

# Digitally Assisted Diffusion of Innovations

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(Fraser and Villet, 1994)

For several years, I have focused on how information and communication technologies (ICTs) can practically benefit impoverished communities in rural Africa. While working with telecentres in Nigeria, I noticed that text-based information in CD-ROMs, websites and emails were under-utilized, even when the source was personally known to the centre staff. This is not unique. In her research on the impact of ICTs for development in Africa, Thione (2003, p.66) reports that even information that communities request tends to remain unused. However, I noticed that the youth at one telecentre watched the only available music video daily. I began noticing the difference between my assumptions and preferences, as a member of a text-based culture, versus those of people from a more oral culture. For example, I used the Internet to search for information for the telecentre, and copied text-based resources to the hard drive for offline viewing. The telecentre staff did not review these resources. They primarily used the Internet for email, which they typed slowly, even if they had taken a typing course. My touch-typing skills surprised them. Also, they did not use their local languages on the computers. Their software and much of their writing was in English, the official language, although local languages are spoken almost exclusively. They had a Yoruba font to support their accents, but had not installed or used it. Later, when I asked for a written translation of an English video script, the project members referred me to a Yoruba expert after hours of struggle; writing Yoruba is much more difficult than speaking it. All of these experiences piqued my curiosity about the impact of audiovisual mediums versus text as tools for informal adult education and community development in Nigeria. This led to a joint solar cooking/video project with these telecentres.

The impetus for the project began when the Ago-Are Information Centre and Fantsuam Foundation asked for help learning how to solar cook. I sent them four-page illustrated instructions for building and using a cardboard solar cooker, which I had successfully implemented. My contacts were personal friends to whom I provided email support. The necessary materials were available for under \$5 US. The instructions were never fully implemented, although they confirmed their interest in solar cooking and requested I continue supporting them.

This intrigued and sobered me. If literate, educated people did not successfully use textual material to implement solar cooking, what would help them better? To test whether a video would be more effective than text alone, we collaborated on a solar cooking and video training project. While the project was too limited to fully answer this question, the initial results were encouraging. New videographers picked up camera and editing skills easily, and the amateur videos quite effectively trained people how to solar cook.

If audiovisual materials indeed communicate more effectively than text, then a great deal of development information could achieve better results if it was delivered differently. Studies show that “we retain **10% of what we read**, 20% of what we hear, 30% of what we see, **50% of what we hear and see**, 70% of what we say, and 90% of what we say and do” (Pike 1989, p.61, emphasis mine). In development contexts, **content from audiovisual training materials** is recalled **four or five times better than heard material**, and **nine times better than read material** (Fraser and Villet 1994). Ninety-two per cent of primarily illiterate farmers in Peru liked watching training videos because “it was like ‘actually being in the field’” (Fraser and Villet 1994). Multimedia content is also more relevant than text for many developing countries (Spence 2003, p.76). Centre de Services de Production Audiovisuelle (CESPA) in Mali uses culturally adapted visual pedagogy principles developed by Manuel Calvelo, and trains people to use educational videos for community outreach.

Text, radio, and verbal presentations are prevalent ways of sharing development information. If one retains only 10% of what one reads and 20% of what one hears, impacts when using these mediums are significantly curtailed. Adding audiovisual materials increases retention rates to 50%. When interactive training methods are used to prompt the learners to say what they have learned, retention increases to 70%. It reaches 90% when one explains the lesson out loud while practicing it. This is particularly encouraging for “train the trainer” programs. New technologies make creating and distributing multimedia content easier and less costly, and reduce or remove obstacles posed by limited access to bandwidth, electricity grids, and broadcast networks. In the North this is seen through the multiplication of amateur videos, video blogs and podcasts. In the South, it is time to take another look at development communications, their effectiveness, and the potential of video to improve development impacts at the individual and community level.

This paper uses the lens of diffusion of innovations (DOI) research to analyse how development communications can support programs such as introducing solar cooking. Strengths of DOI include its history, wide applicability (from marketing to health interventions), breadth of communications activities (from building awareness to persuasion to diffusion), and international relevance (Rogers 2003, p.59, 93-94, 102-105). This paper proposes ways that diffusion of innovations can be improved by the thoughtful incorporation of video. DOI also provides a valuable model for designing the most effective video content. Therefore video and DOI strengthen each other. This will be explored through the solar cooking case study.

