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Keywords

video training, knowledge gaps, group training, Uganda, pico projector

Research

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Introduction and Statement of the Problem

The purpose of this study was to learn about the effectiveness of video—especially using new small battery operated projectors—as a tool to either complement or replace the existing lecture-demonstration mode of training small farmer groups in a rural African country. 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

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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 generators, DVD players, projectors 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 often 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 video 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? (3) Does the video training method decrease the knowledge gap between men and women?

Theoretical Framework

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). 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.

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. 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 (Vogel, Dickson & Lehman, 1986).

Video Training in Development Projects

Videos can be very persuasive (Lie & Mandler, 2009). Agricultural concepts and technologies hard to describe in words are easily understood when demonstrated visually (Gandhi et al., 2007). Long agricultural processes can be compressed into short video segments, thus enhancing training efficiency (Lie & Mandler, 2009). 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). These benefits can be harnessed as the cost of audio-visual technologies substantially declines (Coldevin, 2003).

In general, localized videos that integrate content, production and dissemination into the social context are most likely to be accepted (Anderson, Dickey & Perkins, 2001). This is so because such content provides evidence that recommended practices work in the local environment (Gandhi et al., 2007). 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.

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). Digital Green formed training groups based on existing local farmer cooperatives. Group training in India (Gandhi et al., 2007) and in Ghana (David & Asamoah, 2011) indicates that group participation guarantees a regular schedule of content screenings; encourages learning, adoption and innovation through peer pressure; and even reunites estranged family members. In many instances, local facilitators with some agriculture training are hired to conduct the training and record attendance, feedback and adoption rates of recommended practices.

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 or TV to present digital contents in rural areas (Jain, Birnholtz, Cutrell & Balakrishnan, 2011). 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). Pico projector images are suitable for viewing by groups of 15-20 people (Mathur et al., 2011).

Video as a Complement to or a Replacement for Traditional Training

Van Mele (2008) finds video "easy to integrate with other rural training methods" (as cited in Zossou et al., 2009a, p. 120). 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, Van Mele, Vodouhe & Wanvoeke, 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). In other studies (Gandhi et al., 2007; Zossou et al., 2009b), the adoption intentions of suggested practices were higher in the video + traditional training group than those who learned in the traditional only group.

In many projects, video has replaced traditional 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.

In Ghana, experimental groups shown videos had higher knowledge test scores compared with farmers in the control group who received traditional training (David & Asamoah, 2011). Exposure to video training alone was more successful in creating interest in rice parboiling technology than attendance at a traditional workshop (Zossou et al., 2010).

Video Training and Knowledge Gaps between Men and Women

In general, individuals with higher socio-economic status are able to experiment with 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 161 out of the 195 countries in the United Nations' Gender Inequality Index (UNDP, 2013). Women have limited access to information beyond their local communities (Rogers, 2003). Most women 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 willing to pay more to get video disks (Tumwekwase Ahabwe, 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

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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.

Purpose and Objective

This study examined whether video training can complement and/or replace the traditional lecture-demonstration method to increase farmers' knowledge of the training topic. This study also explored changes in knowledge gaps between men and women after training in three treatment groups. Specifically, this study addressed the following research questions:

1. How effective is video for increasing knowledge when used to complement traditional lecture-demonstration training?
2. How effective is video as a replacement for traditional lecture-demonstration training with minimal facilitator involvement in knowledge gaining?
3. Can training methods including video as a complement or replacement for traditional lecture-demonstration effectively decrease the knowledge gap between men and women?

Methods/Procedures

Participants and Sampling

Farmers (N=325) from four parishes of Butansi sub-county, Kamuli District (See Figure 1) who grew beans and were members of farmers' groups served by a local NGO named VEDCO participated in the study. Before this study, these farmers had been trained in their 8-15 member groups by VEDCO each month using lectures, demonstrations and flip charts. On average, these farmers were 41 years of age and women (75.4%). The average household size was eight (often with three adults and five children). The average years of education (see Table 2) was 5.81(SD=3.81), but 6.3% of the men and 22% of the women had never been to school. Participants planted an average of 0.54 acres (SD=.41) of beans, which is about 14% of the average total farmland they own.

