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Testing the Effectiveness of Video to Complement or Replace the Lecture/demonstration Group Training Approach for Farmers in Kamuli District, Uganda

Tian Cai
Iowa State University

Testing the effectiveness of video to complement or replace the lecture/demonstration group training approach for farmers in Kamuli District, Uganda

by

Tian Cai

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Program of Study Committee:
Eric A. Abbott, Major Professor
Robert E. Mazur
Frederick O. Lorenz
Lulu Rodriguez

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ABSTRACT

This study explored the effectiveness of video as a tool to either complement or replace existing lecture/demonstration training for small farmer groups. The effectiveness of video in decreasing the knowledge gap among farmers who differ by gender, bean production volume, and education level was also evaluated. Quantitative and qualitative data were gathered through a quasi-experiment including a pre-test and a post-test design with three experimental groups. Results showed that video could be an effective complement and replacement for the conventional lecture/demonstration training method. The training method that included both video and traditional lecture/demonstration was especially effective for groups with relatively low prior knowledge of the training topic. Video alone or video plus traditional lecture/demonstration were as effective as traditional training in decreasing gaps in learning among subjects of both genders, varying education levels and scales of bean planting.

Video has advantages in rural areas because it does not require face-to-face presentation by skilled trainers. Video might be an attractive alternative or supplement if the production cost is low enough, or if conventional lecture/demonstration cannot meet the demand for training. Using local actors, shooting video in the local environment and using local languages add to video's advantages for training purposes. When used to demonstrate a farming technique or practice in a group setting, videos were found to enhance interaction (e.g. discussion and peer learning) among farmers.

Chapter 1

INTRODUCTION AND STATEMENT OF THE PROBLEM

The purpose of this study is to learn about the effectiveness of video as a tool to either complement or replace the existing lecture/demonstration mode of training small farmer groups. Farmer groups in the Kamuli District of Uganda have been receiving training in topics relating to sustainable rural livelihoods since 2005 as part of a livelihood improvement program coordinated by Volunteer Efforts for Development Concerns (VEDCO), a Ugandan non-government organization, the Center for Sustainable Rural Livelihoods (CSRL) at Iowa State University (ISU), and Makerere University, Uganda. Although some interactive charts, handouts and photos have been developed to support the traditional approach, lectures and hands-on demonstrations have been the most commonly used training methods.

Currently, approximately 1,200 farmers are reached by the program. Training messages are delivered by community-based trainers (CBTs), who are paid VEDCO staff members selected from the local rural community. These CBTs have been trained and are supported by VEDCO Program Extension Officers. Each CBT is responsible for eight to ten groups with a total of approximately 100 farmers.

Evaluations have shown that although farmers have adopted some of the recommended technologies, such as improved banana planting practices, there have been problems in motivating farmers to attend group sessions. In addition, the CBTs report that farmers respond better when different training approaches are used. Role playing, field demonstrations, and other techniques have been tried in addition to standard lectures. Project staff members are interested in increasing the impact of their activities in the area by expanding the number of farmers who can benefit from farming recommendations. Video offers a means of complementing current training modes or providing a stand-alone training method for other farmers.

Video is now commonly used as a training tool in many development projects. The use of moving images and video's flexibility of use have been cited as important advantages for agricultural training in developing countries (Van Mele, 2011). However, in most cases, the use of videos has not been carefully evaluated in terms of its possible complementary role as well as its ability to replace current training approaches (Gurumurthy 2006; Gandhi, Veeraraghavan, Toyama & Ramprasad, 2007; Zossou, Van Mele, Vodouhe & Wanvoeke, 2009a; Van Mele, Wanwoeke & Zossou, 2010; Van Mele, 2011). The current study examines the use of locally created videos that show local farmers on local fields using the local language.

A 2010 study by Van Mele, Wanwoeke and Zossou found that 78% of development organizations, including universities, research institutes and non-government organizations (NGOs) use video to train farmers. Until recently, however, video training in rural areas required a generator, DVD player, projector and other audio-visual equipment. Farmers often had to come to central areas to see them. These characteristics pose serious limitations to those who live in the countryside with poor roads and where there is no electricity. In the past few years, small battery-powered pocket projectors have been developed and tested to offset these difficulties. Trainers on foot or bicycle can easily carry these portable devices to places where farmers live. The increased capacity of these devices to extend training to rural areas has again focused attention on how they might be used for training purposes. Thus, this study asks: (1) Can locally created video enhance and/or complement existing training techniques? (2) Can video alone or with minimal facilitation potentially replace the traditional training approach by the CBTs?

Chapter 2

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Information Processing and the Power of Visuals

Information processing theory emphasizes cognitive learning, which is considered to involve receiving, processing, extracting, and remembering information initially stored in short-term memory. Individuals construct a connection between a stimulus and prior knowledge and store such associations in long-term memory. Information encoding and retrieval are also important steps in the cognitive information processing approach (Miller, 1956), which encourages learners to transfer and assimilate new information by processing, storing and retrieving information for later use (Bovy, 1981).

In the information-processing framework, visual information has established its potential for cognitive impact directly or by representing and allowing the elaboration of concepts, abstractions, actions, metaphors, and modifiers (Scott 1994).

Educational literature suggests that individuals demonstrate a preference for particular information processing styles to assimilate new information (Eastman, 2010). Other studies have also shown that people apply different learning processes depending on the source of new information (e.g., the channels of communication or media) (Coldevin, 2003). For example, some learn better from and prefer the visual media compared to materials primarily delivered by audio. MacInnis and Price (1987) compared what they call the “imagery (or symbol) process” and “discursive (or language-oriented) process” that people generally resort to when exposed to stimuli. The fundamental difference was that imagery processing promoted multi-sensory experiences, such as smell, taste, sight and tactile sensations in working memory. In the discursive process, sensory experience was absent, which made the discursive information process more abstract.

Information from different media provides multiple reinforcing channels and thus is able to accommodate various learning styles and preferences (Coldevin, 2003). That is, the use of multiple channels that engage more senses makes it possible to present and reinforce messages in multiple ways (Lie & Mandler, 2009, p. 20).

When it comes to quick, clear communication, visuals have advantages over text. Psychologists (e.g., Mehrabian, 1981) have demonstrated that 93% of human communication is nonverbal. This is so, Mehrabian (1981) explains, because the human brain deciphers image elements simultaneously, while language is decoded in a linear, sequential manner, taking more time to process.

Biologically, millions of years of evolution have genetically wired people to respond differently to visuals than text. In short, some think better using pictures. Burmark (2002) writes that "...unless our words, concepts, ideas are hooked onto an image, they will go in one ear, sail through the brain, and go out the other ear. Words are processed by our short-term memory where we can only retain about 7 bits of information (plus or minus 2)… Images, on the other hand, go directly into long-term memory where they are indelibly etched" (p. 5). Therefore, it is much easier to show than to describe with words.

The powerful images and contextualizing reality in video could help remove the learning obstacle of low literacy people. By visually portraying many complicated issues or arguments that might be hard for audiences to understand, video can be an effective tool for raising awareness (Lie & Mandler, 2009).

In 1986, a study at the University of Minnesota School of Management found that presenters who use visual aids were 43% more effective in persuading audience members to take a desired course of action than presenters who did not use visuals. Researchers found that average presenters who used visual aids were as effective as more advanced presenters who used no visuals. In addition, the study found that the audience expected the advanced presenters to include professional, quality visuals (Vogel, Dickson & Lehman, 1986).

Graphics have been found to quickly affect people cognitively and emotionally. At the cognitive level, visuals expedite and increase the levels of communication. They increase comprehension, recollection, and retention. Visual clues help people decode text, attract or direct attention, increasing the likelihood that the audience will remember (Levie & Lentz, 1982).

People attracted to visual elements quickly absorb data more efficiently and effectively, and also are affected emotionally. In other words, pictures also enhance or affect emotions and attitudes (Levie & Lentz, 1982). They engage the imagination and heighten creative thinking by stimulating other areas of the brain, which in turn leads to a more profound and accurate understanding of the presented material (Bobrow & Norman, 1975). It also has been shown that emotions “play an essential role in decision making, perception, learning, and more ... they influence the very mechanisms of rational thinking" (van Oostendorp, Preece & Arnold, 1999, p. 67).

The emotional elements in video learning enhanced the effectiveness of Bangladeshi videos when they were introduced to African audiences. The “enthusiasm, self-confidence and emotions” of farmers who acted in the Bangladeshi video connected the African audiences and “strongly complement the technical content” (Van Mele et al., 2010a, p. 85)

2.2 Videos in Training

Studies have shown that using videos increases training quality (Van Mele, 2011). Compared with textual materials, videos, especially those done in the local language, transcend the literacy barrier. In a 2011 survey, Van Mele found that approximately 80% of his respondents who are members of development organizations, research institutes and NGOs, rated videos “quite to very useful” in reaching less educated audiences. Video use in training also decreased the technological support requirement of farmers (Gandhi et al., 2007). Videos also can be very persuasive (Lie & Mandler, 2009). Agricultural concepts and technologies hard to describe in words are easily understood when demonstrated visually. For example, video has been used to demonstrate the cleanliness and low rates of breakage of parboiled rice, and was effective in convincing farmers to increase the amount of parboiled rice they sell (Gandhi et al., 2007). Long agricultural processes can be compressed into short video segments, thus enhancing training efficiency (Lie & Mandler, 2009). These benefits can be harnessed as the cost of audio-visual technologies substantially declines (Coldevin, 2003). Aspects of an actor’s character that farmers find attractive enhance learners’ attentiveness (David & Asamoah, 2011). Video is flexible because it can be shown anywhere at any time (Coldevin, 2003). Video also has been used to standardize the information provided when interacting with farmers (Gandhi et al., 2007).

2.3 Localization of Training Videos

Effective training videos are those that depict local scenarios, examples and concerns. Videos also are able to address local institutional barriers (Van Mele et al., 2010b). Eighty-five percent of development organizations that responded to Van Mele's (2011) online survey agreed that videos in the local language and those that demonstrate farmers' experience enhance training effectiveness. In general, videos that integrate content, production and dissemination into the local social condition are most likely to be accepted (Anderson, Dickey & Perkins, 2001). This is so because such content provides evidence that recommended practices work under the local environment (Gandhi et al., 2007). Lack of local context causes "impedance mismatches" between audience and producers that hinder knowledge acquisition (Wang et al., 2005).

Chowdhury, Van Mele and Hauser (2011) found that farmers were more likely to be convinced by videos featuring actors similar to themselves in dialect and accent, culture, education and agricultural expertise. In their study, an experienced female farmer who appeared in a Bangladesh rice video enhanced the perceived reliability of training materials. Farmer audiences were more likely to adopt the recommended technology after seeing video showing peers using it (Gandhi et al., 2007). Farmers' interaction and participation in video production and dissemination have been shown to be an effective localization method in many studies (Zossou et al., 2009a; Gandhi et al., 2007; Shanthy & Thiagarajan, 2011).

2.4 Length of Training Videos

How long should these videos be? According to Van Mele (2011) videos should be between 5 and 15 minutes in length in recognition of people's limited information processing capabilities. To present complex topics, AfricaRice extended its rice videos to 19 minutes. The preferred length may also be culture-bound. For example, African farmers are more accepting of longer videos compared with their peers in Asia (Van Mele, 2011). Special formats, such as dramas and soap operas, are featured in these longer formats (Van Mele, 2011).

2.5 Small Group Training Using Video

When used for training purposes, videos are often shown to small groups of five to 30 farmers who live in close proximity to one another (Gandhi et al., 2007; Zossou, Van Mele, Vodouhe & Wanvoeke, 2010; David & Asamoah, 2011). Training farmers as a group makes it easier to repeat central points, promote discussion, collect feedback, and test trainees' understanding (Coldevin, 2003). Digital Green formed training groups based on existing local farmer cooperatives. In field tests, group participation guaranteed a regular schedule of content screenings; encouraged learning, adoption and innovation through peer pressure; and even reunited estranged family members (Gandhi et al., 2007). In Ghana, farmers in training groups decreased the period needed to learn new technologies (David & Asamoah, 2011). The social network built by Video Viewing Clubs (VVC) functioned beyond the duration of the project as 34% of participants continued to meet to share information even after the project was over. Women in central Benin maintained their groups organized during video-mediated training in which they were taught how to secure micro-finance services and how to market rice (Zossou et al., 2010).

Often, a mediator/facilitator with some agricultural training organizes and manages the training. In many instances, local facilitators are hired to conduct the training and record attendance, feedback and adoption rates of recommended practices. Such an approach takes advantage of available local knowledge sources and reduces logistical costs considerably. A facilitator also had the added function of sustaining the trainees (Gandhi et al., 2007). In Ghana, farmer-facilitators of video viewing clubs made the messages more credible to target audiences (David & Asamoah, 2011).

2.6 Video Training and Gender

In general, individuals with higher socio-economic status are able to experiment and adopt new technologies more quickly than those with low income and education (Rogers, 2003). The latter characteristics often describe rural women who comprise the majority of the world's poorest (FAO, 2009). In addition, they lack access to information and resources that may save labor and increase productivity (Butler & Mazur, 2007). However, women are often responsible for multiple tasks in their family and their community.

Uganda ranked 116 out of the 141 countries in the United Nations' Gender Inequality Index (UNDP, 2011). Only 9.1% of Uganda females have at least secondary education (UNDP, 2011); they have limited access to information beyond their local communities (Rogers, 2003). Because men are usually the key decision makers (Zossou, Van Mele, Vodouhe & Wanvoeke, 2009b), most females lack the opportunity to communicate outside of their families (Zossou et al., 2010). Video-mediated training has a strong potential to overcome this information inequality (Bery, 2003; Lie & Mandler, 2009; Zossou et al., 2010).

Studies have shown that women prefer video-mediated approaches to text materials and are more willing to pay more to get video disks (Tumwekwase, Kisauzi & Misiko, 2009; Van

Mele, 2011). In Central Benin, men who lacked access to video were eager to learn from women who have access (Van Mele, 2006). In a Bangladesh village, women became increasingly involved in decision-making on how to spend the family's disposable income after exposure to a training video. Their ability to explore sources, bargain for better prices, and manage organizational support was strengthened by training programs that made use of videos (Chowdhury et al., 2011).

Shingi and Mody (1976) concluded that the communication effects gap could be prevented if "appropriate communication strategies are pursued in development efforts" (p. 189). In their field experiment, they found that the gap between farmers with different prior knowledge levels was closed after their exposure to credible TV programs made up mostly of training videos. Low-knowledge farmers learned more, while those with higher knowledge about the topic before viewing the TV program gained less information because of the "ceiling effect." Farmers with higher knowledge before video exposure also showed lower interest in the TV program because they perceived the content to be of low value to them.