## **DIFFUSION OF INNOVATIONS**

Everett Rogers, a pioneer in the field of diffusion of innovations, defines DOI as the “process in which an innovation is communicated through certain channels over time among the members of a social system” (2003, p. 5). It has four component parts: “the innovation, communication channels, time, and the social system” (Rogers 2003, p.11). Adoption or rejection of the innovation occurs when an individual’s knowledge about it reduces uncertainty to a tolerable level, allowing a decision to occur (Rogers 2003, p.14). Rogers conceptualizes the innovation-decision process in five stages: “(1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation” (2003, p.20).

The communication process about the innovation has different channels and objectives at different points in the diffusion process. For example, mass media may be involved in the introduction of the innovation to a population. When a respected leader shares the information (called an “opinion leader” in DOI literature), its impact increases. Since communities are not homogeneous, its various sub-groups may have their own opinion leaders. Adoption is strengthened when the appropriate opinion leader is used for the target audience (Rogers 2003, pp.26-27).

The promoter of the innovation, called the “change agent” (Rogers 2003, p.473), may discuss the innovation with people several times. The more similar they are to their audiences, the more effective change agents are. Since in fact they often differ substantially from their audiences, a more similar communications aide is often used to reach target audiences (Rogers 2003, pp.19-20, 28).

The rate of adoption of an innovation varies significantly (Rogers 2003, p.20). It is usually graphed as an S-curve, with the steepness of the slope indicating the speed of adoption (Rogers 2003, p.23). The “take-off point” occurs when 10-20% of the population have adopted an innovation (Rogers 2003, p.11, 274), after which diffusion becomes self-sustaining. The time to take-off can vary tremendously, and is generally measured in years (Rogers 2003, p.351). Via email in August 2005, Pascale Dennery from Solar Cooker International shared that it takes five years of active promotion to reach the take-off point for solar cooking.

Professor Albert Bandura (Stanford University) provides important insights into DOI via social learning theory, which states that people learn from others by observing them in person or via media (Rogers 2003, p.341). Examples include parents modeling for their children, teachers modeling for students, or children imitating their favourite television characters. Even adults continue to learn in this manner, for example, through television do-it-yourself programs.

Some weaknesses of DOI research are its bias towards successful diffusions (Rogers 2003, pp.106-107), under-emphasis of the rejection, discontinuance and re-invention of innovations (Rogers 2003, p.107, 111), and the tendency to assign the blame for rejecting a technology with the laggards, rather than with the system, change agency, or developer of the innovation (Rogers 2003, pp.118-125). DOI is sometimes criticized for helping the rich get richer, while leaving the poor no better off (Rogers 2003, p.130). This can be avoided by forecasting the impact of an intervention, targeting recipients from lower economic strata, and providing enabling social conditions such as cooperatives and credit to give disadvantaged people better access to innovations (Rogers 2003, p.134, 456-469).

Röling et al. (1976, p.162) provide another important critique of the DOI model: the fact that information is distorted as it passes from the initial recipients to the secondary audience. In one experiment, only 14% of the information reached the second generation of learners. In another study, farmers received only the new seeds introduced in a package of innovations, but no information that was critical to successfully growing these seeds. In a third case, the information reaching 25% of second-generation recipients was distorted (Röling et al. 1976, p.162). These factors severely limit the ability of indirect learners to implement an innovation. This contributes to increasing failure rates of innovations due to lack of information, rather than lack of value.

## **Video’s Contributions to Diffusion of Innovations**

How can video contribute to more effective diffusion of innovations? The low and inaccurate knowledge transfer rates that Röling et al. quoted (1976, p.162) are reason enough to incorporate video, which will consistently and accurately communicate 100% of the message to all generations of learners. Also, seeing is a more effective communication method than only reading or hearing (Fraser and Villet 1994, Pike 1989, p.61). Videos, therefore, are valuable additions to seminars, lectures, and print-based training materials. They can bridge geographical distances, compress time, and illustrate the impacts of competing choices. Opinion leaders, change agents and trainers can reach larger audiences on video than they can in person. They can be shown at times that are convenient to the audience and be watched multiple times. They can supplement in-person training programs, or replace them when they are not feasible. They can be combined with other technologies such as email, telephone, or SMS to provide remote support. This increases the impact of training programs while decreasing their dissemination costs.