A quasi-experimental design (Wimmer & Dominick, 2006, p. 243) was used because treatments were not randomly assigned to participants. Instead, the farmers were assigned to one of three experimental groups depending on which parish they came from (see Table 1)

Experimental Treatments

The participants in the three groups were exposed to different training components (Table 1). The traditional-only group received only the traditional lecture-demonstration presented by the community-based trainers (CBTs). In this condition, the CBTs first presented the theory underlying the practice of planting beans in rows and then showed the tools, seeds and process during the 30-minute field demonstration. The traditional + video group received both the traditional lecture-demonstration (same as the traditional only group) and an eight-minute video that features a local male farmer explaining the theory of row planting and demonstrating how to plant beans in rows on his land with assistance from his wife. They used local tools and explained the topic in the local language. The video-only group received the training video with minimal facilitation from CBTs. The video was shown twice to this group to enhance recall. For this group, the CBTs only mobilized farmers and organized the training.

Figure 1. Location of Kamuli District, Uganda
Note: from http://www.ezilon.com/maps/africa/uganda-maps.html

Table 1.
The Study's Experimental Design

Experimental Group	Parish	Training components (in order)	Duration (min.)
1. Traditional lecture-demonstration	Naibowa & Bugeywa	1. Traditional lecture and field demonstration	30
2. Traditional lecture-demonstration + Video	Butansi	1. Traditional lecture and field demonstration	30
		2. Video	8
3. Video only	Naluwoli	1. Video	8
		2. Video	8

In order to control uniformity of traditional training quality, only two CBTs were selected to conduct training in this research. A training outline was provided by local NGO staff, and the two CBTs were required to cover all the contents during their training. The first author and members of the local NGO staff operated the pico-projector to guarantee uniform video quality throughout all groups.

Experimental Procedure: Pretest > Training (Experimental Treatment) > Posttest

Before each training session, a knowledge pretest about row planting was administered to the subjects to evaluate their knowledge of the recommended practice for row planting of beans. After training, subjects completed a posttest that included the same knowledge test used for the pretest. Local interviewers who spoke English and the local languages were trained and hired to conduct the pretest and posttest. Each participant was tested individually at the training site immediately before and after the training. The first author participated in all experimental procedures and ensured data quality in the field.

A pilot study was conducted before the experiment to evaluate the experimental procedure and the questionnaire. Thirty-one participants who are residents of a non-experimental parish in Butansi sub-county were involved in the pilot study. All of them received the traditional + video training and took the both pretest and posttest. After the pilot study, small changes in the questionnaire were made, but there was no change in experimental procedure.

Conceptual and Operational Definitions of the Dependent Variable

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 is intended to solve? (2) What are the main procedures involved in row planting? (3) What are the benefits you would get from adopting row planting? (4) What tools do you need to implement row planting?

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 benefit(s) can be derived from adopting row planting?" received two points. The knowledge score was determined by counting the number of correct answers about bean row planting. The highest possible score was 15; the lowest was 0. The score a participant received before training was labeled time1 score. After training, the posttest score was called the time2 score.

Data Analysis

The first and second research questions tested whether videos could effectively complement or replace the traditional lecture-demonstration training method. Given the between and within subject design described above, these research questions were addressed by using a repeated measurement.

The third research question examined whether the video method can decrease the knowledge gap between men and women. This research question was studied by conducting a separate repeated measurement with gender as the covariant.

Results/Findings

Comparisons of Time1 and Time2 Knowledge Scores

The pretest conducted prior to the training was especially important in this case because local

Research

CBTs had already conducted training on row planting once during the previous growing season (September/October 2011) with the very same groups of farmers involved in the experiment. However, the local CBTs had 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.

A complicating factor for the experiment was that the time1 scores for the traditional training group were higher than those in the other two experimental groups ($F [2, 298]=6.88, p < .01$) (Table 2). Ideally, they would have been the same. 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.