2.7 Use of Pico Projectors for Video Training

Until recently, the shortage of electricity and limited access to the Internet and other modern technology have limited the adoption of modern training devices such as computers and TV to present digital content in rural areas (Jain, Birnholtz, Cutrell & Balakrishnan, 2011). The low information and communication technology proficiency of rural training facilitators dictates simple and easy-to-use training devices. Because videos are shown in multiple locations that do not have electricity, low-cost battery-operated devices are a must.

Recently, a small battery-operated video projector called the "pico" has been tested in rural areas. Smaller than a normal projector (the 3MPro150 version is 1 by 2.4 by 5.1 inches and weighs 5.6 ounces) (*PCMag*, 2010), it is "bright, battery powered, portable, durable and affordable" (OMPT, 2010). In two trials in India, a pico projector was connected to a camera phone to present training materials stored on a cell phone (Jain et al., 2011; Mathur, Ramachandran, Cutrell & Balakrishnan, 2011). Some types of pico projectors have an internal memory or an SD card slot, so they do not need to be connected to a computer or DVD player. Pico projector images are suitable for viewing by groups of 15-20 people (Mathur et al., 2011).

The projector, however, has two major disadvantages. First, because of its relatively low luminosity, videos must be shown in a darkened room. Second, it requires an external speaker because its audio capacity is not sufficient to be heard by a group of 15-20 farmers (Mathur et al., 2011).

2.8 Video as a Complement to Traditional Training Methods

Training that combines video and traditional methods such as lectures and farmer-to-farmer extension has proven to be more effective than traditional training methods alone (Zossou et al., 2009b; Gandhi et al., 2007). In an experiment, greater knowledge gain was recorded for a group of farmers given a lecture and shown a video compared to another group that received only the lecture (Shanthy & Thiagarajan, 2011). Digital Green split villages into two groups: those that were given regular training and those that received conventional plus video training. One-half of those who received conventional + video training expressed greater interest in adopting the suggested practice, which was several times more than those in the control village (Gandhi et al., 2007).

In another study, more farmers in the group receiving video + conventional workshop training could properly handle rice after harvest than was the case in the group that participated only in the conventional workshop (Zossou et al., 2009b). In central Benin, 92% of farmers exposed to a training video and who attended a workshop adopted the rice parboiling method being recommended compared to 19% of those who learned about the method in a workshop (Zossou et al., 2009b).

2.9 Video as a Stand-Alone Training Material

In many projects, video has replaced conventional training and served as a stand-alone knowledge and innovation dissemination approach. Video training is cheaper than traditional extension methods such as farmer-to-farmer extension and lecture, especially when more farmers need to be trained. Stand-alone video training has been most effective when farmers already know the scientific principles and already are practicing the techniques shown in the video (Van Mele, 2006).

Exposure to video training alone was more successful in creating interest in rice parboiling technology than attendance in a traditional workshop (Zossou et al., 2010). In Ghana, experimental groups shown videos had higher knowledge test scores compared with farmers in the control group who received conventional training (David & Asamoah, 2011). The percentages of farmers in the video-only group that changed the technique used to reduce moisture loss (drying rice on tarpaulins), and removing shoes when turning the paddy over were 87%, 99% and 96%, respectively. In the control group subjected to a traditional workshop, the percentages were only 22%, 59% and 40%, respectively (Zossou et al., 2009a). Significantly more farmers in the video group in Central Benin sold parboiled rice to earn extra money to purchase food (Zossou et al., 2010).

In Bangladesh, farmers exposed to videos that demonstrated seed drying technologies showed an increase in the adoption of the treatment from 9% to 67%, while a much lower increase was found in the control village trained through extension (Van Mele, Zakaria, Begum, Rashid & Magor., 2007). A total of 72% of farmers in central Benin who received only video training innovated based on the new practice shown in the video, compared to 19% of those who learned the same practice through workshops only (Zossou et al., 2009a).

Van Mele (2008) finds video "easy to integrate with other rural training methods" (as cited in Zossou et al., 2009a, p. 120). In another study, video was supported by practical tasks, oral testimony and/or farmer discussion to help enhance learning (Lie & Mandler, 2009). This may be because information presented through multiple channels is more likely to enhance learning (Coldevin, 2003). Learning with the use of different media also can satisfy people's different learning preferences (Shanthy & Thiagarajan, 2011). In some instances, videos shown on television or cable networks were accompanied by a two-way communication channel to enable audience members to ask questions and interact with the extension worker (Lie & Mandler, 2009).

2.10 Video and Participatory Training

A participatory and interactive training approach involves farmers as important partners in development decision-making and promotes their interaction with researchers, communicators, extensionists, and educators (Coldevin, 2003). Participatory methods, such as Farmer Field Schools, offer farmers the chance to observe, record and discuss what happens in the field after regular training. Instead of only receiving information, farmers obtain a deep understanding of concepts and their practical applications (Coldevin, 2003).

However, scaling up this participatory training method has met with some difficulties in terms of resources and quality control. The zooming-in, zooming-out (ZIZO) approach involves farmers in the process of addressing local issues, video creation, production and delivery. Local needs and knowledge are gathered by immersion in local communities (Van Mele, 2006). Local farmers' ideas, concepts and innovations were applied to produce the training video of rice post-harvest processes (zooming -in); the raw video was shown to farmers outside of the community and more suggestions were collected, leading to further versions of the training video (Zossou, 2009a).

Similar to the ZIZO method, in the production of a rice training video in Bangladesh, local knowledge was evaluated, and the technologies and video scripts were tested among rural women who suggested how their roles were to be portrayed. Farmers also chose the dates and location of video training (Van Mele, Salahuddin & Magor, 2005). The Video Viewing Club offered video and field experience, reflection and conclusions through farmer group discussion.

Digital Green (2010) developed an interactive voice response question-and-answer system based on mobile phones to collect information about farmer needs and interests and to solicit feedback after video exposure. The toll-free voice system encouraged farmers to record questions and receive responses concerning video production and dissemination.

2.11 Research Questions

This study has two objectives: The first is to test and compare the effectiveness of three training approaches: (1) traditional lecture/ demonstration alone; (2) traditional lecture/ demonstration plus video; (3) video alone. Two comparisons were made to test the effectiveness of video training both as a complement and a replacement method for traditional lecture/ demonstration within existing training groups. The effectiveness of both was measured by changes in knowledge, attitudes and adoption intention. Two research questions are used to address the first research objective.

RQ1: How effective is the video when used to complement conventional lecture/demonstration training?

Previous research has shown that the combination of video with traditional conventional lecture/demonstration can effectively increase knowledge and develop positive attitudes toward the training technique and adoption of the recommended practice (Gandhi et al., 2007; Zossou et al., 2009b). Addressing this research question involves comparing the effectiveness of traditional lecture/demonstration only with the traditional lecture/ demonstration + video method.

RQ2: How effective is the video as a stand-alone training method with minimal facilitator involvement?

Many studies have found that training methods using video alone can attract farmers' interest, promote innovation and increase the adoption rate (Van Mele, 2006; Van Mele et al., 2007; Zossou et al., 2009b and 2010). Addressing the second research question involves comparing of effectiveness of video only with the traditional lecture/demonstration only method in improving knowledge levels, creating positive attitudes, and enhancing adoption intention.

The second objective of the current study is to evaluate the effectiveness of alternative training approaches in decreasing the gap in learning between male and female farmers, and among farmers with different bean planting volumes and education levels. Quantitative and qualitative data were gathered to answer the following research question:

RQ3: Can the video training method decrease the knowledge gap among farmers of different gender, acres of beans, and educational level?

The knowledge gaps between female and male farmers, and between farmers with higher or lower education levels and larger or smaller bean fields need to be understood and addressed. Research has shown that video can increase women's interest and involvement in the training and has the potential to promote learning (Bery, 2003; Van Mele, 2006; Lie & Mandler, 2009; Zossou et al., 2010; Chowdhury et al., 2011).

Chapter 3

METHOD

This study has three research questions: (1) to test whether video could be an effective complement to traditional lecture/ demonstration (comparison of traditional lecture/ demonstration method with the training method including the traditional lecture/demonstration plus video); (2) to test whether video could be an effective replacement for traditional lecture/demonstration with minimal facilitation (comparison of the traditional lecture/demonstration method with the video only method) ; and (3) to evaluate the effectiveness of training methods including video as a complement or replacement for the traditional lecture/demonstration method in decreasing knowledge gaps about row planting of beans among farmers who differ by gender, acres of beans planted and education level.

The first and second research questions test the effects of each training approach on farmers' knowledge, attitudes and intended behaviors about the row planting of beans. The third research question evaluates the effectiveness of alternative training approaches in decreasing the gap in knowledge levels between male and female farmers, and among farmers with different bean acreages and education levels.

The study was conducted as a quasi-experimental design, with three experimental groups to which participants were not randomly assigned. The study was conducted in four parishes (Naibowa, Bugeywa, Butansi and Naluwoli) in the Butansi sub-county of Kamuli district in Uganda. Quantitative and qualitative data were gathered. Quantitative data were collected using a pre-test/post-test design.

3. 1 Geographic location of the study

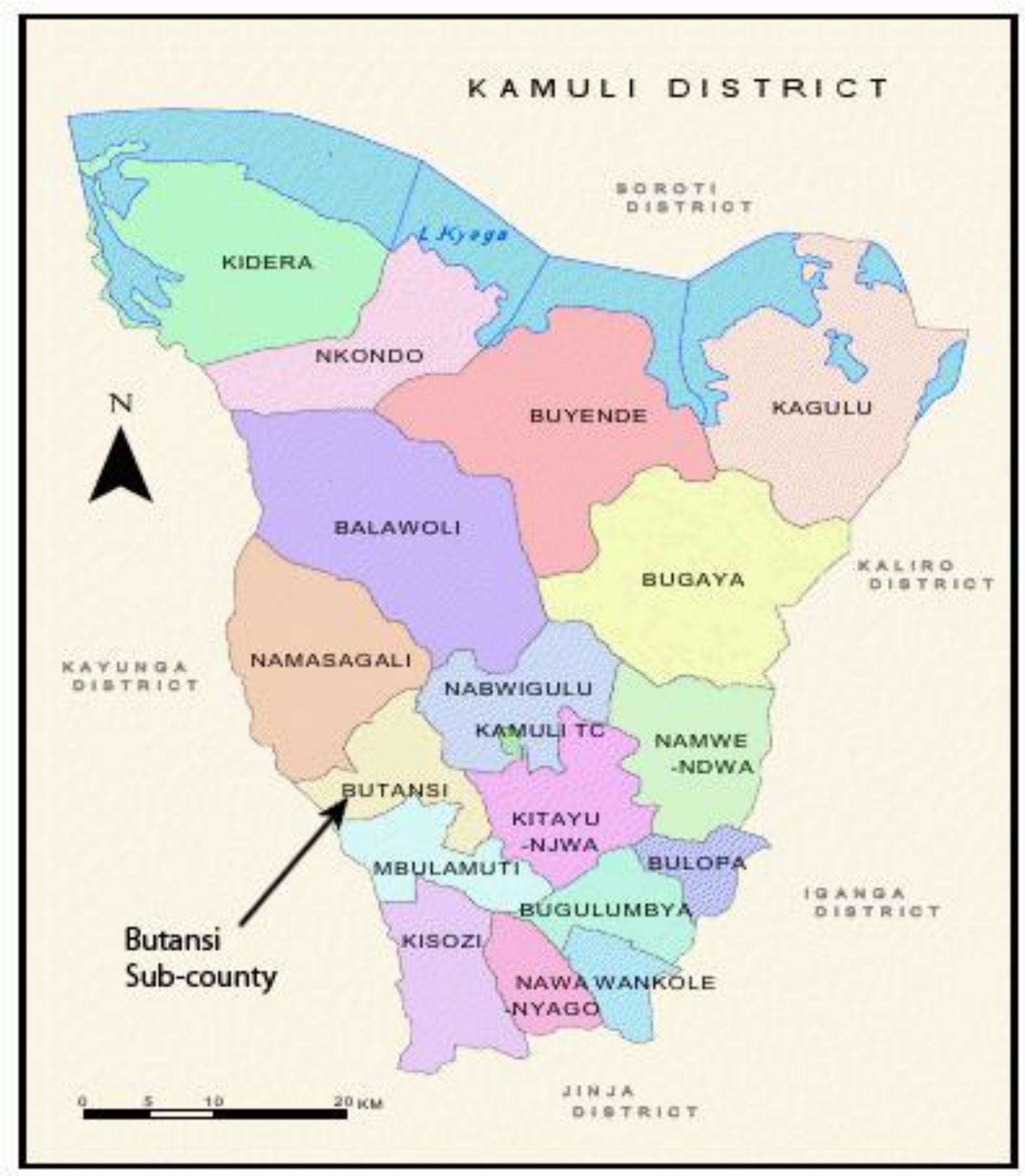
All farmers in Kamuli District who grew beans and were members of VEDCO's farmer groups (Figure 1) were eligible to participate in the study. The local extension staff and researchers chose Butansi sub-county with its four parishes as the research area (Figure 2) in part because farmers who were members of VEDCO groups in these four parishes had previously participated in a project under the Dry Grain Pulse Collaborative Research Support Program (CRSP).

The training activities in this area had been part of a joint project launched in 2004 by VEDCO, CSRL at Iowa State University, and Makerere University (Butler & Mazur, 2007). Before the quasi-experiment was implemented, the standard training procedures included lectures, demonstrations and flip charts. These procedures had been delivered to groups of 8-15 farmers each month.

Figure 1. Location of Kamuli District

Source: http://www.ezilon.com/maps/africa/uganda-maps.html

Figure 2. Location of Butansi sub-county



Source: https://sites.google.com/site/ictcentreuganda/kamuli-district

3.2 The Study Design

3.2.1 Sampling

The evaluation portion of this study is best described as a quasi-experimental design (Wimmer & Dominick, 2006, p.243) because participants were not randomly assigned to experimental treatments. Instead, farmers were assigned to experimental groups based on the sub-county district where they reside. The traditional lecture/demonstration group included participants from two small parishes (Naibowa and Bugeywa). The traditional lecture/demonstration + video group was composed of farmers from Butansi parish (same name as the sub-county). The third experimental group, the video only group, was composed of farmers from Naluwoli parish. The extent to which these groups are non-equivalent is explored later in the results section.

3.2.2 Experimental Groups

The division of farmers into three experimental groups is outlined in Table 1. Groups differed from each other based on the components of the training they received. They are as follows:

The traditional lecture/demonstration (traditional only) had 111 farmers and received only traditional lecture/demonstration training conducted by a community-based trainer (CBT). The lecture/demonstration lasted 30 minutes. The CBT staff first presented the theory underlying the training topic, which was followed by a field demonstration that used real tools, and the row planting process in a natural environment.

The traditional + video group was composed of 103 farmers and received the traditional lecture/demonstration plus the video training. Besides the same 30-minute traditional lecture/demonstration that the traditional only group received, the group was shown an eight-minute video immediately following the traditional lecture/demonstration.