## **SOLAR COOKING CASE STUDY**

The goals for incorporating video into the solar cooking project were to expand its geographical reach, to provide quality assurance for the diffusion efforts, and to leave a knowledge resource behind with the trainees that was available on-demand for unlimited use. Without incorporating video, the training would have been limited to the two communities that I trained in person. As a source of quality-assured content, the videos would overcome the risks of low rates of knowledge transfer between first and later generations of learners (Röling et al. 1976, p.162). They can virtually share messages from opinion leaders, experts, or drama troupes that could not be made in person due to time, distance, or budget. They can be reviewed when experiencing difficulties, or when one wishes to incrementally adopt new skills (e.g., first learning how to solar cook food, then adopting solar water pasteurization). Combining them with in-person interaction and demonstrations strengthens both training methods. Video can also be used interactively during the diffusion process itself, to capture new trainees' efforts, to help them see their successes and mistakes more clearly, or to show the benefits and challenges others faced when adopting the innovation. The best additional footage could be incorporated into future training programs. Video is also a very powerful communication method to deliver questions and answers between a trainer and trainees, allowing the trainer support more people than s/he could in person. Video is a valuable communications tool between extension agents, farmers, and agricultural institutions, where better information can improve farm yields and influence future agricultural research (Walker 1999). They can be delivered physically, electronically, or both, effecting a local, regional or global impact.

What did our solar cooking video project demonstrate? After using the videos we created in Nigeria during training workshops, I am convinced that they do communicate more effectively than print. Everyone who saw the solar cooking video wanted to try solar cooking, although most had no prior knowledge of it. However, the project leaders did not thoroughly review the printed training materials I brought, nor photocopy them. While time and financial constraints may have influenced this decision, they could have been overcome by asking volunteers to scan the materials. Print resources would have been even less effective for those project beneficiaries who had limited education, or who were functionally illiterate in English, the language of the training materials. In contrast, even passers-by stopped to watch the videos, which were in local languages. Video is a very popular medium in Nigeria. Both project communities have viable video rental stores, although a small proportion of the population owns TVs and VCRs. Ago-Are Information Centre's most popular business is selling tickets to watch televised soccer games. Showing educational videos after the games was one of the outreach plans we discussed.

To evaluate the video's impact, we administered baseline questionnaires to test participants' familiarity with solar cooking. Except for those who had seen someone solar cooking on the premises, none of the participants had any prior knowledge of solar cooking, and they reported their knowledge as "none" or "a little." We showed the video, then administered follow-up questionnaires to gauge the knowledge learned from the video. Next, we tested the participants' practical solar cooking skills by asking them to demonstrate the use of three types of solar cookers. Finally, we demonstrated solar cooking in person, and cooked a meal together.

Everyone could successfully demonstrate how to solar cook in the simple box cooker after watching the video. Only 28% of the trainees understood how to use the more complicated parabolic cooker based on the video alone, and no one's first try at aiming the parabolic stove was completely accurate. Ideas to improve future training results include interspersing watching the video with implementing the steps one by one, and improving the video content. For example, it could show people attempting to aim the stoves. The narrator could ask the viewers to identify any mistakes made, either individually or in groups, and instruct the viewers to pause the video while they discussed this. The subsequent footage would provide the correct answers. The videos should also contain self-evaluation indicators for the trainees to test their implementation skills (e.g., showing onions frying on the parabolic cooker, and encouraging trainees to adjust the cooker until they achieved enough heat to do the same).

A home economics teacher and a nurse were the participants who most quickly and thoroughly grasped the principles and skills of solar cooking. They could capably experiment with solar stove designs and recipes, and their teaching and public health experience would make them excellent trainers. I believe they could have successfully learned solar cooking based on video training alone. Most other participants, who were primarily housewives or market vendors, needed more support and in-person demonstrations to successfully solar cook. While the training methodology could be improved, adopting a new cooking method is more complex than just learning the skills. One needs to be persuaded it is valuable, invest in the solar cooker, persevere in practicing the skills and perfecting new recipes, and build the various steps of solar cooking into the household routine. Therefore, I recommend that videos first be used to “train the trainers,” whether this is through distance education or in-person training. These trainers can then show others how to solar cook with the support of the video for 100% knowledge transfer, and to show time-compressed demonstrations of solar cooking and multiple recipes (which would take hours in person, and which busy women and men do not have time for at a workshop). Sharing supporting information is important, like how quickly the cooker pays for itself, the health and workload benefits, opportunities for small businesses, etc.

Fully understanding the video’s success was curtailed in some respects by project limitations. For example, we could not afford to buy prefabricated stoves. Instead, we sought to train entrepreneurs how to make solar cookers for sale to the community. We ran three construction workshops, but no trainees made cookers to sell while I was there, and no families made their own cookers. Since no one adopted solar cooking at home, we could not compare the effectiveness of interpersonal knowledge transfer with video-based knowledge transfer to second-generation learners.