Table 2.
Results of ANOVA Tests of the Difference in Knowledge Scores Among the Three Groups at Time1, Time2 and the Gain Score

Experimental Group	N	Mean	SD	M.S.	df	F	p
	Time1						
Traditional	107	10.02	2.61				
Traditional + Video	99	8.64	2.54	49.14	2	6.88*a	.00
Video only	95	9.34	2.86				
	Time2						
Traditional	111	13.93	1.47				
Traditional + video	108	13.93	1.40	2.15	2	.92	.40
Video only	100	13.81	1.70				
	Gain in Score (Time2 - Time1)						
Traditional	106	3.92	2.57				
Traditional + video	98	5.28	2.71	47.46	2	6.95*a	.00
Traditional	93	4.48	2.56				

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

Unlike the time1 scores, results in Table 2 for the time2 score indicate that there were no statistically significant differences among the three groups. The last ANOVA test in Table 2 showed that there is a significant difference of gain score among three groups ($F [2, 294] = 6.95, p < .01$). The post hoc test showed that the gain score in traditional + video group is significantly higher than those in traditional only group. Four separate t-tests (see Table 3) show that time2 scores were significantly higher than time1 scores in all three groups and in total. Subjects in the traditional + video group had the highest difference ($M=5.29, SD=2.71, t =19.34, p< .001$) in knowledge scores between time1 and time2, while subjects in the traditional only group had the smallest difference.

Table 3.
Results of t-Tests Showing Difference in Time1 & Time2 (Gain) 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*

*$p < .01$

Figure 2 presents the knowledge score of the three groups at time1 and time2. All three lines show increases in knowledge over time. However, there was a clear difference in time1 scores between groups. The traditional lecture-demonstration group had the highest time1 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.

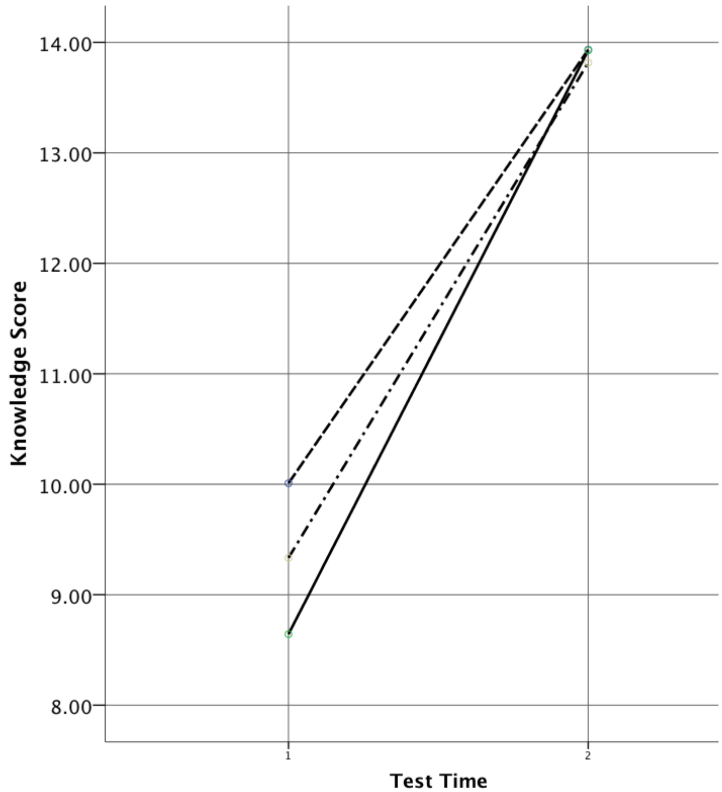

Figure 2. Knowledge Score of Three Experimental Groups Before and After Training

A repeated measures ANOVA test was conducted to test whether differences in knowledge scores between groups over time observed in Figure 2 were significant. The results, shown in Table 4, revealed that the knowledge score change observed in the traditional lecture-demonstration group, which had the highest time1 score (Table2), was significantly less than the change in scores seen in the traditional lecture-demonstration + video group ($p < .01$) and the video only group ($p=.04$).

