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Abstract

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Abstract

This study explores the effectiveness of three training methods (traditional lecture-field demonstration, lecture and field demonstration + video, and video only) to narrow the gap in knowledge about row bean planting between men and women farmers in Kamuli District, Uganda. Using a pretest-posttest quasi-experimental design, this study found that the method that combined video and lecture/demonstration was significantly more effective in narrowing the gender knowledge gap. Use of video alone improved women's knowledge scores, but did not close the gap.

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Introduction

Although women are by no means invisible farmers (Sachs, 1983), their impact on the agricultural scene has historically been underestimated. According to recent estimates, women comprise 43% of the agricultural labor force worldwide (FAO, IFAD, & ILO, 2010). This percentage, however, masks regional variations and differences across and within countries. For example, in Sub-Saharan Africa and East Asia, they make up 60% of the agricultural labor market (Food and Agriculture Organization [FAO], 2011). In Uganda alone, women constitute 70-80% of the agricultural labor force, typically working without pay on family farms (Mijumbi, 2002).

Despite this, gender parity in terms of access to land, labor, inputs, and human and financial capital remains elusive. The Food and Agriculture Organization (2011) bemoans that "agriculture is underperforming in many developing countries for a number of reasons. Among these is the fact that women lack the resources and opportunities they need to make the most productive use of their time" (p. 3). Women face severe constraints in credit markets that rarely make loans on collateral other than land, which women do not own. They are not able to experiment with and adopt new technologies as quickly as men partly because of their lack of access to information (Butler & Mazur, 2007). In recent decades, development planners have become optimistic that the gender gap can be narrowed with the advent of information and communications technologies (ICTs) that promise to reduce transaction and information costs, but females have yet to benefit equally from their availability (Oudshoorn & Pinch, 2003). Messages and message delivery also have been known to cater almost exclusively to men's needs. Indeed, according to Farrell and Isaacs (2008), "the digital divide in Africa is also a gender divide" (p. 25), and this may exacerbate the pre-existing gap in knowledge between men and women (Huyer & Mitter, 2003).

How can recent innovations in mobile technologies and applications narrow this divide? Studies that test methods of using ICTs to decrease the knowledge gap between genders in developing nations are few and far between. This study attempts to contribute to this nascent field of inquiry by evaluating the impact of videos as a component of training sessions aimed to teach farming techniques to growers regardless of gender. Conducted in Kamuli district in southeast Uganda as part of a livelihood improvement program coordinated by a local non-government organization (NGO) and a Midwestern university, this program placed special emphasis on small-scale women farmer-landholders who were organized in groups of 10 to 30 to receive training. At the district level, the traditional lecture-demonstration method conducted by local extension workers or NGO staff has fallen short of the challenge. Field evaluations show that farmers demand more frequent and high quality training. In many cases, however, it has been difficult to motivate farmers to attend standard lectures. Employing other approaches, such as role playing and field demonstrations, appears to buoy interests. More recently, the project experimented with videos to complement or replace the traditional lecture-demonstration method of presenting information.

The impetus to deploy videos came from evidence that women respond more to visuals rather than to text-heavy materials (Tumwekwase, Kisauzi, & Misiko, 2009). Another push came with the release of durable, portable and battery-powered devices that can be used in the fields. In this study, a small "pico" projector was tested to train groups of 15-20 farmers at a time. Smaller than a normal projector (the 3MPro150 version is 1 by 2.4 by 5.1 inches and weighs 5.6 ounces) the pico can present training materials stored on a cell phone (Jain, Birnholtz, Cutrell, & Balakrishnan, 2011; Mathur, Ramachandran, Cutrell, & Balakrishnan, 2011). Some have an internal memory or an SD card slot, so they do not need to be connected to a computer or DVD player.

This study compares the ability of stand-alone video and other training approaches in reducing gaps in knowledge about a specific farming practice between men and women. Previous research has emphasized the pathways, patterns, and problems of introducing ICTs in developing countries (e.g., Jackson, Pompe, & Krieshok, 2012), but few studies have attempted to explore the extent to which ICTs outperform traditional training approaches in enhancing women's farming skills. Some scholars have focused on increasing women's farming knowledge within all-female groups (e.g., Zossou, Van Mele, Vodouhe, & Wanvoeke, 2010). However, many agricultural extension programs are implemented in settings where men and women learn together (Davis et al., 2012). The present study addresses gender inequalities in knowledge acquisition within a mixed learning environment.

