitative measure of knowledge, type of knowledge includes an assessment of the level of detail and accuracy of knowledge about a topic as well as other knowledge considered to be related to the topic. Responses were scored in five categories giving points ranging between +2 to -1. The categories were as follows:

- +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)

Scores ranged from +2 to -2 in each category, where +2 was given to a correct answer, +1 was applied to a correct answer which 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 which could lead to detrimental behaviour towards the animal (i.e., in Kenya, farmers using washing powder to treat Cow Pneumonia). Finally, a neutral category of 0 was given to cases where there were no responses.

Using the sum of scores, each participant was given a single score on each assessment category (symptoms, causes, treatment and prevention) before and after training, using the following formulae:

$$Assessment\ Score = \Sigma((AC*2)+(GE*1)-(ER*1)-(ED*2))$$

As a different number of responses were possible in each assessment category (e.g., while there are many correct symptoms of a disease there may only be two correct types of treatment), the data was normalised in order to make knowledge uptake in each category comparable. Hence, scores in each category were divided by the total number of scores possible in the category deriving a score between 0 and 1.

By comparing knowledge scores prior to and after training, any learning which had occurred could be ascertained and compared between disease modules and topics within disease modules. The learning score was therefore derived using the following formulae:

$$Learning\ Score = Post\text{-}assessment\ Score - Pre\text{-}assessment\ Score$$

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).

2.6 Media Comparison

The participants were exposed to one of three different media; the multi-media programme (Livestock Guru or El Promoter), video or pamphlets. In Bolivia, three of the previously identified priority livestock diseases were analysed: Foot and Mouth Disease, Mastitis and liver fluke (*Fasciola hepatica*). 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 1: Participants by Media and Disease: Bolivia

Media	Mastitis	Liver fluke	FMD
El Promotor	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

To explore the effect of media on knowledge uptake, learning scores derived from users of the 'El promoter' were compared to scores of participants trained using videos or pamphlets.

3. RESULTS

3.1 Knowledge Uptake: Bolivia

The table below presents the average assessment scores of participants, both prior to and after training in the different disease modules.

Table 3 Knowledge Assessment and Learning Scores by Disease Module

	Mastitis (n=101)	Liver fluke (n=85)	FMD (n=26)
Mean Pre-assessment Score	0.10	0.11	0.18
Mean Post-assessment Score	0.43	0.43	0.48

The knowledge scores in the table above suggest that learning had occurred across all the learning modules. Indeed, there was a significant difference ($p<0.001$, LSD $p<0.05$) in pre-assessment and post-assessment scores for three major disease modules. Interestingly, within each module knowledge uptake differed depending upon the topic area i.e., whether it was regarding disease causation, symptoms, treatment, or prevention as seen in the following table.

Table 4. Learning Scores disaggregated by Topic

Learning Scores	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

Overall, there were significant effects of topic in all the disease modules (Mastitis and FMD: p< 0.001; Liver fluke: p= 0.043). As the table demonstrates, knowledge uptake on the mastitis module was highest with regard to prevention and lowest with regard to causation while the opposite was found for the Foot and Mouth disease module. The findings may be explained by the type of previous knowledge that participants had regarding the diseases. For example, FMD vaccination campaigns are widespread in Bolivia and vaccination is a well known prevention strategy. Conversely, the cause of FMD disease is less well known.

3.2 Media Comparison Bolivia

The following table presents the learning scores in each disease module disaggregated by media.[2]

**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

The results suggest that all of the media groups had a positive effect on learning. Indeed, there was a significant affect of media on learning scores associated with liver fluke ($P = 0.042$). With regard to mastitis, however, a significant interaction ($P = 0.004$) was found between media and topic (cause, symptoms, treatment and prevention) over time (pre- and post-assessment), as shown in the Fig. 1.

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[2] Data from the FMD module were not included in this section as this module was only done by one training group (El Promotor).