Inexperienced volunteers developed the video. They quickly grasped videotaping and editing skills, and required guidance in designing the storyboards, timelines, and content. Videographers who made VHS or digital videos for weddings or government functions had the best video skills, and would be the natural choice for video “train the trainer” programs.

## **CONCLUSION**

Easier and less expensive technologies make it more feasible for people to be digital content creators today than ever before. The content can remain local to one computer, one community centre, shared with small numbers via email or online groups, or with the world via the Internet. Video podcasts with creative commons licences offer one way of sharing content.

Colle (2005) suggests that universities and research centres link with telecentres to develop and distribute local content to communities. Aina (2006) recommends linkages between libraries, extension agents, and farmers, and the repackaging of print-based materials into accessible formats for illiterate farmers, including video.

In 2005, the Ago-Are Information Centre and the International Institute of Tropical Agriculture (IITA) implemented a joint project to help farmers interact with researchers via email. Unedited video would be even better for showing crop problems and interventions. It is more accessible to illiterate farmers, and allows more “virtual” discussions with an extension agent than are possible in person. The videos could contribute to training resources for IITA to share with other research institutions through online and offline methods.

Clearly, a video that successfully communicates knowledge is a static tool until somebody watches it, implements it, and promotes it. That is why CESPAs train its trainers to effectively use video educational materials. In the book “Participatory Video,” Shirley White (2003, pp.392-397) shares valuable recommendations about using video for development, including evolving telecentres into Community Communication Centres that serve as hubs for local development.

Investing in this vision would have a greater impact at the telecentres I have worked with than investing in more computers or bandwidth would.

If modern audiovisual materials are indeed more effective educational materials than text, a wonderful opportunity exists to increase the impact of existing development knowledge by supplementing text-based communications with multimedia communications. Audiovisual training materials allow professional knowledge producers such as development organizations and grassroots organizations such as telecentres make important information more accessible to the neediest audiences. Development libraries should provide more multimedia materials, accept content created in the field, and validate them for accuracy. They should be indexed by topic, audience, format, and language, and peer-ranked for effectiveness, similarly to how software is ranked on [www.download.com](http://www.download.com). They can be shared online, via physical media, or broadcast. They are accessible to illiterate people, to those whose learning styles favour demonstration and oral communication over reading, and to women, who suffer from the highest rates of poverty and the lowest rates of education. In all sectors and regions, the potential to increase information retention from 10% to 50% simply by changing its medium is very compelling. The training needs surrounding HIV/AIDS provide good examples. Whether to teach prevention methods or to help AIDS orphans gain life skills, videos may be more than just alternatives to printed materials in these cases – they may be important supplements to severely limited human resources.

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## **RECOMMENDATIONS AND FUTURE RESEARCH QUESTIONS FOR THE USE OF VIDEO FOR DEVELOPMENT**

The experience of implementing the solar cooking and video training project provided some valuable lessons that may be helpful for future projects, and questions for future research. These are shared below. For more information about the project, please visit [www.fluidITsolutions.com](http://www.fluidITsolutions.com).

### **CONTENT AND FORMAT**

#### **Quality Assurance: Evaluate Practical Skills Practically**

Testing whether a video communicates the desired information effectively is very important to fine-tuning it. If the video seeks to impart practical skills, it should be evaluated by asking viewers to provide hands-on demonstrations, because they may miscalculate their level of learning during an interview or questionnaire. In the solar cooking project, more people said they were ready to solar cook on the questionnaires than could properly apply the techniques in person.

#### **Self-Evaluation Content In Lieu Of An In-Person Trainer**

When the finished video is used for distance learning situations in which no trainer is available in person, participants must be able to evaluate their learning themselves. It is helpful to include content that allows people to confirm that they have applied the lessons correctly. For solar cooking, one could describe the expected shadows under the solar cookers, how long certain foods take to cook under various weather and seasonal conditions, and show foods frying in the parabolic solar cooker.

#### **Consider Various Audiences: Novice, Beginner, Intermediate and Advanced**

Consider the needs of viewers at various stages of implementation of the lessons on the video. Often a video assumes the audience has never seen it before. When a video will be used to train people in practical skills, especially by self-directed learning, it should encompass the learner's needs throughout the learning cycle. What are the needs of learners who are novices, beginners, intermediate, advanced, or those who could become trainers of others? A novice needs full information, but delivered in manageable chunks. A beginner would benefit from a summary of the key lessons that can quickly reviewed. A troubleshooting section might be helpful for those who are struggling with some aspects of implementation. An intermediate learner is ready for more advanced techniques – in solar cooking, this might be new recipes, or the principles needed to experiment with one's own recipes. An advanced solar cooker might be ready for baking. And a "train the trainer" section would support people who wish to share the lessons they learned through the video with others in person. For example, Centre de Services de Production Audiovisuelle (CESPA) in Mali produces videos, and also trains people how to use them effectively for community outreach. For complex topics, perhaps a video series would be best.