The video only group was composed of 103 farmers who saw the training video (same as the video shown in the traditional + video group) with minimal facilitation (no traditional lecture/demonstration). For this group, the CBTs only mobilized farmers, organized the training, and promoted discussion. The video was shown twice to this group to enhance farmers' knowledge.

In all groups, after the lecture/demonstration and/or video, a "fellow farmer demonstration and discussion" followed in which one or two farmer-trainees were given 5 to 10 minutes to repeat in the presence of other farmers the theory and process taught by the CBTs or the video. A group discussion of 15-20 minutes followed.

Four CBTs were involved in this study. Two conducted the training, taking turns to reduce variations in training quality. The two other CBTs organized training and mobilized farmers.

Table 1. The Study's Experimental Design

Treatment	Parish	Training components (in order)	Duration (min.)
Traditional lecture/ demonstration only	Naibowa & Bugeywa	1. Traditional lecture and field demonstration	30
		2. Farmer demonstration and group discussion	15
Traditional lecture/ demonstration + Video	Butansi	1. Traditional lecture and field demonstration	30
		2. Video	8
		3. Farmer demonstration and group discussion	15
Video only	Naluwoli	1. Video	8
		2. Farmer demonstration and group discussion	25
		3. Video	8

3.3 Experimental Procedure

Before training, a knowledge test about bean row planting was administered to the farmer-participants. This test was developed with the local extension staff and is described further in section 3.5. Basic demographic data, such as household characteristics, bean production data and information sources for bean production also were obtained. Although most participants had previously received training on row planting during the June to July 2011 planting season, the local extension staff had observed that many had already forgotten some of the main procedures the technique entails.

After training, farmers completed a post-test which included the same knowledge, attitude, and adoption intentions test used for the pretest and were asked to evaluate the training method to which they had been exposed. Local interviewers who spoke English and the local languages were trained and hired to collect data. Before the experiment, they were trained by the researchers and local extension staff about row planting and skills for interviewing and data collection. Each participant was interviewed individually at the training site immediately before and after the training.

A pilot study of the experimental procedure and questionnaire was conducted on Feb. 13 and 14, 2012, in a non-experimental parish where farmers had characteristics similar to those in the test groups. The participants in this pilot-testing site received the traditional + video training and were evaluated following a pretest/post-test design. Slight changes were made to the questionnaire as a result of the pilot study.

In the actual experimental test sites, the researcher, through a translator, read the informed consent document, which specified the purpose of the study and the estimated time it would take to conduct the study. They were also told that their participation should be completely voluntary. Participants were told they could choose not to answer any question that might make them feel uncomfortable, and they were free to stop the interview at any time. The study and its component questionnaire were approved by Iowa State University's Institutional Research Board and the Uganda National Council for Science and Technology.

3.4 Training Topic and Video

Row planting (or planting in lines) is a technique to improve bean yield and bean quality. This technique requires farmers to (1) plant beans at the beginning of the rainy season (2) in rows that are 50 cm (1.5 ft) apart with (3) each seed planted 15-20 cm (0.5 ft) apart. (4) Different varieties should be planted at least two meters apart so they do not mix. Row planting makes weeding, identification of pests and diseases easier, facilitates spraying, and helps the plant to access sufficient nutrients. The main tools used for planting in rows include strings, two 1.5 ft. sticks (pugs) and a hoe.

The video was shot in Kamuli district in July 2011 by ISU professors Eric Abbott and Robert Mazur. In the video, a male local farmer demonstrated row planting in his own garden, which had similar field conditions to those of the subjects in the training. He explained the theory of row planting, including the problems it solves, the main process it involves and the tools needed in the local language. Then, he demonstrated each step of the row planting process, including digging the trench, measuring the distance between rows using the pug and planting the seeds. In late August 2011, the author edited the raw video. Professors and students at ISU and Makerere University, as well as the local extension staff reviewed the video for technical accuracy.

3.5 Conceptual and Operational Definitions of Study Variables

To test the effectiveness of each training method, the participants' knowledge, attitude toward the training topic, and intention to adopt the innovation were measured before and after the training.

Knowledge score. A knowledge test composed of four open-ended questions about row planting was used to evaluate what farmers learned. The questions are: (1) What are the problems row planting intends to solve? (2) What are the main procedures involved in row planting? (3) What are the benefits of row planting? (4) What tools do farmers need to implement row planting? The answers to this knowledge test are summarized in Table 2.

To measure knowledge, trained interviewers asked farmers to answer each of the four questions in their own language. Farmers received one point for each correct answer. For example, one participant who mentioned "higher yields" and "making spraying easier" in answer to the question, "What are the main benefit(s) you get or would get from adopting row planting?" received two points. The knowledge score was determined by counting the number of correct points about bean row planting. The highest possible score was 15; the lowest was 0. The score a participant received before training was labeled Time 1 Score. After training, the post-test score was called the Time 2 Score

Table 2. Knowledge Test Questions and Answers

Knowledge Test Questions	Answers	No. of subjects with correct answer before training (% of N)	No. of subject with correct answer after training (% of N)
1. What are the problems row planting is intended to solve?	a. Weeding difficulty	293 (90.2)	316 (97.2)
	b. Spraying difficulty	145 (44.6)	304 (93.5)
	c. Insufficient nutrients for plants	87 (26.8)	242 (74.5)
2. What are the main procedures for row planting?	a. Plant at the beginning of the rainy season for better utilization of soil moisture	273 (84.0)	309 (95.1)
	b. Plant beans in rows	293 (90.2)	318 (97.8)
	c. Rows should be 50cm (1.5 ft) apart	130 (40.0)	318 (97.8)
	d. Seeds should be sown 15-20cm (0.5 ft) apart	122 (37.5)	310 (95.4)
3. What are the main benefit(s) you get or would get from adopting row planting?	a. Higher yields	262 (80.6)	305 (93.8)
	b. Making weeding easier	287 (88.3)	318 (97.8)
	c. Making spraying easier	145 (44.6)	320 (92.9)
	d. Increasing access to sufficient nutrients	105 (32.3)	261 (80.3)
4. What tools would you need to adopt row planting?	a. Strings	233 (71.7)	321 (98.8)
	b. 2 pugs each one 1.5 ft	130 (40.0)	308 (94.8)
	c. Hoe	286 (88.0)	320 (98.5)

Attitude. Attitude toward the recommended practice was measured by asking farmers to rate the overall value of planting beans in rows to improve production. A four-point scale gauged the participants' attitudes (1 for "will not be an improvement at all" and 4 for "would be a substantial improvement").

Adoption intention. The participants' intention to adopt row planting was measured by asking how likely (1 for "not likely at all" and 4 for "very likely") it would be that they would use the recommended practice during the next bean growing or post-harvest season.

To evaluate the quality of the three training methods, farmers were asked to rate how clearly they heard and saw each training message.

Demographic differences among farmers can affect their learning from training. In order to answer the third research question, gender, education level, and acres of beans planted were used as covariates to test the effectiveness of each training method in decreasing knowledge gaps about row planting.

Education level was measured by asking how many years of formal education the participants had received. Acres of beans planted was calculated by the acres of beans subjects planted in the most recent growing season.

In addition, participants rated the usefulness and technical correctness of the messages provided during the training (1 for "lowest quality" and 4 for "highest quality").

Open-ended questions were asked to collect in-depth opinions about which training methods enhanced farmer understanding of row planting. Farmers were asked about perceived advantages and disadvantages of row planting of beans, and suggestions were solicited regarding how to improve the effectiveness of each training method.

3.6 Data Analysis

The first and second research questions asked whether video could effectively complement and replace the traditional demonstration and lecture training method, respectively. Given the between- and within-subjects design described above, differences in knowledge, attitudes and adoption intentions before and after training were tested by using repeated measures ANOVAs. The visual and audio quality of the training method also were evaluated to answer the first two research questions.

The third research question examined whether the video method can decrease the knowledge gap among farmers of different gender, acres planted to beans, and educational level. This research question was studied by conducting three separate repeated measures ANOVAs of knowledge scores that use the demographic variables gender and educational level and the agriculture characteristic acres devoted to bean planting as separate covariates.

A repeated measures test was conducted to test the difference in knowledge scores between experimental groups over time. Simple between-subjects ANOVA tests were not employed because they assume independent observations. In this study, the before-after knowledge score comparison violated this assumption because it measured the same subjects before and after training.

CHAPTER 4

RESULTS AND DISCUSSION

The main purpose of the study was to evaluate the effectiveness of video as a training tool in Kamuli District, Uganda. Three research questions were examined: (1) How effective is video when used to complement conventional lecture/demonstration training? (2) How effective is video as a replacement for conventional lecture/demonstration training with minimal facilitator involvement? (3) Can the video only method decrease the knowledge gap among farmers who differ by gender, farm size, and educational level? The sample for this study consisted of 325 farmers from Kamuli District, Uganda, who volunteered to participate in the study.

Tables 3 and 4 present the participants' demographic and bean production characteristics. Table 3 shows that 80 males and 245 females participated in this research. Agriculture was the main occupation of all but eight participants. Table 4 shows that the average years of education was 5.81(SD = 3.81), but 18.2% had never been to school. Only 26% had finished primary school (seven years of education); less than 3% finished senior school (13 years of education). The average age of all participants was almost 41 years (M = 40.97, SD = 12.12). The average household size was eight (often with three adults and five children). The participants planted an average of 0.54 hectares (SD = 0.41) to beans, which is about 14% of the average total farmland they own (M = 3.85, SD = 5.07). A great majority (77.5%) said they saved beans for seeds (N = 252, M = 19.38, SD = 18.25), 77.2% saved beans for home consumption (N = 251, M = 38.07, SD = 37.72), and 53.2% saved beans for sale (N = 173, M= 65.40, SD = 124.90).

4.1 Comparison of Demographic Characteristics by Experimental Group

Chi-square tests indicate a significant difference in the percentage of men and women in the three experimental groups (Table 3). Specifically, the percentage of men was much lower (12.6%) in the video only group than in the other two groups.

The results of a one-way ANOVA test show significant differences among the three groups in terms of education (F [2, 322] = 3.68, *p* = .03) (Table 4). A Least Significant Difference (LSD) *post hoc* test indicated that members of the traditional lecture/demonstration group had significantly higher education than those in the video only group (p < .01) (Table 4). There were no significant differences in age (F [2, 317] = 2.71, p = .07) and farmland owned (F [2, 314] = 1.21, p = .30).

However, the traditional lecture/demonstration group planted significantly more beans during the 2011 growing season (Table 4). An LSD *post hoc* test showed that farmers in this condition produced significantly more beans in 2011 (M = .68, SD = .49) than those in the video only group (M = .5, SD = .35) and the traditional + video group (M = .43, SD = .31).

The difference in amount of beans used for seed among experimental groups was also significantly different (F [2, 250] = 3.05, p = .05). An LSD *post hoc* test found that farmers in the traditional group saved significantly more beans for seeds than those in the video only group. Farmers in the traditional + video and video only groups saved fewer seeds, but sold more, which suggests that they depended more on outside seed sources.

Table 3. Comparison of Demographic and Farming Characteristics of Subjects by Experimental Group

		Traditional only		Traditional + video		Video only		Total		
Variable	Category	N	%	N	%	N	%	N	Total %	χ^2
Gender	Male	37	33.3	30	27.0	13	12.6	80	24.6	12.88**
	Female	74	66.7	81	73.0	90	87.4	245	75.4	
	Total	111	34.2	111	34.2	103	31.7	325	100	
Occupation	Agriculture	108	97.3	108	97.3	101	98.1	317	97.5	.17
	Other	3	2.7	3	2.7	2	2.0	8	2.5	

$^* p < .05$, $^{**} p < .01$

Table 4. Comparison of Demographic Characteristics of Subjects by Experimental Group

	Traditional only		Traditional + video		Video only		Total		
Variable	Mean	SD	Mean	SD	Mean	SD	Mean (SD)	F	sig
Years of education	6.40	3.92	5.96	3.86	5.02	3.54	5.81 (3.81)	3.68*[b]	.03
Age	39.86	12.01	43.12	13.42	39.78	10.37	40.97(12.12)	2.71	.07
Total household members	8.09	3.59	8.10	3.91	7.91	2.63	8.04 (3.42)	.10	.90
Acres of farmland owned	4.29	6.82	3.99	4.29	3.23	3.27	3.85 (5.07)	1.21	.30
Acres of beans planted	.68	.49	.43	.31	.50	.35	.54 (.41)	11.68**[ab]	.00
Beans for seeds (KG)	22.79	22.40	18.07	16.16	16.28	12.95	19.38 (18.25)	3.05*[b]	.05
Beans for home consumption (KG)	38.83	41.30	40.05	37.40	34.64	32.86	38.07 (37.72)	.43	.65
Beans for sale (KG)	57.82	93.35	72.31	153.09	69.91	135.65	65.40 (124.90)	.253	.78

[a]LSD *post hoc* test confirms a significant pairwise mean difference between traditional group and traditional + video group.
[b]LSD *post hoc* test confirms a significant pairwise mean difference between traditional group and video only group.
$^* p < .05$, $^{**} p < .01$

4.2 Research Questions 1 and 2: Video as a Complement to or Replacement for the Traditional Lecture/Demonstration Training Method

The first research question asked whether video could be an effective complement to the conventional lecture/ demonstration method. The second research question evaluated the effectiveness of video in replacing the conventional lecture/ demonstration method. These research questions were explored by evaluating participants' knowledge of, attitudes about, and intentions to adopt row planting.

4.2.1 Pre-test of Subjects' Knowledge Level, Attitude and Adoption of Row Planting Before Training

Prior to the experiment, a pre-test was conducted to assess what farmers already knew about row planting, and how many were already using this practice. This was especially important because the local extension staff had already conducted training on row planting during the last growing season (September and October 2011) with the very same groups of farmers involved in the experiment. However, the local extension staff reported that many farmers had already forgotten their knowledge of row planting, perhaps because what they learned had not been reinforced since the last growing season.

The pre-test showed that 92.9% had heard about row planting. Fifty-two percent said they knew something about row planting, 30.2 % thought they knew a little, and less than 10% said they knew a lot about row planting. A large percentage (85.5 %) reported planting their beans in rows in the last growing season.

Open-ended questions were asked to analyze the reasons for adoption (What is the main reason for your decision?) and to identify the problems hindering the adoption of the technique after training (What might cause farmers like you to *not* adopt the practice that was recommended?). The main reasons for adopting row planting included the understanding that row planting could simplify agronomic practices and that the practice increases yield. Information learned from training led many to adopt the row planting method.

The following are examples of reasons for adopting row planting:

"(Row planting) helps ease agronomic practices like weeding, spraying, and harvesting."

Female, 32

"Because of the training (I received), I will be able (to plant in rows), a practice that will give higher yields."

Female, 52

"High yields are obtained from a small piece of land (when one practices row planting)."