Literature Review and Theoretical Framework

Over time, African women have taken on more responsibility and heavier workloads on the farm (Damisa & Yohanna, 2007; Ogunlela & Mukhtar, 2009) as men withdraw from the fields in search of employment opportunities in the cities (FAO, 1998; Young, 1993). In Uganda's Kamuli district, women are the ones who grow food crops; both men and women take care of cash crops, such as maize and groundnut (Sseguya, Mazur, & Masinde, 2009). Despite this hefty share of the farming responsibility, men still make the key agricultural management decisions and control the productive resources (Ogunlela & Mukhtar, 2009). Innovations in mobile technologies and applications have not made a dent in enhancing women's contributions to the agricultural enterprise. This is particularly true in Uganda, which ranks 161st among 195 countries on the Gender Inequality Index, a measure of how women and girls are "discriminated against in health, education and the labor market" (UNDP, 2013, para. 70).

Differences in gender access to land, labor, inputs, and financial capital have spawned asset inequality that has been shown to reduce potential gains in yields and output by an estimated 20–30% and 2.5–4%, respectively (FAO, 2011). Abundant evidence shows reducing the barriers that limit women's access to income is important in alleviating the non-monetary dimensions of poverty (Quisumbing, 2003; Smith, Ramakrishnan, Ndiyae, Haddad, & Martorell, 2003).

The Knowledge Gap Hypothesis

The knowledge gap hypothesis states that segments of the population with higher socioeconomic status tend to acquire information at a faster rate than the lower status segments, so that the gap in knowledge between these segments tends to increase rather than decrease with the increasing flow of information on a topic (Tichenor, Donohue, & Olien, 1970). There are forces that may act to widen or narrow this gap. Tichenor et al. (1970) identified formal education as one of them. In this case, because men often receive more formal education, they tend to acquire higher levels of agricultural productivity (Browne & Barrett, 1991; Farrell & Isaacs, 2008).

A second factor is differential access to relevant information (Tichenor et al., 1970). The traditional top-down agricultural extension approach in developing countries has mainly targeted and benefited better-off farmers, often men, who are exposed to more information from both formal and informal channels. Such training has often been poor at reaching women (Vodanovich, Urquhart, & Shakir, 2010).

Third, social norms in many Sub-Saharan countries restrict women's opportunities to communicate outside their families (Zossou et al., 2010), especially with male extensionists. A Mozambique report says, for example, that more than 30% of husbands get angry when male extension workers visit their wives (Salmen, 1999). Social norms also restrict women's mobility to travel to attend training sessions (Huyer & Sikoska, 2003; Zossou et al., 2010). In Uganda, only 27% of women-farmers, compared to 69% of men, have attended demonstrations and training courses (Salmen, 1999).

Fourth, information is often presented in forms that cannot be understood easily by less educated audiences. Because many women have not undergone formal schooling, the use of technical terms in written formats often precludes them from learning from training. The use of videos in their own language could offset this barrier.

Knowledge gap studies since the 1970s have shown that different media channels, depending on how they are used, may widen or narrow existing knowledge gaps (Donohue, Olien, & Tichenor, 1987; Griffin, 1990; Katzman, 1974; Kwak, 1999; Liu & Eveland, 2006). Indeed, the introduction and the application of ICTs to development projects have brought both opportunities and challenges in addressing gender knowledge gap issues (Geldof, 2011; Huyer & Mitter, 2003; Katzman, 1974). On the one hand, ICTs have the potential to narrow the gap by providing greater access to the information-poor, offering understandable and useful content, and fostering a supportive environment for accessing and learning new information (Katzman, 1974; Shingi & Mody, 1976). On the other hand, women's lack of financial resources, higher levels of technological and language illiteracy, norms that discourage women and girls from using technology, and lack of control over and ownership of technology restrict female access to ICTs (FAO, IFAD, & ILO, 2010).

Videos for Training and Gender Knowledge Gap Reduction

Overall, studies have shown video-mediated training has strong potential to overcome information inequalities between gender (Bery, 2003; Lie & Mandler, 2009; Zossou et al., 2010). Approximately 80% of development organizations surveyed by Van Mele (2011) rated videos as quite to very useful in reaching less educated audiences. Heffernan and Nielsen (2007) also concluded visual elements enhanced learning among the poor. Training videos that show successful adoption evidences within a local environment and those that feature actors culturally similar to audiences were rated highly (Chowdhury, Van Mele, & Hauser, 2011; Gandhi, Veeraraghavan, Toyama, & Ramprasad, 2007). Videos have also been known to transcend the literacy barrier (Coldevin, 2003; Gandhi et al., 2007; Lie & Mandler, 2009).

Some scholars have offered evidence that women prefer video-mediated approaches over text materials and are willing to pay more to get video disks (Tumwekwase, Kisauzi, & Misiko, 2009; Van Mele, 2011). In a Bangladesh village, women became increasingly involved in deciding how to spend the family's disposable income after exposure to a training video. Their abilities to explore sources, bargain for better prices, and manage organizational support were strengthened by training programs that made use of videos (Chowdhury et al., 2011).