## **Maximizing Recall And Practice**

Encouraging viewers to think through and/or vocalize the principles being taught may lead to better recall and practice. For example, one could show examples of solar cooking, and ask the viewers to pause the video, then discuss whether the stoves were used correctly or not. Then they could continue watching the video to hear the answer and explanation for it. Include enough examples to review the most common mistakes revealed during the video evaluation step.

## **Reinforcing Content Through Creative Interaction And Pedagogy**

DVDs and online multimedia programs make it easy to separate content into questions and answers, or into chapters. Videos presented in other formats can be manually stopped and restarted. Be creative with the interactive use of video training materials. A video can introduce a scenario, be paused for group discussions, be interspersed with hands-on practice, or ask a question and be paused for people to hold discussions in pairs or groups, or come to their own conclusions. Video use should be incorporated into educational best practices, going beyond the broadcast model of simply showing a video from start to finish, without interaction. This type of interactivity is especially well supported by computer and web-based training.

## **Languages and Translation**

To use the same footage for videos in different languages, it is helpful to separate the action shots from the explanation shots. Since explanations take different lengths of time in different languages, timing voiceovers to action shots is difficult. It is easier to do a voiceover of someone explaining something, when you can truncate some footage or extend it by inserting images, as needed. One can even videotape someone explaining the action shots in the second language, and intersperse this footage with the original action shots. This methodology would be better than voiceovers, based on diffusion of innovations research that states that change agents with similar backgrounds and languages exert the most influence on audiences.

## **ONGOING SUPPORT**

Support is easiest to offer in person, but it can also be provided remotely. The intention with the solar cooking project was to develop videos that could be used as distance learning materials by people without access to in-person training. ICTs offer various means of providing this support, including email, voice over IP (VOIP), online instant messaging, online groups, SMS text messages, or telephone. In this project, we tested weblogs and email groups as potential support mediums for the geographically dispersed participants. People preferred the format of weblogs, but wanted the functionality of online groups – particularly because one can participate in the group simply via email. Therefore we chose a solar cooking Yahoo! Group as our method of ongoing interaction. Where possible, a community resource person can participate in the online discussions and relay messages back and forth to their communities in person. To broaden accessibility even further, the interactions on the email group can be converted into audiovisual materials and periodically delivered to participating communities, so that the information is shared beyond project members whose literacy, language skills, and Internet access allow them to participate online.

## **OPPORTUNITIES FOR FUTURE RESEARCH**

### **Amateur Versus Professional Videos**

It would be worthwhile to compare the impact of a professional-looking, edited video with a simple video that uses in-camera edits, or no edits at all. If a simple video is equally or almost as effective as a professional video, then almost anyone can be trained to use a basic camera for educational purposes. The video content would need superior planning and storyboarding, however, because editing it later would not be possible in this case. Simple videos will likely be effective, based on the strong history of participatory video. For example, Ochuko Ojidoh from the Community Life Project in Nigeria told me that “rough cut” videos enhance their work. They videotape meetings, and playback the video immediately to remind people of the discussion, make the issues clearer, and help them see gaps in the discussion or plans. New video trainees also quickly gain the skills needed to produce their own videos. Trainees from the solar cooking project gained the skills to create a water and sanitation video in a three-day video production workshop. These examples show how valuably video can contribute to community feedback, participation, and awareness building.

### **Comparing Educational Materials**

This research project explored the question as to whether a video would be a more successful training medium than Solar Cooking International's printed training materials. It would be interesting to formally evaluate this. The research criteria could include how much information was remembered immediately after the training, and after a period of time; how much information reaches the second generation of learners, how accurate the information is, and the adoption rates of solar cooking. It will be important to isolate the impact of the training mediums from other factors that might influence the adoption of solar cooking.

### **Impact Of Videos On Rates Of Adoption Or Rejection Of An Innovation**

To successfully introduce solar cooking to a new region takes approximately five years, according to Solar Cooking International. It would be interesting to research whether the use of video accelerates the decision-making step in the diffusion of innovations process (Rogers 2003:20), or if it reduces the amount of time required to achieve the “take-off point” of sustainable diffusion.