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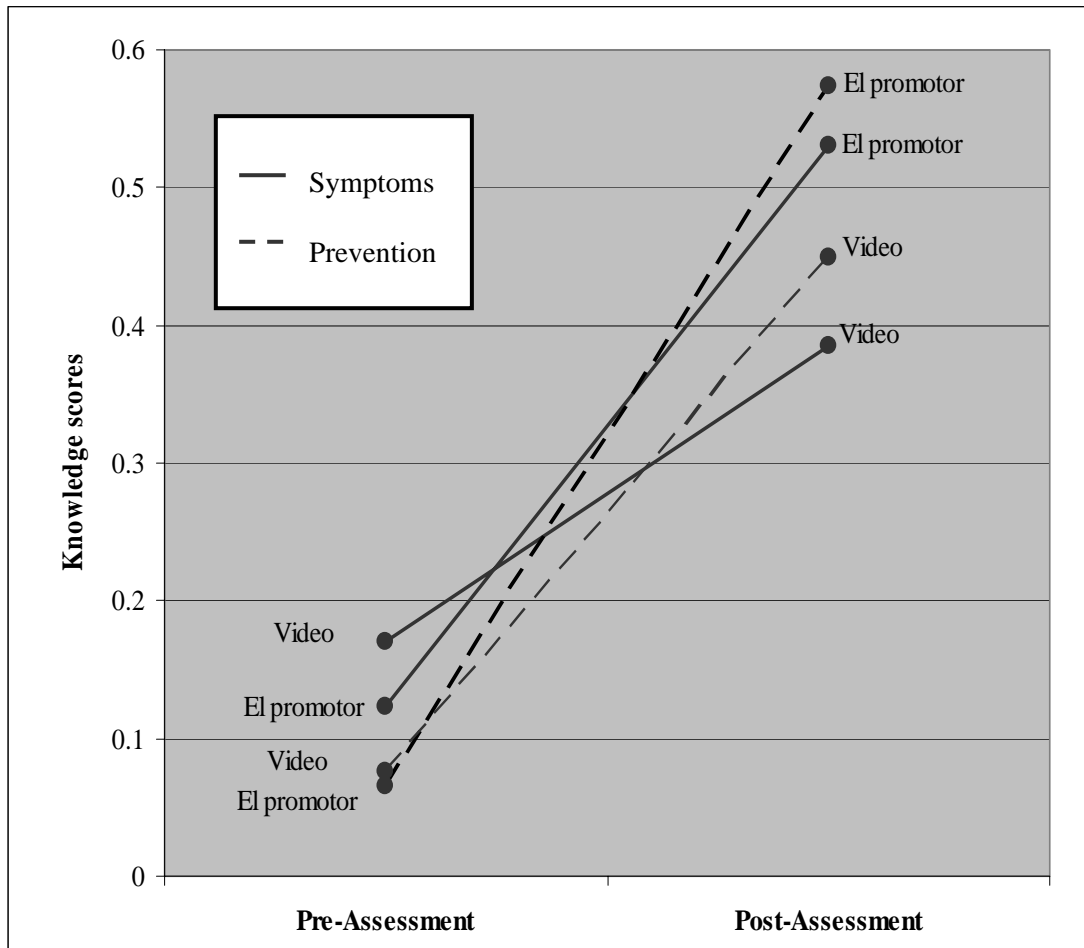

As the Fig. 1 shows, there was a clear advantage of training with El Promoter with regard to disease symptoms and prevention. For the other topics i.e. treatment and cause, the training videos were as effective as El Promoter.

Similar findings were noted with the liver fluke module (Fig. 2).