Female, 52

The participants were also asked what might hinder a farmer's adoption of the practice. The answers were grouped into six categories listed in Table 5. Some said that although row planting could ease weeding, spraying and harvesting, it takes more time and energy because the farmer has to follow a certain spacing method. Moreover, the lack of seeds and training decreased farmers' ability to take advantage of this practice. Other reasons for non-adoption included sickness, low appreciation of the need to plant in rows, and natural impediments such as drought and hail.

Table 5. Problems Hindering Adoption of Row Planting

Problems	Number of people who mentioned this problem	% of N
The practice consumes a lot of time and energy	70	21.5
Insufficient seeds	21	6.5
Lack of farmers' training	20	6.2
Low regard for row planting	8	2.5
Sick	7	2.2
Bad natural environment	5	1.5

The following are examples of factors cited as hindering the adoption of the row planting technique:

"Farmers had difficulty because they have never been trained on how to do row planting."

Male, 52

"You need two people (to do this). The work load is too much for just one person."

Female, 48

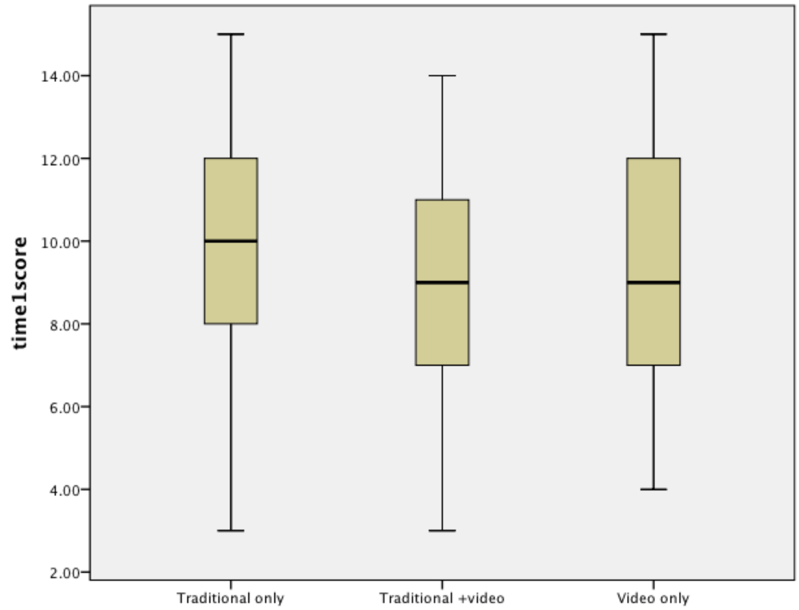
"Some fail to get seeds or were sick at planting time."

Female, 66

4.2.2 Knowledge Scores Before Training (Time 1 Score)

Knowledge scores across the three experimental groups before training (Time 1) were analyzed using one-way ANOVA tests (between experimental groups). The boxplot in Figure 3 shows that all three experimental groups were approximately balanced around the median of each group. The traditional lecture/demonstration group had a higher Time 1 score than in the video only group and the traditional + video group. In addition, there is more variation in the video only group than in the other two. The results shown in Table 6 suggest that before training, the knowledge scores of farmers in the three groups were significantly different ($F[2, 298] = 6.88$, $p<.01$). An LSD *post hoc* test showed that the traditional lecture/demonstration group's score at Time 1 (M=10.02, SD=2.61) was significantly higher than that of the traditional + video group (M=8.64, SD=2.54) ($p < .01$). Besides differences in education levels and acres planted to beans, these differences could be caused by the differing effectiveness of previous training, which might be attributed to differences in the ability of CBTs to deliver content and to mobilize farmers to adopt row planting.

Figure 3. The boxplot of Time 1 knowledge score in each experimental group



experimental group

Table 6. Results of an ANOVA Testing the Difference in Knowledge Scores Among the Three Groups at Time 1

	N	Mean	SD	M.S.	df	F	sig
Traditional	111	10.02	2.61				
Traditional + Video	111	8.64	2.54	49.14	2	6.88**[a]	.00
Video only	103	9.34	2.86				

[a]LSD *post hoc* test confirm a significant pairwise mean difference between traditional only group and traditional + video group
*** p < .01*

4.2.3 Knowledge Test Scores After Training (Time 2 Score)

Farmers' post-test knowledge scores (Time 2) across the three experimental groups also were analyzed using a one-way ANOVA test (between experimental groups). The boxplot in Figure 4 shows that the distribution of knowledge scores in all three experimental groups shifted to the top part of the inter-quartile range at Time 2 (the full score was 15). The Time 2 knowledge score of the traditional + video group was almost the same (Table 7) as the Time 2 knowledge score of the traditional only group, but higher than that of the video only group. A ceiling effect in knowledge scores may be occurring here.

Test results in Table 7 show that knowledge scores across groups were not significantly different at Time 2 (F [2, 315] = .92, p = .40).

Figure 4. The boxplot of Time 2 Knowledge Scores for each experimental group

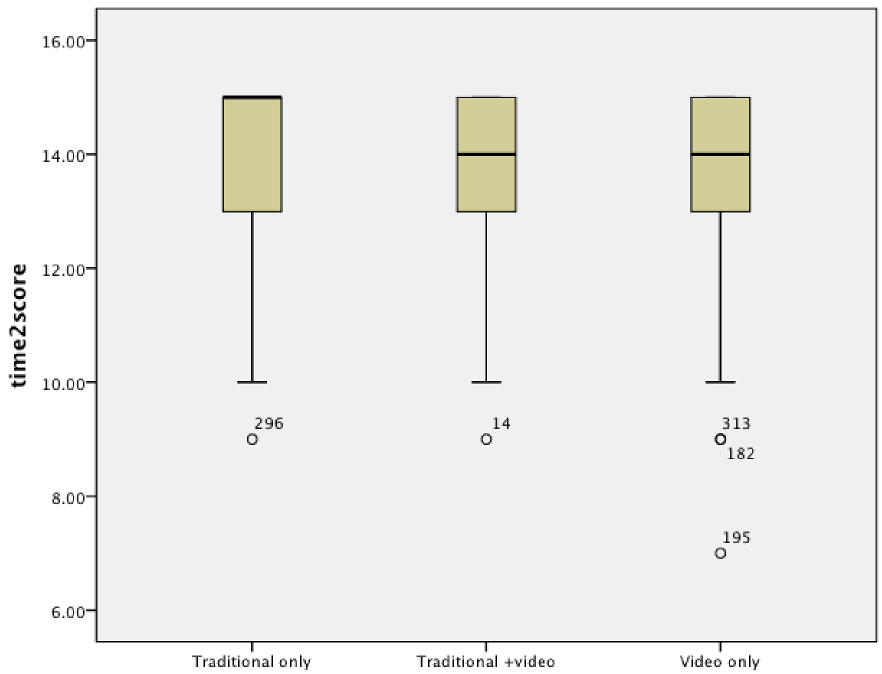


Table 7. Results of an ANOVA Testing the Difference in Knowledge Scores Among the Three Groups at Time 2

	N	Mean	SD	M.S.	df	F	sig
Traditional	111	13.93	1.47				
Traditional + video	111	13.93	1.40	2.15	2	.92	.40
Video only	103	13.81	1.70				

4.2.4 Knowledge Scores Before and After Training

Farmers' Time 1 and Time 2 knowledge scores within each experimental group were analyzed by using three separate t-tests (within experimental group tests) (see Table 8).

Results indicate that Time 2 scores were significantly higher than Time 1 scores. Farmers in the traditional + video group had the highest difference (5.29) in knowledge scores between Time 1 and Time 2, while those in the traditional only group had the smallest.

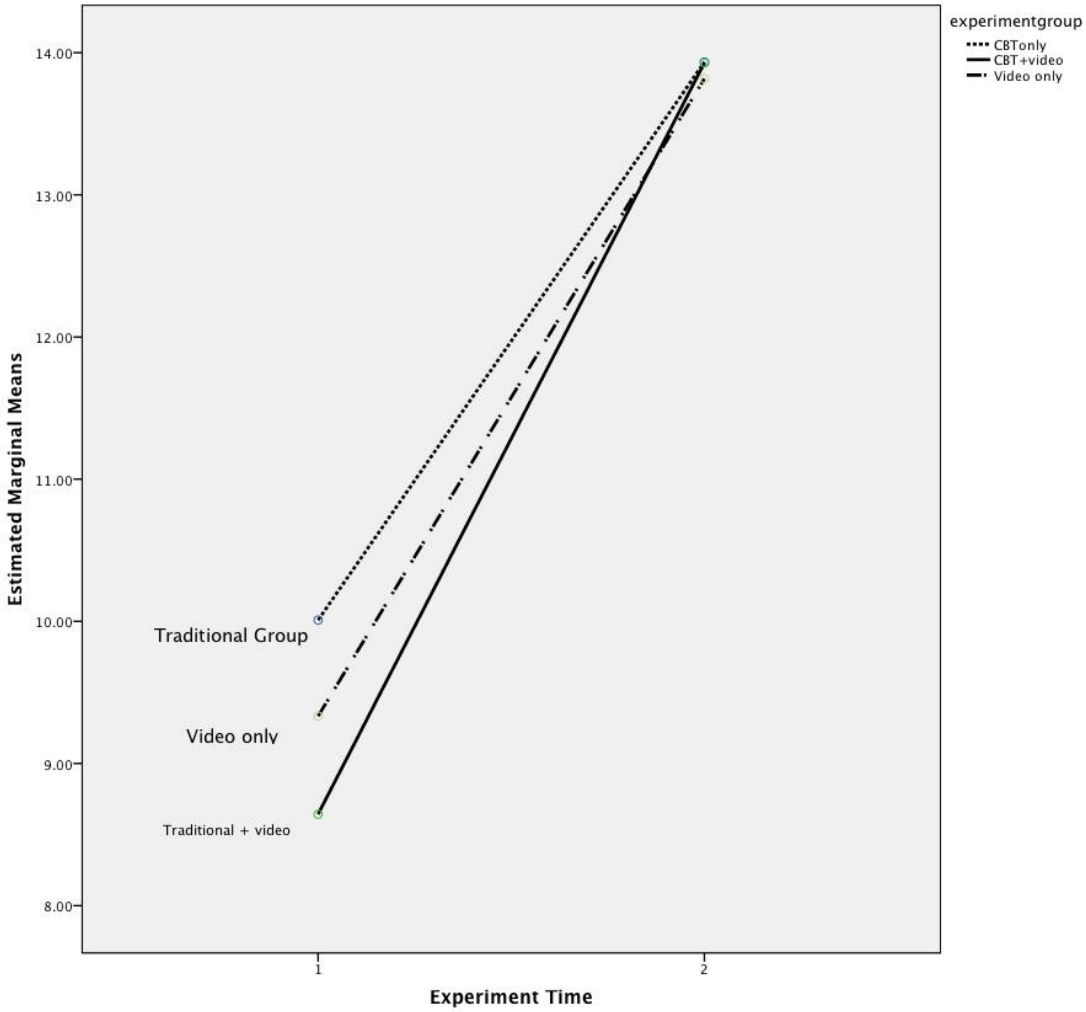
Table 8. Results of t-Tests Showing Difference in Time 1 & Time 2 Scores (Change Score) Within Groups

Experimental Group	df	Time 2- Time 1 (SD)	t-value
Traditional	105	3.92 (2.57)	-15.75***
Traditional + video	97	5.29 (2.71)	-19.34***
Video only	92	4.48 (2.56)	-16.86***
Total	296	4.55 (2.66)	-29.42***

***$p < .001$

Figure 5 shows the knowledge scores of the three groups at Time 1 and Time 2. The short-dash line represents the knowledge score of the traditional lecture/demonstration group, the solid line represents the knowledge score of the traditional + video group, and the stroke-dash line shows the knowledge score of the video only group. All three lines show increases in knowledge over time. However, there was a clear difference in Time 1 scores between groups. The traditional lecture/demonstration group had the highest Time 1 score, and the traditional + video group had the lowest. The difference in scores between groups decreased, and a crossing of the traditional + video group and video only group lines was found, which means that at Time 2, the traditional + video group outperformed the video only group.

Figure 5. Knowledge scores of the three experimental groups before and after training



A repeated ANOVA test was conducted to test whether differences in knowledge scores between groups over time observed in Figure 5 were significant. The results, shown in Table 9, suggest a significant within-group effect between pre-test (Time 1) and post-test (Time 2) scores (Wilks' lambda = .25, F [1, 294] = 904.08, $p < .01$) and a significant between-experimental group effect (F [2, 295]=4.01, $p = .02$).

There is also evidence of a significant 2 x 3 interaction between test time and experimental group (F [2, 295] =6.95, p= .0.01), indicating that the change in knowledge scores was significantly different in the three groups over time. LSD *post hoc* tests of this interaction effect revealed that the knowledge score change observed in the traditional lecture/demonstration group, which had the highest Time 1 score (Table 7), was significantly less than the change in scores seen in the traditional lecture/demonstration + video group ($p < .01$) and the video only group ($p = .04$).

Table 9. Result of a Repeated Measures ANOVA Testing Differences in Knowledge Score at Time 1 and Time 2 by Experimental Group

	Df	ss	ms	F	Pr>F
Between subjects					
Group	2	48.50	24.25	4.01*[ab]	.02
Error	295	1784.75	6.05		
Within subject					
Test Time	1	3085.30	3085.30	904.08**	.00
Test Time*Group	2	46.74	23.37	6.95**	.00
Error	294	1002.54	3.41		

[a]LSD *post hoc* test confirms a significant pairwise mean difference between traditional group and traditional + video group.
[b]LSD *post hoc* test confirms a significant pairwise mean difference between traditional group and video only group.
* $p < .05$, ** $p < .01$

In summary, the results indicate that all three training approaches improved knowledge scores. The results also suggest that videos could effectively complement traditional lecture/demonstrations, and that the training method involving both may be the most effective in enhancing knowledge levels. The video only group's Time 2 score was as high as that of the other two groups after training, which suggests that videos can effectively replace the traditional lecture/ demonstration training method.

Considering the participants' exposure to previous lectures and demonstrations, the relatively low change score in the traditional group may be due to a ceiling effect (Richardson, Kitchen & Livingston, 2002, p. 339). That is, those in this group knew more about row planting before training as evidenced by their knowledge score of 10 (out of 15). In comparison, their counterparts in the traditional + video scored an average of 8.64 while those in the video only group had an average score of 9.34. After the training, the knowledge scores of farmers in the three groups were almost the same. The Time 2 scores approached 14 (out of 15).

4.2.5 Attitude and Adoption Intention After Training

The farmers' attitudes toward row planting were ascertained by asking how they rated the overall value of row planting. Their intention to adopt the practice was measured by asking how likely they were to plant beans in rows during the next growing season.

The results were very similar across groups. Most (N = 310 farmers) agreed that row planting could substantially improve harvest; only eight thought this technique would yield only a slight improvement.

Nearly all (98%) said they were very likely to adopt this technique. Because of the small variance in the answers, no further analysis was done about the relationship between the training method and farmers' attitude toward row planting or intention to adopt. Future studies might be able to confirm actual adoption in the following seasons.