Scholars have also documented increased participation in development programs by farmers shown videos in groups of 10 to 30 (David & Asamoah, 2011; Gandhi et al., 2007; Okry, Van Mele, & Houinsou, 2013; Zossou et al., 2010). Videos have been used in the field as a complement to, or a replacement for, traditional training methods such as lectures and farmer-to-farmer extension. Trainings that combine video and traditional methods have produced greater knowledge gains (Shanthy & Thiagarajan, 2011) and higher adoption intentions to adopt recommended practices (Gandhi et al., 2007; Zossou et al., 2009) versus traditional training methods alone. Other studies have shown exposure to exclusive video training was successful in increasing knowledge test scores (David & Asamoah, 2011) and in creating interest in specific technologies than attendance in traditional workshops (Zossou et al., 2010).

Video training that reaches more audiences has been found to be more cost effective than traditional methods (Van Mele, 2006). Until recently, the shortage of electricity and intermittent access to the Internet and other modern technology have limited the adoption of modern training devices such as computers and TV to present videos in rural areas (Jain et al., 2011). The low ICT proficiency of rural training facilitators also dictates the use of simple and user-friendly training devices. Because videos are shown in multiple locations that do not have electricity, low-cost battery-operated devices are a must. The present study tested the small battery powered pico projector to display images suitable for viewing by groups of 15-20 with an extra sound speaker to increase volume.

Given the axioms of the knowledge gap hypothesis and the availability of ICTs and devices that render video-mediated training feasible in rural areas, this study asked:

RQ1: Can gender knowledge gaps be reduced when male and female farmers are provided equal access to training?

RQ2a: Does the combined used of traditional and video training enhance learning by women and reduce gender knowledge gaps?

RQ2b: Can video alone increase women's knowledge about a farm practice and narrow the gap in farming knowledge between gender?

Methods

The Sample

Three hundred twenty-five residents of four parishes (Naibowa, Bugeywa, Butansi and Naluwoli) in Butansi sub-county, Kamuli district who grew beans and were members of a farmers' group participated in this study. Of these, 245 were females. Before the study, they had received training on a number of farm production practices from an NGO that primarily used lectures and demonstrations delivered by community-based trainers (CBTs). The average age of the farmer-participants was 41 years. The average household size was eight (three adults and five children). The participants had an average of 5.81 years of formal education (SD = 3.81), but 6.3% of the men and 22% of the women had never been to school. They grew beans on about 0.54 acres (SD = .41), roughly 14% of the total farmland they own. The female participants had significantly fewer years of formal education (M = .19, t (323) = 5.39, p < .01], farmed fewer bean acres (M = .36, t (323) = 2.24, p < .05), and used fewer information sources for bean production (M = 1.84, t (315) = 2.16, p < .05) compared with their male counterparts (see Table 1).

Table 1

Comparisons of Years of Formal Education, Number of Information Sources for Bean Production, of Bean Planted Between Men and Women

	Women	Men	*t*-value
Years of formal education	5.19	7.73	5.39^{***}
Number of information sources	1.84	2.10	2.16^{*}
Acre of beans	0.36	0.49	2.24^{*}

Note. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Experimental Treatments

Based on residence, farmer-participants were assigned to one of three experimental conditions: (a) lecture and field demonstration (traditional), (b) lecture and field demonstration + video (traditional + video), and (c) video only (see Table 2). Lectures, field demonstrations and videos that explain and illustrate how to plant beans in rows served as the experimental stimuli.

Table 2

The Study's Experimental Design

Treatment	Parish[1]	Training components (in order)	Duration (min.)	*n*	% Women
Traditional lecture/ demonstration only	Naibowa & Bugeywa	1. Traditional lecture and field demonstration	30	111	66.7
		2. Farmer demonstration and group discussion	15		
Traditional lecture/ demonstration + Video	Butansi	1. Traditional lecture and field demonstration	30	103	73.0
		2. Video	8		
		3. Farmer demonstration and group discussion	15		
Video only[2]	Naluwoli	1. Video	8	103	87.4
		2. Farmer demonstration and group discussion	25		
		3. Video	8		

Note. **[1]** The video was shown twice.

In the group that received the traditional lecture-demonstration, the CBTs first presented the theory underlying the practice of planting beans in rows and then showed a 30-minute demonstration of the process. The traditional + video group received the lecture-demonstration and an eight-minute video in which local residents, using the local language, show how to plant beans in rows. The video group was shown the training video twice with minimal facilitation.

The Experimental Stimulus

Row planting (or planting in lines) requires farmers to plant beans at the beginning of the rainy season in rows 50 cm (1.5 ft) apart with seeds planted at a distance of 15-20 cm (0.5 ft). Beans of different varieties are planted at least two meters apart so they do not mix. Row planting makes it easier to weed, identify pests and diseases, spray. It helps the plant to access sufficient nutrients. For this process, planters need strings, two 1.5-ft. sticks, and a hoe.