Fig. 2 *The interaction effect of media before and after exposure to the liver fluke training module: symptoms and prevention (Bolivia)*
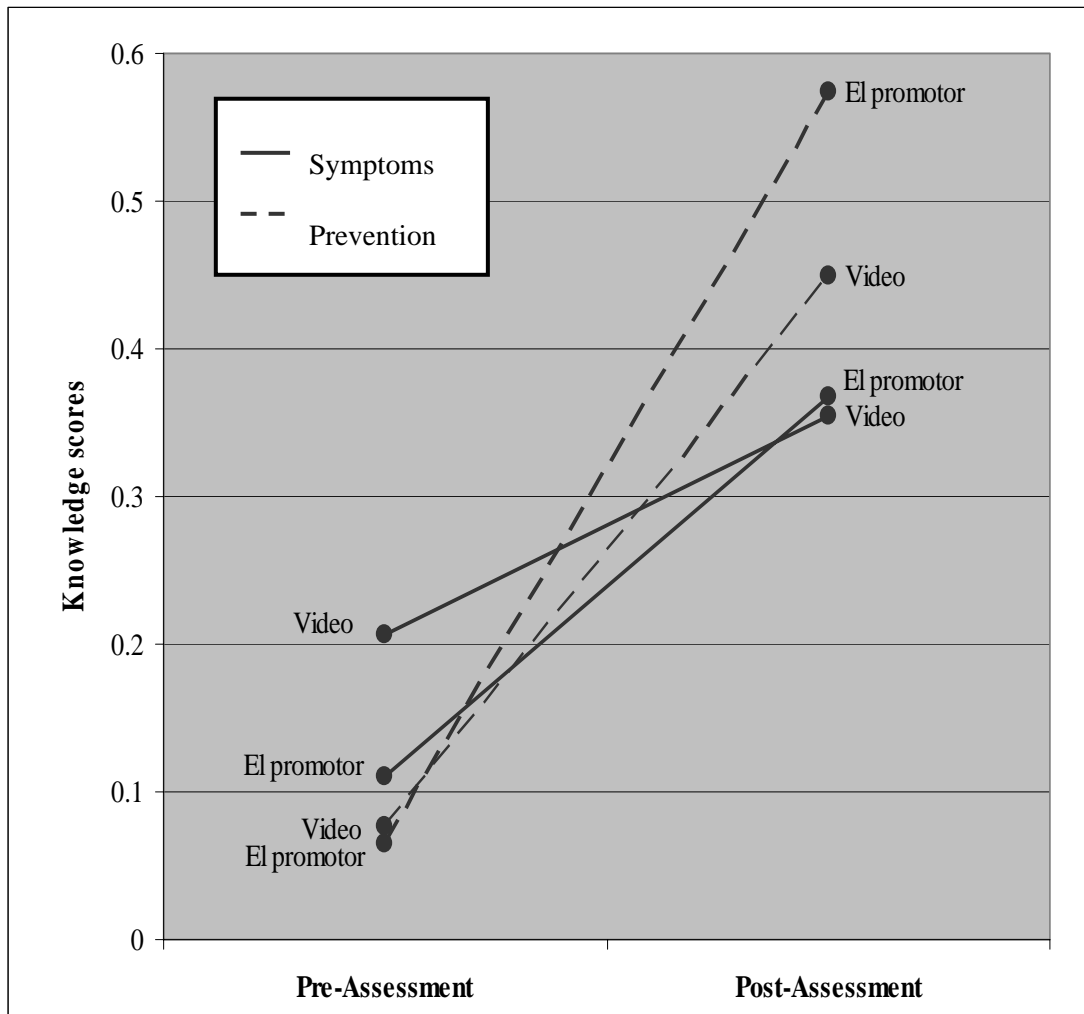
As the figure demonstrates, the software programme showed enhanced learning outcomes compared to the video for liver fluke symptoms and prevention.

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

3.3 Learning Outcomes: India

As the following table demonstrates, similarly to Bolivia, learning occurred across all of the media in both disease modules.

Table 6 Mean Learning scores by Disease Module[3]

Assessment Scores	FMD (n=97)	Mastitis (n=115)
Mean Pre-assessment score	0.13	0.16
Mean Post-assessment score	0.29	0.37

Equally, within each disease, there was a difference in learning across the different topics.

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

Interestingly, the greatest learning occurred with regard to symptoms of FMD. 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 disease in cattle. Conversely, individuals were more conversant with the symptoms of mastitis but less knowledgeable about causes, treatment and prevention.

3.4 Media Comparison: India

When the modules were disaggregated by media, overall, the Livestock Guru showed the greatest impact on learning outcomes across both disease modules (Table 8).

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

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[3] In total, 74 individuals participated in both the FMD and Mastitis module.