Research Question 1 asked whether or not the addition of video increased the learning of the farmers. Because the group receiving the traditional lecture-demonstration + video learned significantly more than the group receiving only the traditional lecture-demonstration, the answer for this experiment is that video was an effective complement to traditional training, resulting in more knowledge gain than the traditional lecture-demonstration only method.

Research Question 2 asked if video could replace the traditional lecture-demonstration training. In this experiment, results show the video only group members increased their knowledge scores significantly more than the traditional lecture-demonstration group. This suggests that video alone could be an effective replacement for the traditional training approach.

One cautionary note is that the relatively low change score in the traditional lecture-demonstration group may be due to a ceiling effect (Richardson, Kitchen & Livingston, 2002, p. 339). The ceiling effect could occur because those in the traditional group already had relatively high knowledge scores at time1 which made it difficult for them to learn more. Their time2 scores approached the maximum of 15. However, even if a ceiling effect was present for the traditional group, the results indicate that the video only groups increased their knowledge significantly due to the training, which supports the idea that video might be able to replace the traditional lecture-demonstration approach.

Table 4.
Result of a Repeated Measurement ANOVA Testing Differences in Knowledge Score at Time1 and Time 2 by Experimental Groups

	df	ss	ms	F	p
Between subjects					
Group	2	48.5	24.25	4.01* ab	.02
Error	295	1784.75	6.05		
Within subject					
TestTime	1	3085.3	3085.30	904.08**	.00
TestTime*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.
** $p < .01$, * $p < .05$

The third research question asked whether the use of video in training decreases the knowledge gap about row planting of beans between men and women. To examine this research question, the change in knowledge scores over time was evaluated based on the repeated measurements adding gender as a covariant.

Table 5 presents knowledge scores by group for men and women at time1 and time2. 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 men, who averaged 10.15 at Time 1 and 14.19 at Time 2, an increase of 4.04. These results indicate that women had lower knowledge scores than men at Time 1, and although they never increased their scores to a higher level than men, they increased their scores more than men.

Results in Table 5 also show that in the traditional lecture-demonstration only group, women gained 4.09 points and the men's knowledge score increased 3.56 after training; the difference in knowledge scores between gender narrowed from 0.63 (time1) to 0.1 (time2). In the traditional + video group, the women's score increased by 5.64; and men's score was up by 4.39. In the video only group, there was only a slight difference of knowledge score gain between men (4.45) and women (4.49). Women learned as much as men in this group, and the gender knowledge gap about the training topic remained.

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 6. 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 in all three experimental groups, so differences in knowledge about row planting between men and women existed before the training (see Table 5). However, after the training, the gap in knowledge scores between genders decreased. Women's knowledge scores increased most rapidly in the traditional + video group (from 8.17 to 13.81).

Research

Table 5.
Knowledge Score Means (with Standard Deviations) at Time 1 and Time 2 by Treatment and Gender

	Traditional only		Traditional + Video		Video only		Total	
	Mean (N)	SD	Mean (N)	SD	Mean (N)	SD	Mean (N)	SD
Women T1	9.81 (72)	.31	8.17 (71)	.32	9.24 (84)	.29	9.09 (227)	2.80
Women T2	13.90 (74)	.18	13.81 (78)	.18	13.73 (87)	.17	13.72 (239)	1.59
Men T1	10.44 (35)	.46	9.82 (28)	.50	10.00 (11)	.80	10.15 (74)	2.33
Men T2	14.00 (36)	.26	14.21 (30)	.28	14.46 (13)	.45	14.19 (79)	1.26

There were also significant within-subjects differences, also indicated in Table 6. The F-test associated with TestTime [F (1, 293)=611.70] is consistent with the fact that average knowledge scores were always higher at time2 compared with time1. There was also a significant TestTime x Group interaction (F [2, 293]=6.97), which indicated that the changes in knowledge scores before and after training between experimental groups were significant after controlling for the effects of gender.