4.3 Evaluation of the Training Methods

After the training, participants in each group evaluated the training methods to which they were exposed.

4.3.1 Quality Evaluation

To determine training quality, the farmers were asked four Likert-scale items that aimed to assess the extent to which (1) they were able to hear the training, (2) they were able to see the training, (3) they consider the training as useful, and (4) they find the training interesting. The lowest score was zero; the highest was four. Table 10 shows that the farmers assessed the three training methods as almost uniformly positive (4 is the highest score).

Table 10. Farmers' Evaluation of Each Training Method

Training method		Traditional lecture/ demonstration only group	Traditional + video group	Video only group
Traditional	Audio	3.98	4.00	-
	Visual	3.96	4.00	-
	Usefulness	3.97	4.00	-
	Interesting	3.99	4.00	-
Video	Audio	-	3.98	4.00
	Visual	-	3.99	4.00
	Usefulness	-	3.98	4.00
	Interesting	-	3.98	4.00

4.3.2 Advantages, Disadvantages and Suggestions About the Traditional Lecture/ Demonstration and Video Training Methods

The farmers' suggestions about ways to improve training were solicited. According to them, the traditional lecture/ demonstration training provided clear and specific information, gave practical examples, and offered opportunities for the trainer to interact with farmers (Table 11). These remarks reflect the fact that CBTs with locally adapted teaching skills were knowledgeable about training topics. How they collect feedback and answer questions during and after training were crucial for local people to understand the theory behind row planting, adopt the technique, and solve problems encountered while implementing the practice.

The main disadvantage of the traditional approach (see Table 12) was the limited number of CBTs who could provide training. Their resources also are limited. Each CBT needs to serve farmers in two parishes. Bad roads and few ways to reach farming areas decrease their ability to provide training.

The farmers said that they need frequent and good quality training, especially before and during the growing season (Table 13). They recommended that CBTs should be further trained to improve their ability to teach. Some suggested the CBTs bring a blackboard to training.

The following are examples mentioned as advantages of traditional training.

"The CBT allowed farmers to ask questions and he answered all of them."

Female, 49

"The CBT was very near to farmers and was very clear in what she has to say."

Female, 42

"The CBT showed farmers how to measure [distance] using the hands."

Male, 24

A farmer said about the disadvantages of traditional training:

"The units (of measure) were not translated into the local language."

Male, 34

The following are examples of suggestions to improve traditional training.

"CBTs should train farmers at the beginning of the (growing) season."

Male, 25

"CBTs should visit farmers regularly so farmers will not forget (what they have been taught)."

Female, 30

"(The CBTs) should have blackboards to make learning easy."

Male, 32

Those who received video training were satisfied with the clarity of the information provided, the field examples, the background information, and the localized content (Table 11). The CBTs often find it hard to demonstrate some techniques in the field because of site limitations. The video, recorded in the field and featuring local farmers, was able to offset this difficulty. Videos also made it possible to show specific details. Some found video training very engaging.

The farmers raised three disadvantages of video training (Table 12). They report not being satisfied with the low interaction. They also said they could not ask questions of the actors. Farmers with vision or hearing problems were disadvantaged. A female farmer complained about the greater role of male farmers in the video.

Nearly a quarter of those who watched the video suggested that it be included in regular training programs (Table 13). Some requested to add female farmers as main actors. Others recommended adding demonstration techniques in different environments, such as row planting on sloping land.

The following are examples of the advantages of video training mentioned by the participants.

"The person in the video talked in the local language, had all the materials, and demonstrated well."

Male, 38

"The use of examples helped me to understand the topic."

Female, 48

"(The video showed the appropriate) way to prepare land, (and) the materials for row planting."

Female, 48

"The video was interesting. The CBTs should continue to use them."

Male, 25

The following are examples of the disadvantages of video training mentioned by the participants.

"The video did not say how to use fertilizers well. In the video, the farmer did not take care of his garden."

Male, 60

"The video did not mention the depth of the trench where one puts the seed"

Female, 40

The following are examples of suggestions to improve video training mentioned by the participants.

"The video should show a bigger picture."

Female, 45

"The woman should participate in planting instead of leaving the man alone to do the job."

Female, 28

Table 11. Perceived Advantages of Each Training Method

Advantages of traditional lecture/ demo	Advantages of video
1. Provides clear and specific information	1. Gives clear training information
2. Localization of measurement and language	2. Provides good examples
3. Good teaching skills	3. Attractive
4. Interaction between CBT and farmer	4. Provides background information
5. Gives confidence to farmer	5. Localization
6. Gives practical examples	6. Teaching in a similar way as the CBT
7. Others	7. Training can be done in distant places

Table 12. Perceived Disadvantages of Each Training Method

Disadvantages of lecture/ demo	Disadvantages of video
1. Not enough CBTs who can train	1. Low interaction
	2. Unclear visual for people with eyesight problems
	3. Only male actors in the video

Table 13. Suggestions to Improve Training Methods

Suggestions for lecture/ demo	Suggestions for video
1. Frequent and regular training	1. Include videos in regular training
2. More interaction between CBT and farmers	2. Provide more examples under different agro-climatic conditions
3. Better demonstration skills are needed	3. Include more women in the video
4. CBTs should increase their own knowledge	4. Improve the sound and enlarge the picture
5. (CBTs should) bring blackboard with them in training	5. Add more information

4.4 Research Question 3: Can Video Training Decrease the Knowledge Gap Among Farmers Who Differ by Gender, Acres Planted to Beans, and Educational Levels?

The third research question explored whether video training can decrease the knowledge gap among farmers who differ by gender, acres planted to beans, and educational level. This research question was studied by employing three repeated measures ANOVAs with a covariate to determine differences in knowledge score change from Time 1 to Time 2 among farmers with different characteristics.

A correlation matrix was produced to examine the relationships among knowledge scores, education, bean acreage, and gender. Table 14 displays the results.

All three covariates had significant correlations with *Time1Score*. These were *gender* (-.17, p < .00), *education* (. 27, p <. 01) and *acrebean* (.21, p <. 01). The associations between *gender* and *Time1Score* indicated that females (*gender* = 1) have lower *Time1Scores* than males (*gender* = 0). In addition, subjects who had higher education levels and acres planted to beans have higher *Time1Scores*.

All three covariates also had significant correlations with *Time2score*. However, the correlations were less strong than those with *Time1score*.

Table 14. Bivariate Correlation of Knowledge Scores, Gender, Education and Acres Planted to Beans (Acrebean)

	Time 1score	*Time 2score*	*Gender*	*Education*	*Acrebean*
Time 1score	1.00				
Time 2score	.32**	1.00			
Gender	-.17**	-.13*	1.00		
Education	.27**	.15**	-.29**	1.00	
Acrebean	.21**	.15**	-.12**	.02	1.00

** p < .05, ** p < .01*

4.4.1 Change in Knowledge Score by Gender

Table 15 presents knowledge scores by group for males and females at Time 1 and Time 2. In total, women increased their average knowledge score from 9.09 at Time 1 to 13.72 at Time 2, an increase of 4.63. These scores were lower than those for males, who averaged 10.15 at Time 1 and 14.19 at Time 2, an increase of 4.04.

Figures 6.1, 6.2 and 6.3 show the change in knowledge score by gender across groups over time. The solid version of these lines represents the knowledge scores of males, while the short dash lines represent the knowledge scores of females.

All six lines show increases in knowledge over time. The figures show that in each experimental group, males had higher knowledge scores than females before and after training. However, the gender difference in knowledge scores decreased over time, suggesting that women learned more from the training than men. In the traditional lecture/ demonstration group, the difference in knowledge scores between men and women narrowed from 0.63 (Time 1) to 0.1 (Time 2). In the traditional + video group, the difference in knowledge scores before training was 1.65 (men=9.82; women=8.17), while the difference between Time 2 scores for men and women decreased to 0.4. In the video only group, there was only a slight decrease in the difference in knowledge scores between men and women; women learned as much as men in the video only group.

The changes in knowledge scores over time, the differences between treatment groups, and differences in knowledge scores between men and women are shown in Table 16. Across time, significant differences between groups [F (2,293) = 3.82] were detected after controlling for the effects of gender. In addition, there were significant gender differences after controlling for the group effect as indicated by the between-subjects average scores for men and women. These were consistent with the finding that women started with lower scores at Time 1(9.09 compared to 10.15 for men) in all three experimental groups. This indicates that differences in knowledge about row planting between males and females existed before the training (Table 15). However, after the training, the gap in knowledge scores between gender decreased. Women's knowledge scores increased most rapidly in the traditional + video group (from 8.17 to 13.81).

There were also significant within-subjects differences, also indicated in Table 16. The F-test associated with TestTime [F (1, 293) = 611.70] is consistent with the fact that average knowledge scores were always higher at Time 2 compared with Time 1. There was also a significant TestTime x Group interaction (F [2, 293] = 6.97), which indicated that the change in knowledge scores before and after training between experimental groups was significant. The change in knowledge score was marginally significant for the TestTime x Gender interaction (F[1, 293] = 4, *p* = .05), which indicates that the change was significant for men and women.

The findings suggest that the traditional + video and the traditional only methods could effectively close knowledge gaps between men and women. The video only method demonstrated a lesser ability to narrow the knowledge gap. It should be noted that men, especially those in the traditional group, already had high scores at Time 1 (10.44), and therefore did not have much room to improve their scores, suggesting a ceiling effect.

Table 15. Knowledge Score Means (with Standard Deviations) at Time 1 and Time 2 by Treatment and Gender

	Traditional only		Traditional + Video		Video only		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Women T1	9.81	.31	8.17	.32	9.24	.29	9.09	2.80
Women T2	13.90	.18	13.81	.18	13.73	.17	13.72	1.59
Men T1	10.44	.46	9.82	.50	10.00	.80	10.15	2.33
Men T2	14.00	.26	14.21	.28	14.46	.45	14.19	1.26

Table 16. Results of a Repeated Measures ANOVA Testing the Differences in Knowledge Scores at Time 1 and Time 2 Using Gender as a Covariate

	df	SS	MS	F	Pr>F
Between subjects					
Group	2	45.09	22.54	3.82*	.02
Gender	1	49.46	49.46	8.38**	.00
Error	293	1730.31	5.91		
Within subject					
TestTime	1	2066.44	2066.44	611.70**	.00
TestTime*Group	2	47.10	23.55	6.97**	.00
TestTime*Gender	1	13.50	13.50	4.00*	.05
Error	293	989.81	3.38		

* $p < .05$, ** $p < .01$

Figure 6.1 Knowledge Scores at Time 1 and Time 2 by treatment and gender in traditional only group

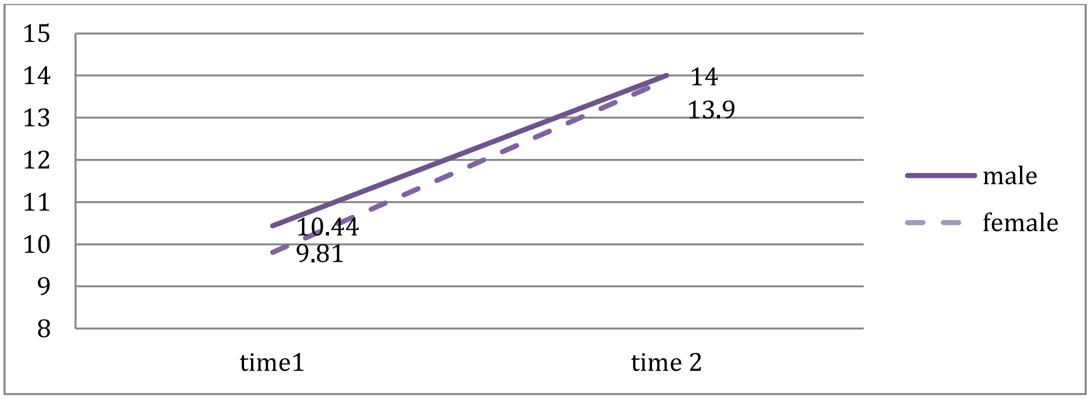


Figure 6.2 Knowledge Scores at Time 1 and Time 2 by treatment and gender in traditional + video group

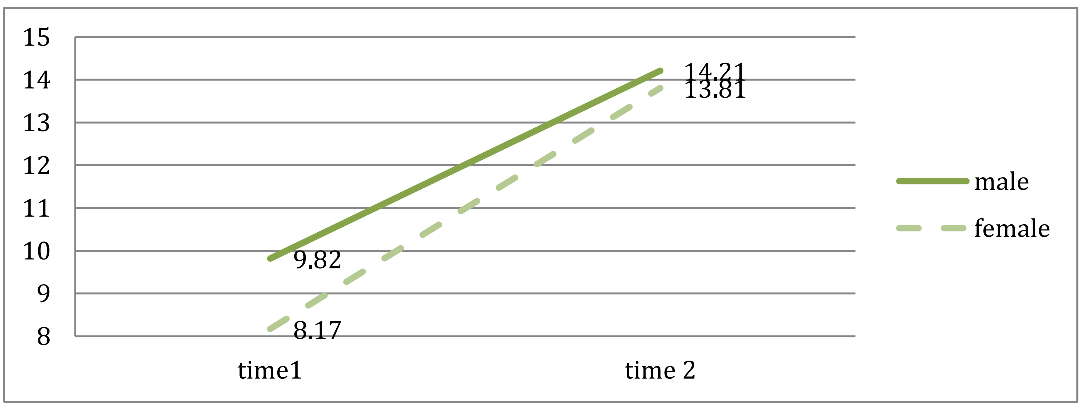
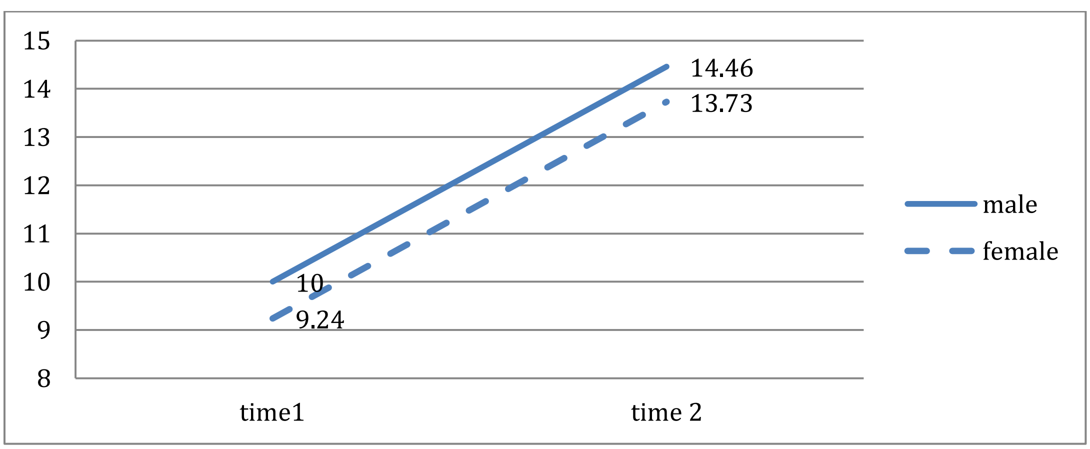


Figure 6.3 Knowledge Scores at Time 1 and Time 2 by treatment and gender in video only group



4.4.2 Change in Knowledge Scores by Acres of Beans Planted for Each Group

The number of acres planted to beans might also influence knowledge acquisition. As shown in Table 17, participants were divided into large scale and small scale growers based on the farm area devoted to beans in the 2011 growing season. Those who planted beans in on one quarter acre or less were considered small farmers (44% of total N); those who grew beans on more than one quarter acre were considered large farmers. Table 17 shows that the average knowledge score of bean growers with small plots increased from 8.59 before training to 13.78 after training. The score before training for growers with larger bean plots (9.96) was higher than the Time 1 score of farmers with small plots. The scores after training (Time 2) were almost the same.