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 ($P=0.685$).
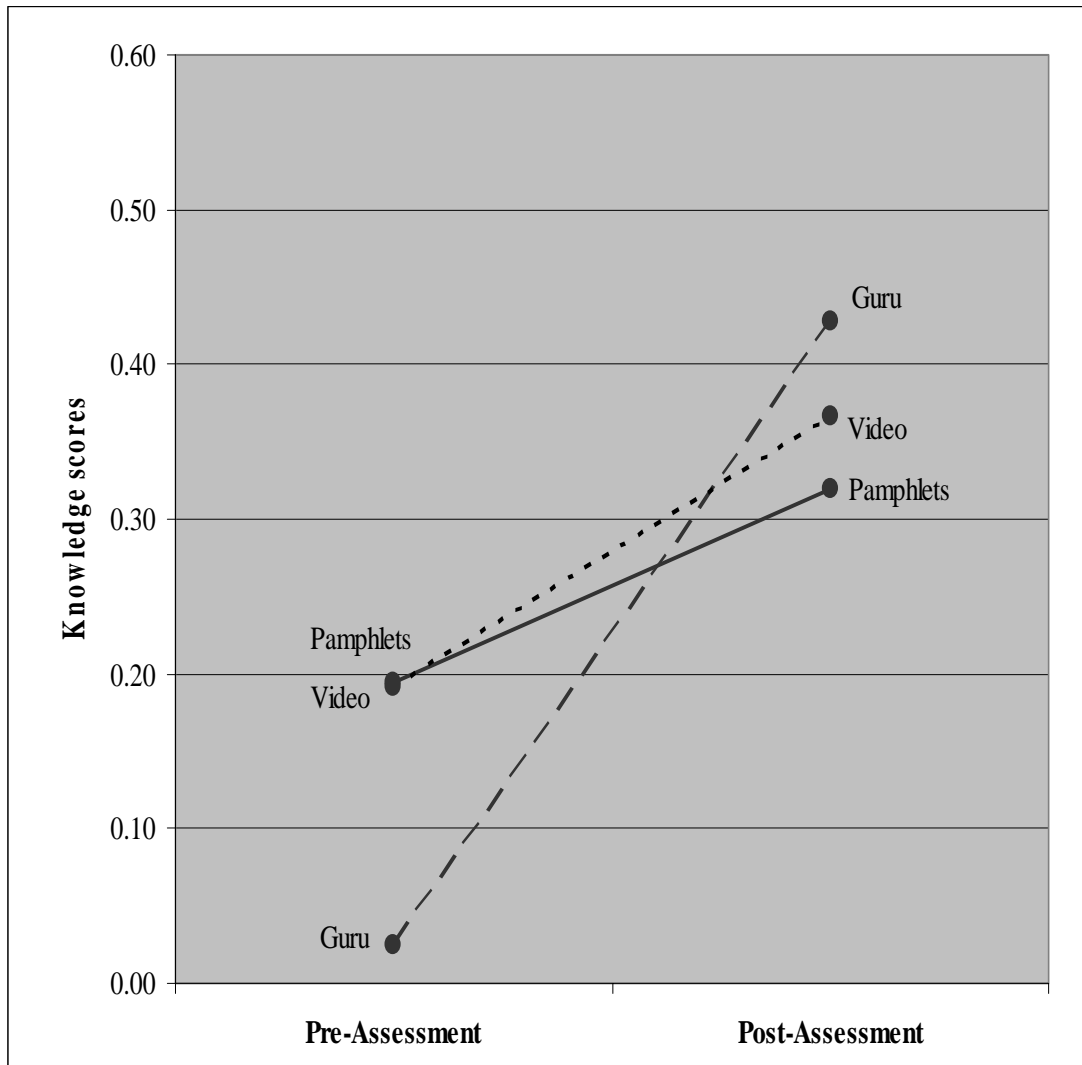
Fig. 3 The interaction effect of media before and after exposure to the FMD training module (India)
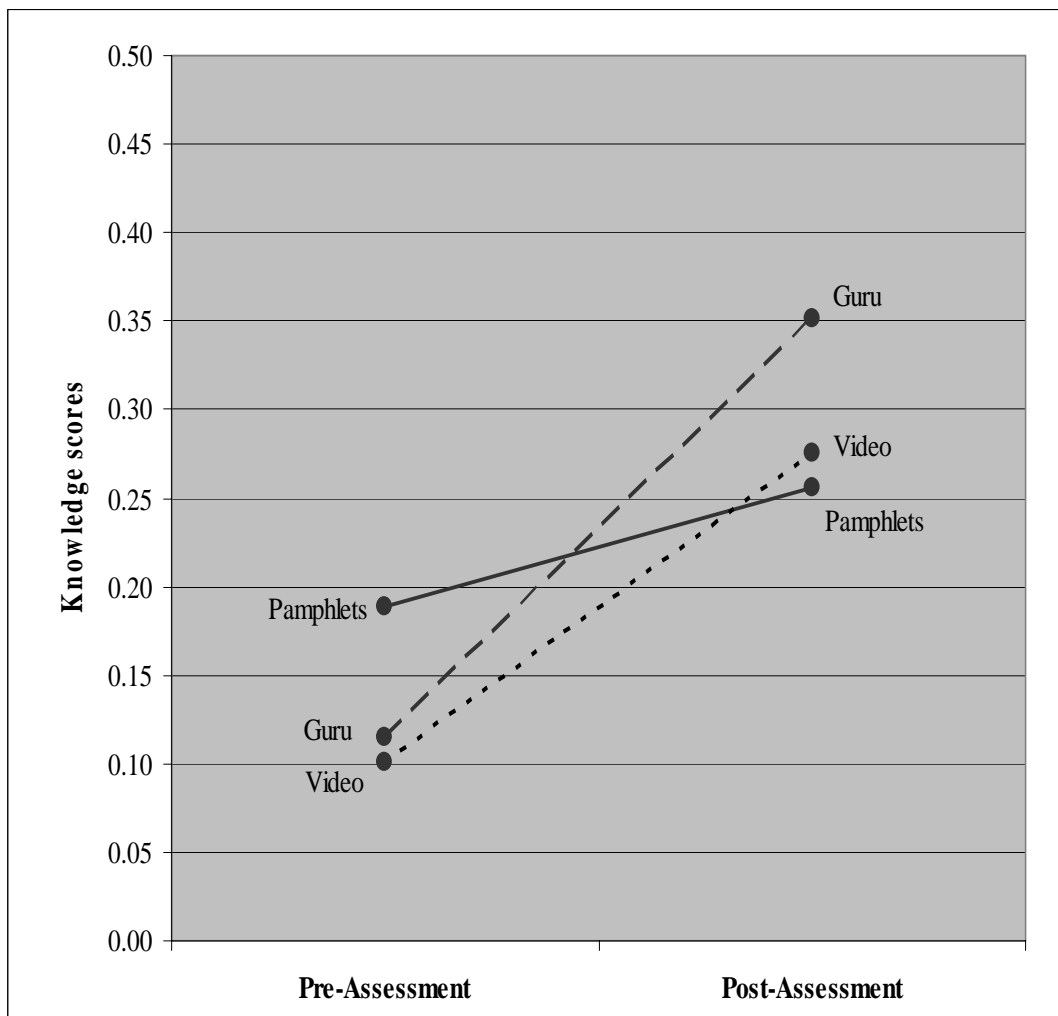
Similarly for mastitis, while the analysis of variance demonstrated the overall effect of media ($P<0.000$).