In the video, a local farmer explains the rationale behind row planting, what it involves, the tools needed, and the benefits the can be derived from the practice. Then, he demonstrates how to dig the trench, measure the distance between rows using a pug, and planting. Project specialists and the local extension staff reviewed the video for technical accuracy.

Experimental Design and Procedures

The experimental procedure and the questionnaire were pre-tested in a non-experimental parish. Before each session, the trainees' knowledge of row planting was assessed. After training, the farmers completed a post-test questionnaire. Participants were interviewed individually at the training site immediately before and after the training.

Operational Definition of Knowledge Gap

In this study, knowledge gap was measured by comparing the difference in pretest and post-test knowledge scores between gender**.** The knowledge test was composed of four open-ended questions: (a) What problems in bean production can row planting solve? (b) What are the main steps involved in row planting? (c) What benefits can be derived from row planting? (d) What tools do you need to do row planting? Farmers received a point for each correct answer.

Incorrect and "don't know" answers received no point. For example, a participant who mentioned "higher yields" and "making spraying easier" in answer to the question, "What benefit(s) do you get from row planting?" received two points. The knowledge score was determined by counting the number of earned points. The highest possible score was 15; the lowest was 0.

Results

Gender Knowledge Gap

To answer the first research question, the knowledge scores and knowledge gaps between male and female participants before and after exposure to training were compared. Table 3 and Figure 1 present the mean knowledge scores at pretest (T1) and post-test (T2). The figures reveal that both men and women increased their knowledge of the topic after training. Although their knowledge scores were lower than those of males, women's average score improved from 9.09 at T1 to 13.72 at T2, an increase of 4.63 points. The men, on the other hand, averaged 10.15 at T1 and 14.19 at T2, demonstrating an increase of 4.04 points. However, the change in knowledge scores for women was significantly larger so that the difference in knowledge scores between the two groups decreased from 1.06 to 0.47.

Table 3

Results of t-tests Showing Difference in Time 1 & Time 2 Knowledge Scores (with Standard Deviations) by Gender

Test Time	Women (*SD*)	Men (*SD*)	Difference	*t*-value
Time 1	9.09 (2.8)	10.15 (2.33)	1.06	2.94**
Time 2	13.72 (1.59)	14.19 (1.26)	0.47	2.37**
Gain Score	4.63	4.04	.59	-1.99*

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

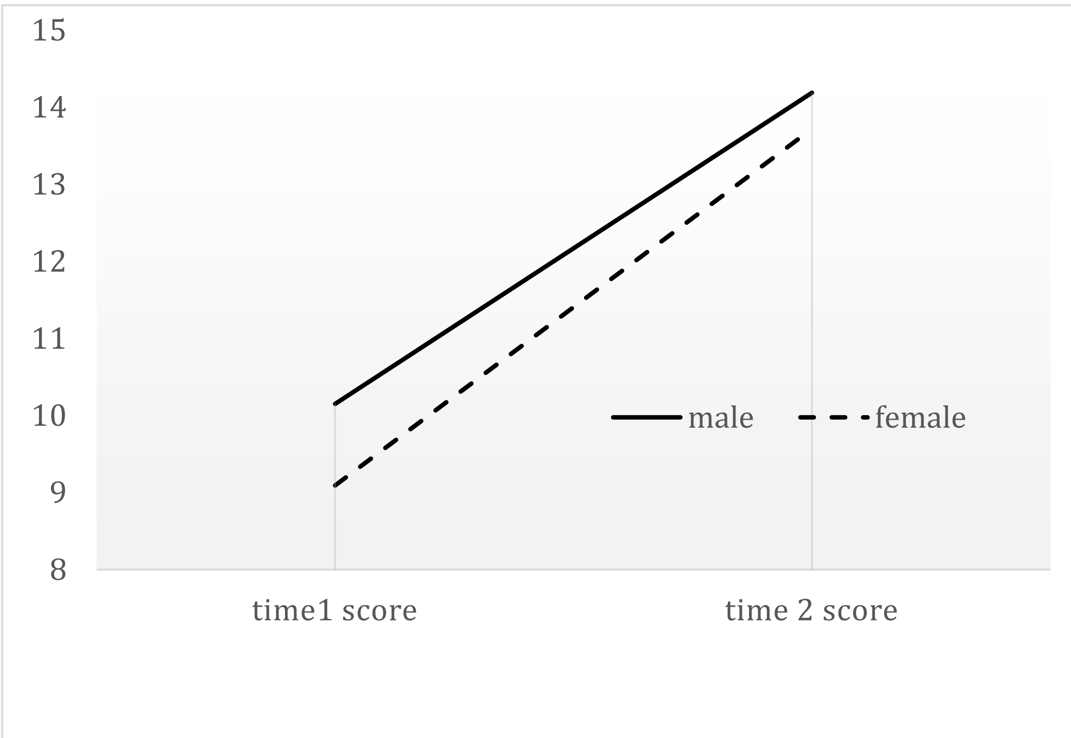

Figure 1. Difference in T1 and T2 mean knowledge scores between males and females.