Figures 7.1, 7.2 and 7.3 show the change in knowledge score by acres of beans planted across groups over time. The solid version of these lines represents the knowledge scores of farmers with larger bean plots, while the short dash lines represent the knowledge scores of farmers with smaller bean plots.

Farmers with small plots in the traditional lecture/demonstration group averaged 8.78 at Time 1 and 14.06 at Time 2. The Time 1 score of farmers with small bean plots was 1.87 points lower than those with large bean plots. However, after training, small farmers slightly outperformed the larger bean plot farmers on the knowledge test. A similar result was found in the traditional + video group: smaller bean growers had slightly higher knowledge scores than larger bean growers after training even though the smaller bean plot growers had considerably lower scores before training. In the video only group, the gap in knowledge scores between large and small farmers did not decrease as much as those in the other two experimental groups.

The results of the statistical tests of these changes over time and the differences between experimental groups and between subjects with different acres of beans planted, are presented in Table 18. They indicate no significant difference according to groups [F (1,290) = 2.33] when knowledge scores were averaged across time while controlling for bean plot size. However, the between-subjects average score indicates significant differences in knowledge scores between farmers with small and large plots after controlling for the experimental treatment effects.

There were also significant within-subjects differences, also indicated in Table 18. The results of an F-test associated with TestTime [F (1, 290) = 164.40] were consistent with the fact that average knowledge scores were always higher at Time 2 compared with Time 1. There was also a significant TestTime x Group interaction (F [2, 290] = 3.96), which indicates that the change in knowledge scores before and after training was significant for all three experimental groups. The significant TestTime x Acrebean interaction (F [1, 290]= 14.68) indicates that the changes in knowledge scores for farmers with large and small bean plots were significantly different.

The findings suggest that the traditional lecture/demonstration + video and the traditional only training could effectively close knowledge gaps between farmers with large and small bean plots. The video only method’s effectiveness in decreasing the knowledge gap between farmers with different bean acres was relatively lower. Farmers with smaller bean plots knew less about row planting before training, although knowledge improved with training.

Table 17. Knowledge Means at Time 1 and Time 2 by Treatment and Bean Planting Scale

	Traditional only		Traditional + Video		Video only		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Smaller Scale T1	8.78	2.80	8.38	2.72	8.72	2.87	8.59	2.78
Smaller Scale T2	14.06	1.60	13.90	1.47	13.35	2.11	13.78	1.72
Larger Scale T1	10.65	2.29	9.07	2.34	9.73	2.81	9.96	2.55
Larger Scale T2	13.96	1.47	13.76	1.32	13.97	1.67	13.89	1.33

Table 18. Results of a Repeated Measures ANOVA Testing Differences in Knowledge Scores in the Three Groups at Time 1 and Time 2 Using Bean Planting Scale as Covariate

	df	ss	ms	F	Pr>F
Between subjects					
Group	2	27.69	13.85	2.33	.10
Acrebean 2 levels	1	57.53	57.53	9.69*	.00
Error	293	1702.99	5.81		
Within subject					
TestTime	1	525.83	525.83	164.40**	.00
TestTime*Group	2	25.35	12.68	3.96*	.02
TestTime*Acrebean 2 levels	1	46.95	46.95	14.68**	.00
Error	290	927.59	3.20		

* $p < .05$, ** $p < .01$

Figure 7.1 Knowledge Scores at Time 1 and Time 2 by treatment and scale of bean planted in traditional only group

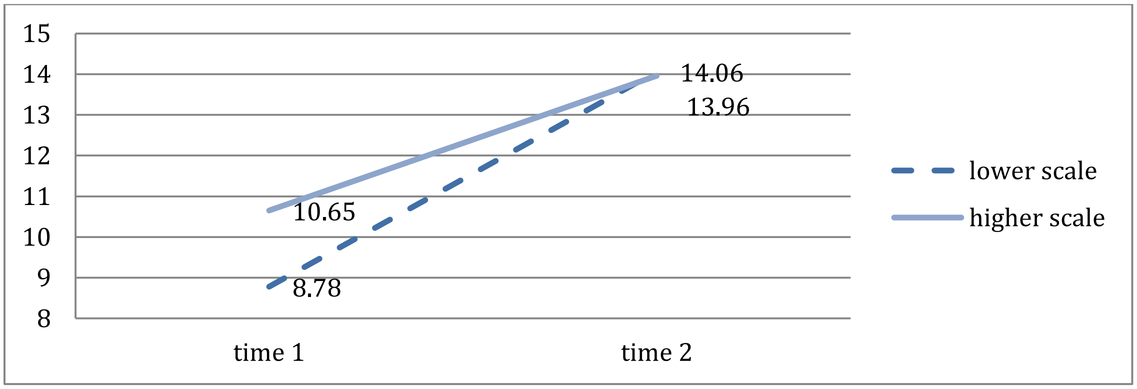


Figure 7.2 Knowledge Scores at Time 1 and Time 2 by treatment and scale of bean planted in traditional + video group

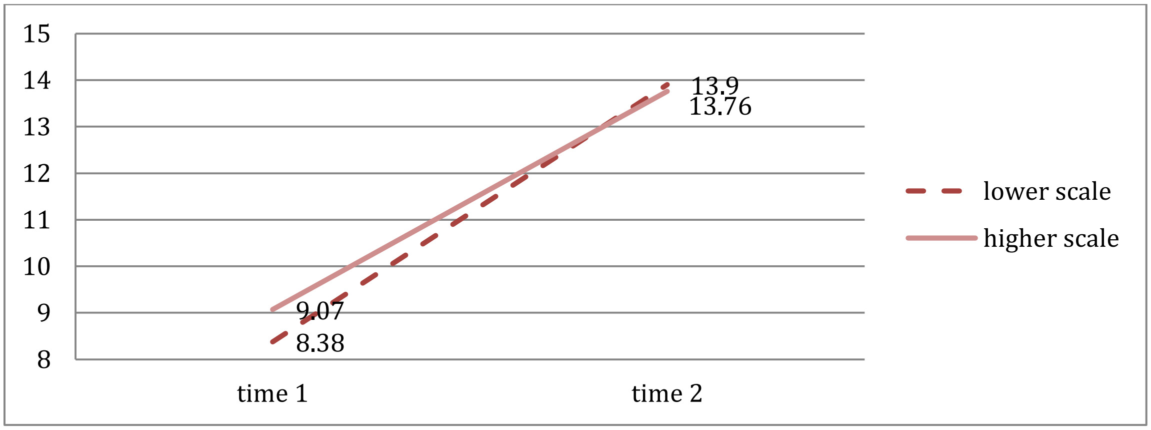
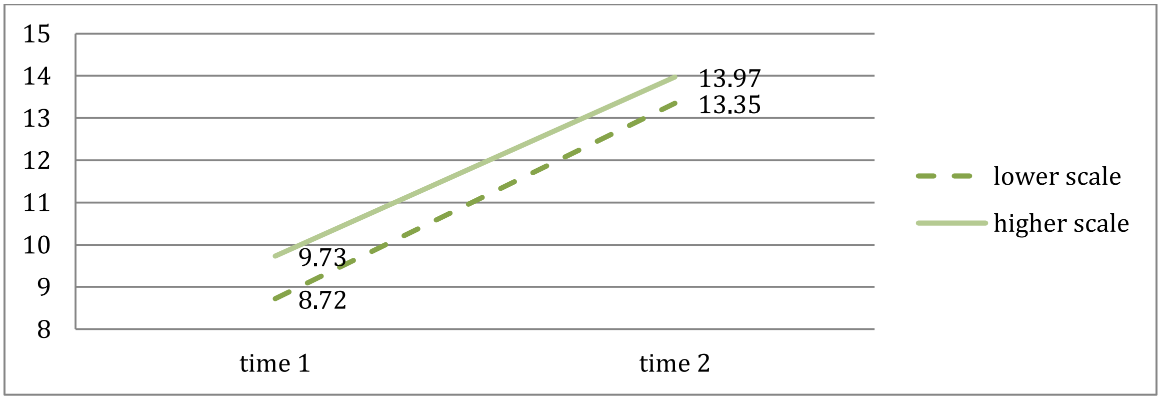


Figure 7.3 Knowledge Scores at Time 1 and Time 2 by treatment and scale of bean planted in video only group



4.4.3 Change in Knowledge Scores by Education Level

To examine changes in knowledge scores over time according to education level, farmers were divided into two groups: those with no education (no schooling) and those with any amount of formal education (81% of total). Table 19 presents the knowledge scores for each experimental group by education levels at Time 1 and Time 2. The average knowledge score of those without formal education was 7.98 before training and 13.41 after training. These scores were lower than those of farmers with formal schooling,, which were 9.66 at Time 1 and 13.93 at Time 2.

Figures 8.1, 8.2 and 8.3 show the change in knowledge scores by education level (with and without formal education) across groups over time. The solid version of these lines represents the knowledge scores of farmers with formal education, while the short dash lines represent the knowledge scores of farmers without formal education.

The difference in knowledge scores between farmers with and without education varied by experimental group. Table 19 shows that farmers without formal schooling in the traditional + video group averaged 7.9 at Time 1 and 13.90 at Time 2, while those with education in the traditional + video group registered average knowledge scores that increased from 8.82 to 13.91 at Time 2. The difference in knowledge scores between farmers with and without education decreased from .92 to .01. In the traditional lecture/demonstration only group, the difference in knowledge scores between farmers with and without education decreased from 1.84 to 0.1. However, in the video only group, the gap in knowledge scores due to education decreased from 2.13 to 1.17. A gap in knowledge about row planting remained.

The results of statistical tests examining these changes over time, and the differences among treatment groups and between participants with and without formal education are shown in Table 20. They show marginally significant differences by group [F (2,293) = 3.67, p = .03] when knowledge scores were averaged across time while controlling for the effects of education. Also, the between-subjects average scores indicated significant differences [F (1, 293) = 18.29] across time between farmers with and without formal schooling after controlling for the effects of the experimental treatments.

There also were significant within-subjects differences as indicated in Table 20. The results of the F-test associated with TestTime [F (1, 293) = 85.79] were consistent with the fact that average knowledge scores were always higher at Time 2 compared with Time 1. There was also a significant TestTime x Group interaction (F [2, 293] = 6.61), which indicates that the changes in knowledge scores before and after training were significantly different among groups. In addition, there was a significant TestTime x Education level interaction (F[1, 293]= 9.00), which suggests that changes in knowledge scores were significantly different between farmers with and without education.

The findings suggest that all three training methods could effectively close knowledge gaps among farmers with and without formal schooling. Farmers without formal education improved their scores more than those with formal education. The traditional lecture/demonstration was still an effective training method for farmers without formal education.

Table 19. Knowledge Score Means at Time 1 and Time 2 by Treatment and Education Level

	Traditional only		Traditional + Video		Video only		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
No Edu Time 1	8.47	2.00	7.90	2.67	7.63	2.77	7.98	2.50
No Edu Time 2	13.88	1.41	13.90	1.84	12.72	1.71	13.41	1.72
Edu Time 1	10.31	2.61	8.82	2.50	9.76	2.74	9.66	2.68
Edu Time 2	13.98	1.49	13.91	1.28	13.89	1.64	13.93	1.47

Table 20: Results of a Repeated Measures ANOVA Testing Differences in Knowledge Scores at Time 1 and Time 2 Among the Experimental Groups Using Education as Covariate

	df	SS	MS	F	Pr>F
Between subjects					
Group	2	41.96	20.98	3.67*	.03
Edu	1	104.58	104.58	18.29**	.00
Error	293	1675.19	5.72		
Within subject					
TestTime	1	285.02	285.02	85.79**	.00
TestTime*Group	2	43.91	21.96	6.61**	.00
TestTime*Edu	1	29.90	29.90	9.00**	.00
Error	293	1675.19	5.72		

* $p < .05$,   ** $p < .01$

Figure 8.1 Knowledge Scores at Time 1 and Time 2 by treatment and education levels in traditional only group

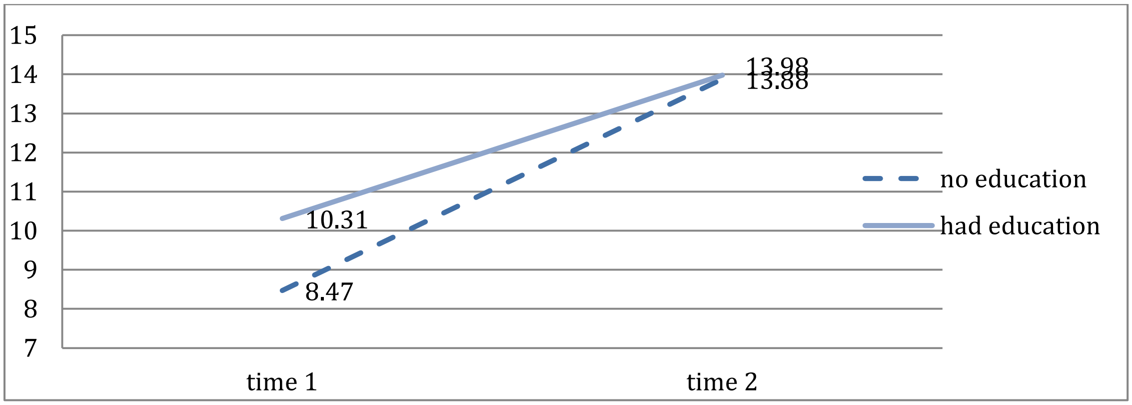


Figure 8.2 Knowledge Scores at Time 1 and Time 2 by treatment and education levels in traditional + video group