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

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 the following table demonstrates.

Table 8: Pre and Post Assessment 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

4. Conclusions

The study demonstrated that ICTs can enhance the learning outcomes of farmers in a developing country context. Further, learning can be significantly enhanced through the use of appropriate and relevant programs as compared to more traditional media. Indeed, with regard to learning outcomes, on average, post assessment scores were significantly higher than pre-assessment scores, which suggest that significant knowledge uptake occurred with use of the software program. Furthermore, there was a wide range of immediate learning outcomes indicating that the material was neither too easy for the study sample nor did it present major difficulties.

The ANOVA analysis of the comparative media demonstrated that uptake depended upon both the media and the specific topic. Indeed, certain topic areas had better uptake using El Promotor, while in other topics the ICT showed no significant advantage. Similar findings were noted in India, with the mastitis module.

Indeed, in both Bolivia and India there was a significant interaction affect of instructional content and media, suggesting that certain types of information are better suited to particular methods of presentation. The finding may help explain why different studies have previously found mixed evidence regarding the effectiveness of different media for learning [9]. Indeed, the results suggest that the task may not simply be to select the most appropriate media, but rather to select the most appropriate media to transfer specific forms or types of information.

References

[1] Livestock Development Group (2003). Livestock Services and the Poor. Report produced for the Global Initiative on Livestock Services and the Poor. Livestock Development Group, The University of Reading, Reading, UK.

[2] P. Lyman, H.R.Varian (2003) *How Much Information? 2003*. School of Information Management and Systems, University of California, Berkeley, USA.

[3] R. Mensell, and U. Wehn, (1998) *Knowledge Societies: Information Technology for Sustainable Development*. Science Policy Research Unit (SPRU), United Nations Commission for Science and Technology for Development, Oxford University Press, Oxford.

[4] G. Sciadas (2003) *Monitoring the Digital Divide and Beyond.* An InfoDev and Orbicom joint publication, in association with NRC Press, Canada Institute for Scientific and Technical Information, Canada.

[5] World Bank (2002). *Using Information and Communication Technology to Reduce Poverty in Rural India.* Premnotes #70, June 2002.