The results of an independent samples *t*-test show that the differences in knowledge scores were statistically significant at both T1 (t (299) = 2.94, p < .002, one-tailed *t*-test) and T2 (t (316) = 2.37, p < .01, one-tailed *t*-test). This suggests although a knowledge gap still can be detected after training, women learned more, effectively narrowing the gap (t (295) = -1.99, p < .025, one-tailed *t*-test) between male and female training participants.

Video as a Training Tool to Reduce Gender Knowledge Gaps

The second research question asked whether the use of video, both as a complement or a substitute to the traditional lecture-demonstration method, decreases the knowledge gap about bean row planting between men and women. To examine this research question, three independent-samples *t*-tests and a repeated measures analysis of variance (ANOVA) test were conducted. Table 4 presents the knowledge scores of men and women at T1 and T2 in each experimental group. The results show men and women in all three groups improved their knowledge scores over time. Men had higher knowledge scores before and after training. However, the gender difference in knowledge scores diminished over time. The most reduction was found in the traditional + video group; the least was observed in the video-only group.

In the traditional group, women gained 4.09 points and the men's knowledge score increased to 3.56 after training. Thus, the difference in knowledge scores between the two groups narrowed from 0.63 to 0.1. In the traditional + video group, the women's score increased from 8.17 to 13.81, up by 5.64. Men averaged 9.82 at T1 and 14.21 at T2, an increase of 4.39. In the video-only group, there was only a slight difference in knowledge gain between men (4.45) and women (4.49). Although women learned as much as men in this group, the gender knowledge gap remained.

The *t*-test results (see Table 4) showed the narrowing of the gap was significant for the traditional + video group (men (4.39) and women (5.64); *t* (96) = -2.10, $p < .02$, one-tailed *t*-test). There was no significant gender difference in knowledge gain detected in both the traditional and the video-only group. The change scores for men in the traditional group were lower than those of the other two groups perhaps because they already had high knowledge scores before training (T1 = 10.44), an indication of a ceiling effect in learning. Participants in the traditional + video group had a lower T1 score, indicating that there is so much more for them to learn.

Table 4

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

		Traditional only		Traditional + Video		Video only	
		Mean	*SD*	Mean	*SD*	Mean	*SD*
Time 1	Women	9.81	.31	8.17	.32	9.24	.29
	Men	10.44	.46	9.82	.50	10.00	.80
Time 2	Women	13.90	.18	13.81	.18	13.73	.17
	Men	14.00	.26	14.21	.28	14.46	.45
Gain score	Women	4.09	2.57	5.64	2.83	4.49	2.02
	Men	3.56	2.55	4.39	2.15	4.45	2.64
	t-value	-1.01		-2.10*		-.04	

Note. *$p < .05$.

The results of the repeated measures ANOVA testing the changes in knowledge scores over time, the differences in knowledge scores between men and women, and differences between treatment groups are shown in Table 5. Across time, 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 T1 (9.09 compared to 10.15 for men), which indicates differences in knowledge about row planting between males and females existed before the training (see Table 4). However, after the training, the overall gap in knowledge scores between genders decreased. In addition, significant differences between groups ($F(2,293) = 3.82$) were detected after controlling for the effects of gender.

There were also significant within-subjects differences as indicated in Table 5. The results of the *F*-test associated with the time of test ($F(1, 293) = 611.70$) are consistent with the fact that average knowledge scores were always higher at T2 compared with T1. The change in knowledge score was significant for the TestTime x Gender interaction ($F(1, 293) = 4$, $p = .05$), which indicates the change in knowledge score is significantly different between men and women. There also was a significant TestTime x Group interaction ($F(2, 293) = 6.97$), which suggests the change in knowledge scores before and after training between experimental groups was significant.

Table 5

Results of a Repeated Measures ANOVA Testing the Differences in Knowledge Scores at Time1 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		

Note. *$p < .05$. **$p < .01$.

The findings for the second research question suggest the traditional + video method could effectively close knowledge gaps between men and women. The video-only method demonstrated a lesser ability to narrow the gap. It should be noted that men, especially those in the traditional group, already had high scores at T1 (10.44), and therefore did not have much room to improve their knowledge, suggesting a ceiling effect.