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 although both men and women learned about equally.

Table 6.
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	p
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		

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

Discussion/Conclusions

The first finding in this study indicates that participants in the group that received the combined traditional lecture-demonstration and video methods got higher scores than the group that only received the traditional lecture-demonstration. This finding suggests that video could be an effective complement to the traditional lecture-demonstration method, which is consistent with previous research (Shanthy & Thiagarajan, 2011) and supports the prediction from information processing theory that the use of multiple training methods can enhance learning (Eastman, 2010). This finding answers the first research question.

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 time1 to time2 between the two groups. This result indicates that the video only method can be as effective as the traditional lecture-demonstration only approach. This finding answered the second research question; video can replace the traditional lecture-demonstration method to help farmers learn new planting techniques. This finding supports several previous studies showing that video can

Research

be at least as effective as and sometimes more effective than traditional approaches (Zossou et al., 2010; David & Asamoah, 2011).

The current study suggests that all farmers in different treatment groups learn when they get access to quality information. The traditional + video method would especially benefit those farmers who had lower prior knowledge or education levels by providing information reinforcement. Furthermore, the video only method can be an appropriate training method in rural development, especially when the number of trainers is too small to meet farmers' demand. Sseguya, Mazur, Abbott and Matsiko (2012) found that less than 30% of households in Kamuli district are covered by reliable information sources (i.e. local NGOs). Working in these areas, video training alone could be used to increase the scale of farmers trained and decrease the costs of reaching each farmer (Van Mele, 2006). It is also possible that farmers could be exposed to training more frequently because video training could deliver information without the need for a professional trainer. As a result, farmers would get the chance to watch video covering the same topics repeatedly. In previous research, this repetition helped farmers to understand the contents and the benefits of the innovation (Chowdhury, Van Mele & Hauser, 2011) and to build enough confidence to try it out on their own land (Gandhi et al., 2011).

The third finding is that women, who had lower mean knowledge scores at time1, gained more knowledge than men in the traditional lecture-demonstration groups and the traditional lecture-demonstration + video groups. Gaps in knowledge about row planting between women and men actually decreased in these two groups. In the video only group, men and women increased their knowledge by about the same amount. This result demonstrated that video alone can at least benefit both men and women even though it did not narrow the gender knowledge gap.

Women in rural Africa commonly have lower social status and often lack mobility to participate in training and the opportunities to communicate with development staffs or rural extension workers (who are predominantly men) because of social norms (Zossou et al., 2010). Researchers have been worried that the introduction of new information communication technologies (ICTs) would deepen the gender knowledge gap (e.g. Oudshoorn & Pinch, 2003). This research suggests that video training delivered by pico-projectors could be an appropriate ICT tool to overcome gender barriers by providing understandable visual messages addressing women's needs in an encouraging group learning environment.

Recommendations for Future Study

Because of the poor road quality and the lack of transportation, it is hard to bring all participants together in a fixed location and randomly assign them to experimental groups. So participants were assigned according to their geographic location in this study which may explain the unequal pre-knowledge of the training topic among the three experimental groups.

In the current study, all three experimental groups were trained on the same topic. Although this enhanced the experimenter's level of control, it is not possible from this study to speculate about the potential effectiveness of video for other training topics. Future studies should explore videos for different agricultural procedures (e.g., planting, post-harvest practices, and marketing) and other issues such as health and nutrition to test video's potential for knowledge enhancement for multiple topics and disciplines, especially those that are new to farmers.

A right-after-training knowledge test was used in this research to evaluate the effectiveness of video training. It would be helpful if future studies could measure actual changes in behavior that occur during future planting seasons due to training. It is quite possible that participants may forget some knowledge of row planting quickly in the absence of appropriate reinforcement.

The pico-projector proved to be a useful device to deliver video training in this study. More research concerning simple, portable and durable devices to provide video training in rural areas, especially for disadvantaged groups, would be useful to increase accessibility.

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