[6] C. Heffernan, (Ed) (2005). *Determinants, Social Constructs and Development: A meta exploration of poverty on the Bolivian Altiplano*. Forthcoming.

[7] S. Batchelor, P. Norrish, N. Scott, M. Webb (2003). *Information and Communication Technology (ICT) Sustainability Factors: Analysis and overview of case studies*. www.eldis.org

[8] L. P.Reiber (2000). *Computers, Graphics & Learning*. Electronic copy, © Lloyd P Rieber.

[9] R.E.Clark and B.M. Sugrue (1995) Research on Instructional Media, 1978-1988. In: *Instructional Technology: Past Present and Future.* (G. Anglin, Ed.) Englewood, CO: Libraries Unlimited. Pp 348-364.

[10] G. Salomon (1979) *Interaction of media, cognition, and learning: an exploration of how symbolic forms cultivate mental skills and affect knowledge acquisition*. Jossey-Bass Publishers, London.

[11] M.J.A. Howe (1980) *The Psychology of Human Learning.* Harper and Row Publishers, Inc., New York.

[12] Jonassen, D. H. and Grabowski, B.L. (1993) *Handbook of Individual Differences, Learning and Instruction*. Lawrence Erlbaum Associates, Inc. Publishers, London.

[13] S.Rist, J. San Martin, and N.Tapia (1999). Andean Cosmovision and Self-sustained Development. In *Food for Thought: Ancient visions and new experiments of rural people.* (Ed. B. Haverkort and W. Hiemstra), Zed Books, London

[14] C.D. Genge (2001). Nurturing: An Alternative Learning Cosmology. In (M. Jain, V. Miller and S., Jain,. eds.): *Unfolding Learning Societies: Deepening the Dialogues* Vimukt Shiksha, Special Issue, April 2001.

[15] M. Lloyd-Laney (2003). Making *Knowledge Networks Work for the Poor: Final Report*. ITDG, London.

[16] T.Schilderman (2002). *Strengthening the Knowledge and Information Systems of the Urban Poor.* Report for DFID, ITDG, Rugby.

[17] G.Sciadas (2003). *Monitoring the Digital Divide and Beyond.* Canada Institute Scientific and Technical Information, Montreal, Canada.

[18] L Soeftestad and M. Sein (2003). ICT and Development: East is East and West is West and the twain may yet meet. In *The Digital Challenge: Information technology in the development context*. (Eds S. Krishna and S. Madon). Ashgate Press, Aldershot.

[19] Livestock Development Group (2004). *Receptors, End-users and Providers: The deconstruction of demand-led research and knowledge transfer in animal health research*. Report for the Wellcome Trust, London, UK

[20] Livestock Development Group (2004). *Global Initiative on Livestock Services and the Poor: Research and Knowledge Management.* Report Produced for the Global Initiative on Livestock Services and the Poor, IFAD, Rome.

[21] Livestock Development Group (2002). *The Delivery of Veterinary Services to the Poor: Findings from India*. Internal Project Report. LDG, University of Reading, Reading, UK.

[22] S. McGrath, (2001). *The British Department for International Development and Knowledge-based aid.* Paper presented at the International Conference on Education and Development, September, 2001, Oxford University, Oxford.

[23] K. King and S. McGrath (2001). *The Knowledge Agency: The impact of the new knowledge theory on the work and understandings of development cooperation agency staff.* www.eldis.org

[24] World Bank (2002). *Using Information and Communication Technology to Reduce Poverty in Rural India.* Premnotes #70, June 2002.

[25] Livestock Development Group (2004). *Poverty and Participation: An analysis of bias in participatory techniques.* Report produced for DFID's Social Development Fund, LDG, University of Reading. www.livestockdevelopment.org

[26] A. Flor (2001). *ICTs and Poverty: The indisputable link.* Paper presented at the Third Asian Development Forum, June 11-14th, 2001. UNESCAP, Bangkok, Thailand.

[27] S.Batchelor, P.Norrish, N.Scott, M.Webb (2003). Information and Communication Technology (ICT) Sustainability Factors: Analysis and overview of case studies. www.eldis.org

[28] D. Lewalter (2003). Cognitive Strategies for learning from static and dynamic visuals. *Learning &Instruction*, 13, 177-189.

[29] W.Schnotz (2002). Towards an integrated view of learning from text and visual displays. In *Educational Psychology Review* 14(**2**) pp101-120