Conclusions

This study reports three major findings. First, the results show the knowledge gap can be narrowed when men and women get equal access to quality information. Second, video training, when combined with the traditional lecture/demonstration method, can significantly narrow knowledge gaps. Third, women exposed to the video-only group learned as much as men. Therefore, although the gender knowledge gap did not narrow following this method, it did not widen it either.

Past studies have shown social structural factors are often responsible for gender knowledge gaps (e.g., Geldof, 2011; Hafkin, 2000; Huyer & Sikoska, 2003). Knowledge gap researchers argue people with lower SES have lower exposure to information sources (Tichenor et al., 1970), which results in less knowledge compared to those with higher SES (e.g., Liu & Eveland, 2006; Shingi & Mody, 1976). The women in the current sample had significantly lower educational experience, smaller farm size, and used fewer agricultural information sources than men. After exposure to quality training, however, women increased their knowledge about a bean production practice significantly. Overall, the gender knowledge gap decreased, although women still showed lower knowledge scores. This finding suggests the magnitude of the gap could be decreased by increasing female access to information, which is consistent with the propositions of Donohue et al. (1987).

The effectiveness of video as a complement and a substitute to the traditional lecture/demonstration method in decreasing the gender knowledge gap was evaluated. The results show the combination of video and traditional lecture/demonstration significantly decreased the gender knowledge gap. The traditional-only method narrowed the gender knowledge gap, but not significantly. This demonstrates women with lower SES can gain significant knowledge, but they need both methods to boost learning.

In the video only group, women learned as much as men, but no significant narrowing of the knowledge gap was observed after training. This result demonstrates video as a stand-alone training method can benefit both men and women even though it did not narrow the gender knowledge gap.

The findings add support to the contention that ICTs can decrease existing economic, political and social inequalities in gender-biased societies (Hafkin, 2000; Tichenor et al., 1970). In this study, the gender gap-narrowing abilities of the method that combined ICTs and conventional training produced the most desired results, supporting the findings of Van Mele (2008) who observed video can be integrated with other learning approaches. Recently, the cost of ICTs such as the portable pico video projector has fallen dramatically. Thus, they could be exploited by local instructors who need to conduct training in remote areas with poor roads and limited electricity. For farmers with less education and skills, the multiple reinforcing channels can improve understanding and recall of concepts and applications (Coldevin, 2003; Lie & Mandle, 2009).

The results indicate the video-only method is most appropriate when the number of trainers is too small to meet farmers' demand. Sseguya et al. (2012) found fewer than 30% of households in Kamuli district are covered by reliable information sources (i.e., the local NGOs). The use of videos alone can therefore expand training reach and frequency. Videos also enable instant replay and repetition, which can aid in the deeper processing of information (Chowdhury et al., 2011). Repetition has also been shown to assist in the building of confidence to try out recommended practices (Gandhi et al., 2007).

Study Limitations and Directions for Future Work

There are several study limitations that curtail the generalizability of these findings. First, the participants were not randomly assigned to the three experimental groups because the training sessions were held based on parish. Although there were no significant differences in age ($F(2, 317) = 2.71$, $p = .07$) and farmland owned ($F(2, 314) = 1.21$, $p = .30$) among the three groups, the results of a Least Significant Difference (LSD) *post hoc* test suggest members of the traditional lecture/demonstration group (from Naibowa and Bugeywa parishes) had significantly higher education than the video only group (from Naluwoli), and planted significantly more beans during the 2011 growing season than those from Butansi (traditional + video) and Naluwoli. Farmers from Naibowa and Bugeywa also saved more beans for seeds, suggesting they relied less on outside seed sources. These differences, which could have been controlled through random assignment, may have influenced the experimental outcomes. Second, the farmer-participants had already been trained about the bean row planting before the experiment. Their familiarity with the topic, therefore, may explain the high pretest scores, especially among men. Future studies should verify the present results using new agricultural practices. Third, training impact could have been gauged in terms of actual bean yield to provide a stronger evidence of the application of concepts and skills learned. Although the majority of the participants said they intended to plant beans using the recommended procedures, the trainers did not check if they actually did so. Fourth, the video only group received ten more minutes of group demonstration and discussion. This study did not test whether that group's longer exposure to demos and discussions had a bearing on the finding that men in the video only group gained the most.

Future studies could explore other factors, such as educational levels and information sources, to explain gender knowledge gaps and to test how the influence of these factors can be reduced by the deployment of ICTs. The cost-effectiveness of training using ICTs could also be evaluated and compared with that of traditional approaches for both small-scale and large-scale training efforts. Finally, more studies that examine appropriate devices that can expand video training in rural areas are in order.

References

Bery, R. (2003). Participatory video that empowers. In S. A. White (Ed.), *Participatory video: Images that transform and empower* (pp. 102-122). New Delhi: Sage.