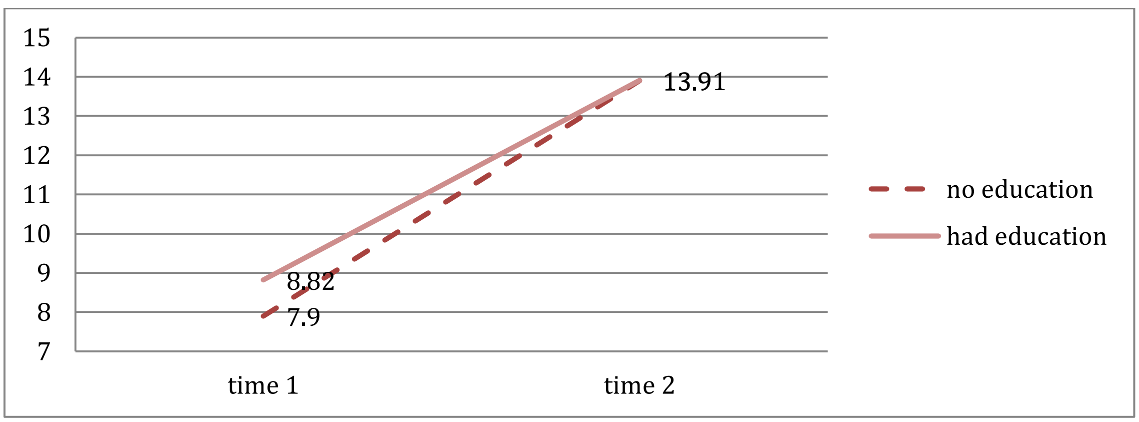
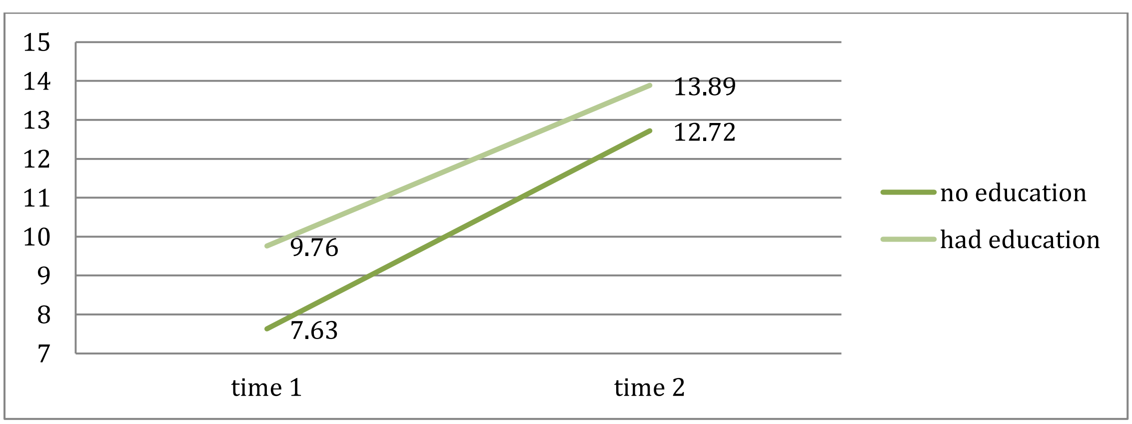


Figure 8.3 Knowledge Scores at Time 1 and Time 2 by treatment and education levels in video only group



CHAPTER 5

CONCLUSIONS

This study tested the effectiveness of video as a complement to or replacement for the traditional lecture/demonstration method of training farmers in Kamuli District, Uganda. It also assessed which training methods could decrease knowledge gaps among farmers who differ by gender, acres of beans planted, and education level. To do so, an experiment was conducted with 325 farmers who were divided into three groups, each of which received one of three training approaches focusing on row planting for bean production: (1) traditional lecture/demonstration; (2) traditional lecture/demonstration plus video component; and (3) video only. All three training groups included a fellow farmer demonstration at the end of each training session. Each group was composed of 10 to 30 farmers who have had previous training on row planting.

5.1 Findings

5.1.1 Video Can Effectively Complement the Traditional Lecture/ Demonstration

Previous research results have demonstrated that training including both traditional lecture/ demonstration and video in training could be more effective than traditional lecture/demonstration alone (Shanthy & Thiagarajan, 2011). In the current study, a comparison of knowledge tests before and after training found that farmers who received the traditional lecture/demonstration plus video treatment learned more about row planting than those who received only the traditional lecture/demonstration. These findings suggest that video can be an effective complement to the traditional mode of training, especially for groups with relatively low prior knowledge about a topic.

The knowledge test scores before training showed that those in the traditional lecture/ demonstration group scored significantly higher than those in the traditional lecture/

demonstration plus video group. The scores after training were almost the same between the two groups. The relatively higher scores of those in the group that received the combined traditional and video methods support the prediction from information processing theory that the use of multiple training methods can enhance learning (Eastman, 2011).

5.1.2 Video Can be an Effective Replacement for the Traditional Lecture/Demonstration Method

In this study, a comparison of knowledge scores between the traditional lecture/ demonstration only group and the video only group showed that subjects in both groups had almost the same knowledge score after the training, and that there was no significant difference in knowledge improvement from Time 1 to Time 2 between the two groups. This result indicates that the video only method can be as effective as the traditional lecture/demonstration only approach.

In this case, the findings suggest that video can replace the traditional lecture/demonstration method to help farmers learn new planting techniques. Previous studies have shown that video training alone was more successful in creating interest in rice parboiling technology than a traditional workshop (Zossou et al., 2010). In some cases, video alone was more effective in increasing levels of knowledge than conventional training (David & Asamoah, 2011).

The second finding supports previous studies that provide evidence that learning materials featuring local actors who use the local language under local environments are effective attributes of videos for training. Previous studies that applied the information processing theory suggest that new knowledge and sources are integrated with old information stored in memory during the information integration phase (Hamilton & Nowak, 2005). Such integration enables learners to trust the content of the training and the approaches used (Wilson & Myers, 1999, p. 80).

The current study suggests that video may be an alternative or a supplementary method to increase the frequency and quality of training. Besides, video could solve the difficulty of scaling up the supply and training of trainers by reducing the technological support requirement for each farmer (Van Mele, 2011). Video also does not require face-to-face presentation by skilled trainers, a limited resource in rural Uganda.

Van Mele (2006) found that video training was cheaper than traditional extension methods such as farmer-to-farmer extension and lecture, especially when more farmers need to be trained. Research conducted by Van Mele (2011) indicated that video, as a tool for persuasion, could provide information that could be easily processed.

5.1.3 Training Decreases the Knowledge Gaps

The present study also found that the three training methods—traditional lecture/demonstration, traditional lecture/demonstration plus video, and video only—can decrease the knowledge gap among farmers of different gender, educational levels, and bean acreage sizes.

In this study, women, who had lower knowledge at Time 1, learned more than men regardless of the training method used. Besides, gaps in knowledge about row planting between women and men decreased in all three experimental groups. The combined lecture/demonstration plus video method was effective in narrowing the knowledge gap between male and female farmers.

Overall, farmers with smaller bean plots registered a bigger change in knowledge scores than those with larger plots, narrowing the knowledge gap. This result held across all three experimental groups.

Across treatment groups, those with low education also learned more from the training.

Rogers (2003) said that access to information by low social status subjects is often restricted by their limited opportunities to be exposed to new ideas and to be connected beyond their local communities. This is especially true for female farmers with low education and small plots. These women often lack the opportunity to communicate with development staff or rural extension workers (who are predominantly males) because of social norms (Zossou et al., 2010). Disseminating training messages through "gender-sensitive" NGOs such as VEDCO could thus help women to access information from new communication channels (video, cell phone and the Internet) (Van Mele, 2007).

The results of the current study are consistent with those of Shingi and Mody (1976) who suggested that the communication effects gap among farmers could be closed by credible and understandable agriculture television programs. They found the greatest knowledge gain among farmers who did not have access to agriculture information sources.

5.1.4 A Disadvantage of the Video Only Method: Low Interaction

According to the participants' open-ended responses, a disadvantage of the video only method is that it does not provide opportunities for feedback and interaction with agricultural specialists. Participants in the video only group complained that there was no one who could answer their questions relating to the training topic. An interactive training approach is one in which farmers have the opportunity to observe, record, discuss, generate their own ideas, and obtain a deep understanding of theories and their practical applications (Coldevin, 2003). In the traditional lecture/demonstration group, trainers are able to answer questions about row planting during or right after the training. The trainer is often an active mediator who encouraged discussions.

Training in small groups (10-30 farmers) could also provide an opportunity for interaction in video only groups. Information processing theory proposes that learning together can create and recreate human communities so that learning occurs in relationship with others (Boyatzis, Cowen & Kolb, 1995). In the current study, most of the training was conducted in groups ranging in size from 10 to 30. However, because of the miscommunication between CBTs and the group leaders, there was one group with seven farmers and another one with more than 40 participants. The quality of learning seemed to vary in these two groups. The group with seven members exhibited low interaction and few group discussions. However, when group size grew to more than 40, training became messy, and farmers at the back had difficulty hearing and watching the video.

5.2 Limitations of the Study

This study has a number of limitations. The first is that the participants were not randomly assigned to the three experimental groups. Because of the poor quality of roads and the lack of transportation, it was not possible to bring all farmers together in a fixed location where they can be randomly assigned to experimental groups. Training had to be conducted by parish. In addition, in order to reduce contamination between groups, the 325 farmers who participated in this study were divided into groups by parishes, which were relatively far apart from each other.

This group assignment mode led to two problems. First, because some demographic characteristics were not equally distributed among parishes, these variables were also not evenly distributed within the study sample. The second problem pertains to knowledge about row planting in the three groups before training. Most farmers had already received training about row planting at least once during the previous growing season. However, they were trained by different trainers according to the parishes where they lived. Although the training had the same content, the training effects could be different. In other words, trainers with different skills could have affected pre-training knowledge levels.

The two problems discussed above increased the difficulty of interpreting the change in knowledge scores from Time 1 to Time 2 and of comparing the effectiveness of each treatment. The knowledge scores before training suggest that the group given the traditional lecture/demonstration had the highest Time 1 score, while the group that received both the traditional lecture/demonstration plus the video had the lowest Time 1 score. Subjects in all groups had similar Time 2 scores.

One possible reason why the change scores of those who received only the traditional lecture/demonstration were significantly lower is because they already had high knowledge scores before training. In terms of knowledge question, they were limited in how much more they could learn. This is commonly called "ceiling effect". Subjects in the traditional lecture/demonstration + video group had a lower Time 1 score, their potential to learn was higher.

The second limitation of this study is the training topic. Because most participants already had been trained about row planting, the topic was no longer new to them. In fact, the majority had already adopted row planting practices before the training. As such, what they know cannot be attributed to training alone; it may have also come from practice. These experiences might have influenced farmers' knowledge scores. For example, before training, some farmers complained that planting in rows was too time and energy consuming, so they might not use row planting in the future. During the experiment, these farmers might not have paid enough attention, producing outcomes worse than those who had never tried row planting before.

In the current study, all three experimental groups were trained on the same topic. Although this enhanced the experimenter's level of control, it makes it hard to speculate about the potential effectiveness of video for other training topics.

The third limitation is that the evaluation of effectiveness might not accurately reflect farmers' knowledge, attitudes and adoption intentions. Farmers may forget some items about row planting quickly in the absence of reinforcements. Thus, the right-after-training knowledge test might not reflect farmers' knowledge levels in the field. Furthermore, attitudes about the recommendation and adoption intentions are known to change over time. Although most were positive about row planting and expressed a strong intention to adopt row planting right after training, actual behavior and attitudes in the field may be different.

The fourth limitation of this research is that farmers' interest in learning from video might decrease as they are exposed more to video training. Considering that most had never received video training before, their interest in learning from a new method was very high, a condition known as novelty effect. However, as their exposure to video training increases, their interest in learning from video might decrease.

The last limitation is that there was no comparison between training conducted in small groups and individual training. In this study, training was conducted in small groups with 10 to 30 farmers. Training in groups could assist learning by promoting discussions and interaction. However, individual training could be more flexible. For example, farmers could be organized on their own time to join the training, and the pace of training could be adjusted to suit individual needs. Because the current study used only a group approach, it was not possible to measure the extent to which being in a group helped or hurt training effectiveness.

5.3 Suggestions for Future Study

Future studies should explore the effectiveness of video for different agricultural procedures (e.g., planting, post-harvest practices, and marketing) to test the video's potential to enhance knowledge acquisition for multiple topics, especially those that are new to farmers. Longitudinal field research measuring actual adoption of training recommendations over time would also be helpful to evaluate video's effectiveness. Future studies also should assess the cost-effectiveness of video training and compare it with that of conventional training for both small scale and large scale training efforts. Lastly, more research concerning appropriate projector devices to provide video training in rural areas would be useful to increase accessibility.

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APPENDIX A

IRB EXEMPT FORM

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Resear
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 12/15/2011

To: Tian Cai
101 Hamilton Hall

CC: Dr. Eric Abbott
204C Hamilton Hall

From: Office for Responsible Research

Title: Comparing Effectiveness of the Existing Group Training Approach with an Enhanced Approach Utilizing Video/Animation in Addition to Group Training

IRB ID: 11-551

Study Review Date: 12/15/2011

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (1) Research conducted in established or commonly accepted education settings involving normal education practices, such as:
  - Research on regular and special education instructional strategies; or
  - Research on the effectiveness of, or the comparison among, instructional techniques, curricula, or classroom management methods.

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**

- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

APPENDIX B

QUESTIONNAIRE

Evaluation of Training Approach

1. a. Questionnaire ID: _____________ b. Date :_________ c. Interviewer: _____________
2. a. Sub-county: _____________ b. Parish: __________ c. Zone/Village______________
3. Group name: ____
4. a. Respondent Name:___________________________ b. Age______ c. Sex_____

   d. **Years** of formal Education ________ e. Occupation as **main income source** _______

Section A

Let's begin by talking about the recommended practice of today's training: **Row Planting**

5. Had you heard anything about this recommended practice or used this recommended practice **before you came for training today**?

   (1) Yes (if yes, go to Question 6)　　　(2) No (Stop interview)

6. If yes, how would you consider your knowledge about row planting before this particular training?

   (1) I don't know anything about row planting.

   (2) I know a little about row planting, but there is a lot I don't know about it.

   (3) I already know some very important point of row planting, but could learn more.

   I already have nearly all knowledge about row planting.

7. Prior to today's training, had you ever used the practice that was recommended today?

   (1) No, I have never used row planting.

   (2) Yes, I have tried row planting, but I am not using it now.
   (Why?____)

   (3) Yes, I use the recommended practice now.

8. a. In your own words, what were the main points about row planting that were presented in today's training? (Address both of the following questions: (1) What problem is the technology intended to solve? (2) What are the main procedures needed to use this technology? *Tick (√) the points farmers addressed and cross (X) the points farmers missed*.

Problems intended to solve: weeding difficulty　spraying difficulty

insufficient nutrients for plants

Main procedures:

Plant at the beginning of the rainy season for better utilization of soil moisture

Plant beans in rows

Row should be 50cm (1.5 ft) apart

Seeds should be sown 15-20cm (0.5 ft) apart

Space rows of different varieties 2 meters apart to prevent mixing of varieties.