Browne, W. A., & Barrett, R. H. (1991). Female education in Sub-Saharan Africa: The key to development. *Comparative Education, 27*(3), 275-285.

Butler, L. M., & Mazur, R. E. (2007). Principles and processes for enhancing sustainable rural livelihoods: Collaborative learning in Uganda. *International Journal of Sustainable Development and World Ecology, 14*(6), 604-617.

Chowdhury, A. H., Van Mele, P., & Hauser, M. (2011). Contribution of farmer-to-farmer video to capital assets building: Evidence from Bangladesh. *Journal of Sustainable Agriculture, 35*(4), 408-435.

Coldevin, G. (2003). *Participatory communication: A key to rural learning systems.* Rome, Italy: The Food and Agriculture Organization of the United Nations.

Damisa, M. D., & Yohanna, M. (2007). Role of rural women in farm management decision making process: Ordered probit analysis. *Trends in Applied Sciences Research, 2*(3), 241-245.

David, S., & Asamoah, C. (2011). Video as a tool for agricultural extension in Africa: A case study from Ghana. *International Journal of Education and Development Using Information and Communication Technology, 7*(1), 26-41.

Davis, K., Nkonya, E., Kato, E., Mekonnen, D. A., Odendo, M., Miiro, R., & Nkuba, J. (2012). Impact of farmer field schools on agricultural productivity and poverty in east Africa. *World Development, 40*(2), 402-413.

Donohue, G. A., Olien, C. N., & Tichenor, P. J. (1987). Media access and knowledge gaps. *Critical Studies in Mass Communication, 4*(1), 87-92.

Farrell, G., & Isaacs, S. (2008). *Beyond primary education: Challenges and approaches to expanding learning opportunities in Africa*. Paper presented at the Biennale on Education in Africa, Maputo, Mozambique.

Food and Agriculture Organization of the United Nations [FAO]. (1998). *Rural women and food security: Current situation and perspectives*. Rome, Italy: FAO.

FAO. (2011). *The state of food and agriculture 2010–2011*. Rome, Italy: FAO.

FAO, International Fund for Agricultural Development [IFAD], and International Labor Organization [ILO]. (2010). *Gender dimensions of agricultural and rural employment: differentiated pathways out of poverty: Status, trends and gaps.* Rome: FAO.

Gandhi, R., Veeraraghavan, R., Toyama, K., & Ramprasad, V. (2007, December). *Digital green: Participatory video for agricultural extension*. Paper presented at the 2007 International Conference on Information and Communication Technologies and Development, Bangalor, India.

Geldof, M. (2011). Earphones are not for women: Gendered ICT use among youths in Ethiopia and Malawi. *Information Technologies & International Development, 7*(4), 69-80.

Griffin, R. J. (1990). Energy in the eighties: Education, communication, and the knowledge gap. *Journalism Quarterly, 67*(3), 554-566.

Hafkin, N. (2000). Convergence of concepts: Gender and ICTs in Africa. In E. Rathgeber & E. Adera (Eds.), *Gender and the information revolution in Africa* (pp. 1-16). Ottawa, Canada: International Development Research Centre.

Heffernan, C., & Nielsen, L. (2007). The livestock guru: The design and testing of a tool for knowledge transfer among the poor. *International Technologies & International Development, 4*(1), 113-121.

Huyer, S., & Mitter, S. (2003). *ICTs, globalization and poverty reduction: Gender dimensions of the knowledge society. Part I. Poverty reduction, gender equality and the knowledge society: Digital exclusion or digital opportunity?* Retrieved from http://unpan1.un.org/intradoc/groups/public/documents/unpan/unpan037351.pdf.

Huyer, S., & Sikoska, T. (2003). *Overcoming the gender digital divide: Understanding ICTs and their potential for the empowerment of women*. INSTRAW research paper no. 1. Retrieved from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SHS/pdf/Overcoming-Gender-Digital-Divide.pdf.

Jackson, S. J., Pompe, A., & Krieshok, G. (2012). *Repair worlds: Maintenance, repair, and ICT for development in rural Namibia*. Paper presented at the ACM 2012 conference on Computer Supported Cooperative Work, Seattle, WA.

Jain, M., Birnholtz, J., Cutrell, E., & Balakrishnan, R. (2011). *Exploring display techniques for mobile collaborative learning in* *developing regions*. Paper presented at the 13th International Conference on Human Computer Interaction with Mobile Devices and Services, New York, NY.

Katzman, N. (1974). The impact of communication technology: Promises and prospects. *Journal of Communication, 24*(4), 47-58.

Kwak, N. (1999). Revisiting the knowledge gap hypothesis: Education, motivation, and media use. *Communication Research, 26*(4), 385-413.

Lie, R., & Mandler, A. (2009). *Video in development: Filming for rural change*. Wageningen, Netherlands: Technical Centre for Agricultural and Rural Cooperation, Deutsche Gesellschaft fur Technische Zusammenarbeit, & FAO.

Liu, Y. I., & Eveland, W. P. (2006). Education, need for cognition, and campaign interest as moderators of news effects on political knowledge: An analysis of the knowledge gap. *Journalism & Mass Communication Quarterly, 82*(4), 910-929.

Mathur, A., Ramachandran, D., Cutrell, E., & Balakrishnan, R. (2011). *An exploratory study on the use of camera phones and pico projectors in rural India*. Paper presented at the 13th International Conference on Human Computer Interaction with Mobile Devices and Services, New York, NY.

Ogunlela, I. Y., & Mukhtar, A. A. (2009). Gender issues in agriculture and rural development in Nigeria: The role of women. *Humanities and Social Science Journal, 4*(1), 19-30.

Okry, F., Van Mele, P., & Houinsou, F. (2013). Forging new partnerships: Lessons from the dissemination of agricultural training videos in Benin. *The Journal of Agricultural Education and Extension, 20*(1), 1-21.

Oudshoorn, N., & Pinch, T. (2003). How users and non-users matter. In N. Oudshoorn & T. Pinch (Eds.), *How users matter: The co-construction of users and technology* (pp. 1-25). Cambridge, MA: MIT Press.

Quisumbing, A. (2003). *Household decisions, gender and development: A synthesis of recent research.* Washington, DC: International Food Policy Research Institute.

Sachs, C. E. (1983*). The invisible farmers: Women in agricultural production.* Totowa, NJ: Rowman and Allanheld.

Salmen, F. L. (1999). *The voice of the farmer in agricultural extension: A review of beneficiary assessments of agricultural extension and an inquiry into their potential as a management tool.* Paper presented at the AKIS Discussion Group, Washington DC.

Shanthy, T. R., & Thiagarajan, R. (2011). Interactive multimedia instruction versus traditional training programmes: Analysis of their effectiveness and perception. *Journal of Agricultural Education and Extension, 17*(5), 459-472.

Shingi, M. P., & Mody, B. (1976). The communication effects gap: A field experiment on television and agricultural ignorance in India. *Communication Research, 3*(2), 171-190.

Smith, L., Ramakrishnan, U., Ndiyae, A., Haddad, L., & Martorell, R. (2003). *The importance of women's status for child nutrition in developing countries.* Washington, DC: IFPRI.

Sseguya, H., Mazur, R., Abbott, E., & Matsiko, F. (2012). Information and communication for rural innovation and development: Context, quality and priorities in southeast Uganda. *Journal of Agricultural Education and Extension, 18*(1), 55-70.

Tichenor, P. J., Donohue, G. A., & Olien, C. N. (1970). Mass media flow and differential growth in knowledge. *Public Opinion Quarterly, 34*(2), 159-170.

Tumwekwase Ahabwe, A., Kisauzi, T., & Misiko, M. (2009). *Media, gender and rice information in Itek-Okile irrigation scheme of Lira District, Uganda.* Cotonou, Benin: Africa Rice Center.

United Nations Development Program [UNDP]. (2013). *International human development indicators: Gender inequality index (GII).* Retrieved from http://hdrstats.undp.org/en/indicators/68606.html.

Van Mele, P. (2006). Zooming-in, zooming-out: A novel method to scale up local innovations and sustainable technologies. *International Journal of Agricultural Sustainability, 4*(2), 131-142.

Van Mele, P. (2008). Multiple approaches to enhance communication between rice farmers, rural service providers and scientists. *Outlooks on Pest Management, 19*(6), 260-263.

Van Mele, P. (2011). *Video-mediated farmer-to-farmer learning for sustainable agriculture.* Ghent, Belgium: Agro-Insight.

Vodanovich, S., Urquhart, C., & Shakir, M. (2010). Same but different: Understanding women's experiences with ICT in the UAE. *Electronic Journal of Information Systems in Developing Countries, 40*(4), 1-21.

Young, K. (1993). *Planning development with women: Making a world of difference*. New York: Palgrave Macmillan.

Zossou, E., Van Mele, P., Vodouhe, S. D., & J. Wanvoeke, J. (2009). Comparing farmer-to-farmer video with workshops to train rural women in improved rice parboiling in central Benin. *Journal of Agricultural Education and Extension, 15*(4), 329-339.

Zossou, E., Van Mele, P., Vodouhe, S. D., & Wanvoeke, J. (2010). Women groups formed in response to public video screenings on rice processing in Benin. *International Journal of Agricultural Sustainability, 8*(4), 270-277.