9. What are the main benefit(s) you get or would get from adopting the practice that was recommended in the training? *Tick(√) the points farmers addressed and cross(X) the points farmers missed.*

Higher yields making weeding easier

making spray easier Increase access to sufficient nutrients

10. What tools would you need to adopt the recommended practice? *Tick(√) the points farmers addressed and cross(X) the materials farmers missed*.

strings 2 pugs each one 1.5 ft hoe

11. a. In your own words, what were the main points about row planting that were presented in today's training? (Address both of the following questions: (1) What problem is the technology intended to solve? (2) What are the main procedures needed to use this technology? *Tick (√) the points farmers addressed and cross (X) the points farmers missed*.

Problems intended to solve: weeding difficulty spraying difficulty

insufficient nutrients for plant

Main procedures:

Plant at the beginning of the rainy season for better utilization of soil moisture

Plant beans in rows

Row should be 50cm (1.5 ft) apart

Seeds should be sown 15-20cm (0.5 ft) apart

Space rows of different varieties 2 meters apart to prevent mixing of varieties.

b. Please rate your understanding of the recommended practice in the training.

Didn't understand at all	Understand little	Understand some, but not very much	Understand a lot	Understand all

12. What are the main benefit(s) from adopting the practice recommended in the training? *Tick(√) the points farmers addressed and cross(X) the points farmers missed*.

Higher yields Making weeding easier Making spray easier

Increase access to sufficient nutrients

13. What tools would you need to adopt the recommended practice? *Tick(√) the points farmers addressed and cross(X) the materials farmers missed*.

Strings 2 pugs each one 1.5 ft Hoe

14. Do you have these materials now?

(1) Yes (2) No

15. Could you get the materials you need to adopt the recommended practice easily?

(1) There is no chance to get the materials (2) It is hard to get materials

(3) Getting these materials is not hard (4) It is really easy to get these materials

(5) Don't know

16. How would you rate the overall value of the recommended practice to you? Would you say that adopting it would not really be an improvement for your bean production, or that it would be a great improvement?

(1) Would not be an improvement at all (2) Would not be much of an improvement

(3) Would be a slight improvement (4) Would be a substantial improvement

(5) Don't know

17. a. Based on what you learned today, is it likely that you will use this recommended practice during the next bean growing or post-harvest season?

(1) Not likely at all (2) Not very likely (3) Somewhat likely

(4) Very likely (5) Don't know

b. What is the main reason for your decision?

___

18. What might cause farmers like you to **<u>not adopt</u>** the practice that was recommended?

___

Section B

19. Now I would like to ask about the training presented today.

Today, **three methods** were used in the training. There was (1) a presentation by the CBT, (2) a training video, then (3) a farmer's demonstration to repeat and describe/explain what was in the training. How helpful to you were each of these training methods? Let's take them one by one.

Let's evaluate the **video.**

i. Could you hear the presentation clearly?

(1) Not clear at all (2) Partly clear (3) Mostly clear (4) Totally clear

b. Was the visual quality good enough for you to see the training method clearly?

(1) Not clear at all (2) Partly clear (3) Mostly clear (4) Totally clear

c. What were the main characteristics of the video that helped you better understand this topic?

____

d. What were the weaknesses of the video that hindered your understanding of this topic?

____

e. What suggestions do you have to improve the video?

____

f. Please indicate how useful this video was for your learning:

(1) Not useful at all (2) Not very useful (3) Somewhat useful (4) Very useful

Now, when you think about the content of the video you saw today:

g. Would you say that the advice was technically correct?

(1) Not correct at all (2) Somewhat incorrect (3) Somewhat correct (4) Completely correct

h. Was the content presented to you in an interesting way?

(1) Not interesting at all (2) Not very interesting

(3) Somewhat interesting (4) Very interesting

Let's evaluate the **CBT presentation:**

a. Could you hear the CBT demonstration clearly?

(1) Not clear at all (2) Partly clear (3) Mostly clear (4) Totally clear

b. Was the visual quality of overall CBT training good enough for you to see the training method clearly?

(1) Not clear at all (2) Partly clear (3) Mostly clear (4) Totally clear

c. What were the main characteristics the CBT presentation that helped you better understand this topic?

____

What were the weaknesses of the CBT presentation that hindered your understanding of this topic?

____Wh at suggestions do you have to improve the CBT presentation?

____

d. Please indicate how useful the CBT presentation was for your learning

(1) Not useful at all (2) Not very useful (3) Somewhat useful (4) Very useful

Now, when you think about the content of the CBT presentation you saw today:

e. Would you say that the advice was technically correct?

(1) Not correct at all (2) Somewhat incorrect (3) Somewhat correct (4) Completely correct

f. Was the content presented to you in an interesting way?

(1) Not interesting at all (2) Not very interesting (3) Somewhat interesting (4) Very interesting

Let's evaluate the **fellow farmer's demonstration:**

a. Could you hear the fellow farmer's demonstration clearly?

(1) Not clear at all (2) Partly clear (3) Mostly clear (4) Totally clear

b. Was the visual quality of overall fellow farmer's demonstration good enough for you to see the training method clearly?

(1) Not clear at all (2) Partly clear (3) Mostly clear (4) Totally clear

c. What were the characteristics of the fellow farmer's demonstration that helped you better understand this topic?

____Wh at were the weaknesses of the fellow farmer's demonstration that hindered your understanding of this topic?

____Wh at suggestions do you have to improve the demonstration by the fellow farmer?

____

d. Please indicate how useful the fellow farmer's demonstration was for your learning:

(1) Not useful at all (2) Not very useful (3) Somewhat useful (4) Very useful

Now, when you think about the content that was in the fellow farmer's demonstration training message you saw today:

e. Would you say that the advice was technically correct?

(1) Not correct at all (2) Not very correct

(3) Somewhat correct (4) Completely correct

f. Was it presented to you in an interesting way?

(1) Not interesting at all(2) Not very interesting

(3) Somewhat interesting (4) Very interesting

20. If you had to choose, which ONE of these three methods would you prefer? *Ask farmers to ank the three methods so that "1" represents the method the farmer likes most and "3" represents the method the farmer likes least*.

Video_________ CBT presentation_________ Fellow farmer demonstration________

Why did you rank these methods in this way?

____

21. a. Do you think combining two or more than two methods was helpful for you to understand the training topic?

(1) No (Please explain why you said no:____)

(2) Yes (Please explain why you said yes:____)

22. If a training approach includes two or more than two methods, which method do you want to come first and which method do you want to come second and third? *Rank so that "1" represents the method the farmers want to come first and "3"' represents the method the farmers want to come third*.

First method___________________ Second method____________________

Third method________________

23. Farmers learn about new ideas and practices from a variety of sources. Now, I'm going to name a number of sources besides this training that you might have used. For each, please tell me if you have used this source to get information about **bean production**.

If you have used a source, I would also like to know how valuable you consider the information you received from the source.

Source	Have you used it?		What information **relevant to bean production** did you get from this information source?	Not useful at all	Not very useful	Somewhat useful	Very useful
	Yes	No					
Radio							
Neighbors/ friends							
Family members							
Newspapers							
NGO/ extension staff							
Politicians							
Other (please specify) ___________							

23a. Rank the quality of the information relevant to bean production provided by these sources? In doing so, please use a scale from 1 to 7 where 1 represents the best quality, and 7 represents the worst quality. *If farmer doesn't use a source, put '0.'*

Radio___; Politicians___; Neighbors/Friends___; Family members___; Newspapers___; NGO/Extension staff___; Others ___.

23b. Rank the information source you used most to get bean production knowledge? ('1' represents used most, and '7' represents used the least, if farmer doesn't use this source, just put '0')

Radio___; Politicians___; Neighbors/Friends___; Family members___; Newspapers___; NGO/Extension staff___; Others ___.

Section C

24. What varieties of beans did you grow during the past three years?

Growing season	**Variety name**	**Acres planted**	**Total yield**	**Amount Sold** (if any)	**Price** (per kg.)	**Problems** (hail, drought, flood, etc.)
1st Season 2011 Variety 1						
1st Season 2011 Variety 2						
1st Season 2011 Variety 3						
2nd Season 2011 Variety 1						
2nd Season 2011 Variety 2						
2nd Season 2011 Variety 3						

25. Did you store beans after your harvest?

   a) No (if no, go to Question 29)   (2) Yes (if yes, go to Question 28)

26. How much of your bean production did **you store** as seed? ___.__kg ___.__kg for home consumption? ___.__kg for sale?

   a) What problems did you have storing it, if any?____________________________

   b) What method(s) do you use to control damage? ____________________________

   c) How successful is your method(s) of control? ______________________________

   d) How much of the stored grain was lost to weevils (bruchids), if any? ________________

   e) When you planted stored grains as seed, approximate what percentage germinated (sprouted and grew)? _______

27. Which varieties of beans do you plan to grow now (first season in 2012)? Is this the same area planted in 2011, or an increase or a decrease? Please explain why.

Variety growing 2012 1st season	**Increase, same, or decrease**	**Reason**
1 =		
2 =		
3 =		

Section D

28. What's the total number of people in your household?_____________

    How many adults? _______   How many children? _______

29. a. How many acres of farmland do you own? _____.___ acres

    b. How many acres of farmland do you rent from others? _____.___ acres

30. Is farming the most important source of income for your family?   (1) No   (2) Yes

APPENDIX C

INFORMATION SOURCES USED FOR BEAN PRODUCTION

According to Sseguya (2009), the main information sources for farmers in Kamuli district are fellow community members, government staff, local business people, NGOs, local leaders and radio. To determine the farmers' source of information for bean production, the current study asked farmers about their use of radio, TV, neighbors/friends, family members, newspapers, NGO/extension staff, and others to get information about beans. For each source, farmers were asked if they used the source and if they did, they were asked what specific information about beans they learned from that source. Farmers were asked to rate the quality of each source used.

Information Sources for Bean Production

Table 4 shows most subjects (96%) confirmed that they received bean production information from NGO/extension staff. This answer perhaps reflects the fact that VEDCO, an indigenous Ugandan NGO, has been active in farmers' training. About 32% used radio to get bean production information. Radio is the channel used with the highest frequency. In comparison, less than 1% said that they get information from TV 3.1% from newspapers). They also frequently mentioned two interpersonal sources: family members (31.1 %) and neighbors/friends (27.7 %).

Frequency of Information Source Use

The farmers were asked to rank their three most frequently used information sources. As shown in Table 5, NGO/extension was ranked first, considered as the most frequently used bean information source. A total of 103 participants used radio, with approximately 78% ranking it as the second most frequently used medium. Many (101) reported getting information from family members, with around 50% ranking them as the second most frequently used information source for bean production. For the 90 farmers who used neighbors/friends, 40% rated them as the second most frequently used source. Another 33.22 % ranked them as the third most frequently used information source.

Table 21. Use and Effectiveness of Information Sources for Bean Production

Source	% who used this source	Effectiveness (SD)
NGO/Extension staff	96.3	3.98 (.25)
Radio	31.7	3.64 (.62)
Family Member	31.1	3.65 (.66)
Neighbors/Friend	27.7	3.40 (.57)
Others	9.2	3.32 (.48)
Newspapers	3.1	3.50 (.53)
TV	0.9	4.0 (0)

Table 22. The Most Frequently Used Information Sources for Bean Production

	Radio %	Family Member %	Neighbors/ Friend %	NGO/ Extension %
First Frequently	5.8%	4.0%	0%	91.7%
Second Frequently	77.7%	49.5%	40.0%	0%
Third Frequently	17.5%	24.8%	32.2%	0%
Total	104	101	90	313

Usefulness Evaluation of Information Sources

Farmers also were asked to rate the usefulness of each information source for their bean production used from “4” (very useful) to “1” (not useful at all). Table 4 shows that NGO/Extension staff (M = 3.98, SD = .25) also led in this aspect. The usefulness score of family members (M = 3.65, SD = .66) and radio (M = 3.64, SD = .62) was less than that of the NGO/extension staff, but slightly higher than neighbors/friends (M = 3.4, SD = .57) and “others” (M = 3.32, SD = .48). Very few used TV or newspapers as an information source for bean production, so caution is needed when examining their effectiveness ratings.

The results for usefulness of information sources was consistent with Sseguya’s (2009) finding that in 12 rural communities of Kamuli district, the reliability and applicability of information from NGOs was rated highly across multiple topics because the information they provide is considered timely, of good quality, and because they regularly follow-up on the application of recommended practices. Information from radio was also rated as being reliable.

Examples of Types of Information Provided by Each Information Source

Subjects were asked to briefly describe the bean production information they got from each information source, and their answers were categorized into six types as listed in Table 6. The most frequent topics mentioned as coming from the NGO/Extension staff related to bean planting methods. Other types of information from this source included bean marketing, the advantages of bean production, harvesting and storage, seed information, and the use of beans.

The following are examples of information received from NGO/Extension staff.

"VEDCO trained us on how to use the rhizobia modulates and to plant in line."

Female, 27

"VEDCO told us to first prepare the garden, then plant beans in rows because it produces higher yield."

Female, 66

"They tell us to form groups, and in our group, we plant in rows and identify markets (for our beans.)"

Female, 60

The participants also say that about 70% of bean production information they get from the radio was relevant to planting methods, including land/garden preparation, planting, weeding, fertilization, and disease control. For example, they learned from the radio when to plant, ways to prepare the garden, and other good planting practices. Bean marketing was also an important bean topic learned from radio.

The following are examples of bean production information received from radio.

"Radio told us where to market beans."

Male, 55

"Radio told us how to make bread from beans."

Female, 28

Other information from radio included how to assess seed quality, improve post-harvest skills, and other advantages of bean production.

The majority of information about bean production received from family, neighbors and friends also focused on planting practices. Also learned from these interpersonal sources were how to market beans, uses of beans, and information about seeds.

The following are examples of topics learned from family members, neighbors or friends.

" *(My family told me)* that *beans are delicious (and can be eaten) with posho, mixed with cassava.*"

Female, 48

" (My family told me about) the price of beans in the market."

Female, 35

" (My family told me) to plant in rows for easy weeding."

Female, 35

"(My neighbor/friend taught me) how to properly plant and manage beans of different varieties."

Female, 40

"(From my neighbor/friend I) get information about how to market our products. We go to market and sell our produce together."

Male, 30

"(My neighbor/friend taught me) how to bake biscuits to earn more money from beans."

Female, 48

Table 23. Types of Information About Bean Production Received From Information Sources

	Bean Planting Method	Advantage of Bean Production	Harvest and Storage	Bean Marketing	Bean usage	Seed Information
Radio	●	●	●	●	●	●
TV	●					
Family	●	●		●	●	
Neighbors & Friends	●	●		●	●	●
Newspapers	●	●		●		●
NGO/Extension Staff	●	●	●	●	●	●
Others	●	●		●	●	