

# Using Video-Based Training in Developing Countries

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Twenty years ago Frederick Mosteller, the pioneer of video-based statistics teaching in the US, noted (Mosteller, 1971):

"We should keep in mind the possibility of the developing countries skipping a generation of statistical developments that other nations have gone through, but which have become not only unnecessary, but possibly even of negative value. The work to be skipped may have been excellent when it was done, but it may now be out of the spirit of new developments in, just to give an example, data handling and analysis. Therefore, even if at first glance some of our work seems not capable of being directed to developing countries, perhaps a second glance may show ways to use these materials to the advantage of those countries."

The second glance was a long time in coming: in February 1989 the ISI obtained funding from Canada's International Development Research Centre (IDRC) for a feasibility study of the use of video-based technology for statistical training in developing countries.

This paper summarises the Final Report of that feasibility study (ISI, 1989). It is in the form of tentative answers to a series of nine questions, and draws especially from my experiences in observing a pilot study carried out in the East African Statistical Training Centre (EASTC) in Dar es Salaam.

(i) *What is a "video-based training package"?* I will use as an example the structure of one module of the video-based BBC-Open University statistics course that we tested at EASTC in Tanzania (from Lunn and Richmond, 1982).

*From the point of view of the student* a video-based statistics course consists of five learning activities, as follows:

| Activity                                   | Time    |
|--------------------------------------------|---------|
| 1. Reading a textbook                      | 6 hours |
| 2. Watching a video                        | 1 hour  |
| 3. Listening to an audiotape, <i>while</i> | 1 hour  |
| 4. Doing exercises in a workbook, and      | 2 hours |
| 5. Discussing problems with a tutor        | 2 hours |

The third and fourth activities, involving the audiotape and workbook, need to be explained a little for those who are unfamiliar with this methodology. Lunn and Richmond give the following example using a typical workbook frame: the student looks at the frame while listening to the audiotape.

$$\int 3x^2 \sqrt{x^3 - 2} \, dx$$

$$\begin{aligned} & \downarrow \qquad \downarrow \\ 2 \quad & = \int \frac{du}{dx} \sqrt{u} \, dx \\ & = \int \sqrt{u} \frac{du}{dx} \, dx \\ 3 \quad & = \int \sqrt{u} \, du = \int u^{\frac{1}{2}} \, du = 4 \quad \boxed{\phantom{000}} = 5 \quad \boxed{\phantom{000}} \end{aligned}$$

$$1 \quad u = \boxed{\phantom{000}}$$

$$\frac{du}{dx} = \boxed{\phantom{000}}$$

In designing such a layout, three things must be considered. Firstly, the layout provides a clear work structure for solving the problem. Secondly, it is necessary to make sure the student's eyes are on the right place in the frame at a given time, and thirdly, support and encouragement must be provided to enable students to do more steps on their own. At prescribed points, the student is required to stop the tape and complete the next few steps. The tape then goes on with answers and more examples, gradually weaning the student into doing all of the steps by himself.

*From the point of view of the course producer* a video-based statistics course consists of five types of instructional materials:

1. A textbook, or student's course guide
2. A videotape
3. An audiotape
4. A workbook
5. A teacher's course guide

The video-based course is an *integrated package of instructional materials*. The power of the audio-visual media depends upon the care that is taken in planning the whole package, including the printed materials (see Richmond, 1989).

(ii) *Can TV monitors and video-cassette recorders be used in African statistical education and training centres?* Yes. Given the location of these centres in African cities (usually the capital) there is no real obstacle that cannot be overcome. Moreover, even in countries which have no broadcast television service, videocassette recorders and TV monitors are used even by more affluent private citizens.

Tanzania, where we did the feasibility study, has no broadcast television service. But, when I arrived at the Dar es Salaam airport with my video equipment, I found I was not the only one bringing a VCR and TV into the country that day. On the drive from the airport to the hotel we passed the Philips Service Centre, where our Philips VCR and TV could be repaired if needed, presumably. And, on my drive out to the EASTC every day, I passed a local video rental shop.

This is not the real question, however. It does not follow that what *can* be done *will* be done (or even *should* be done). Whether it is *appropriate* technology is the real issue. The following questions bear on both technical and social aspects of this issue.

(iii) *Are the technical requirements for using video equipment fulfilled at African education and training centres?* What is needed, really? Just electricity. All of the African statistical education and training centres that are members of the Statistical Training Programme for Africa certainly are supplied with electricity.

Actually the electricity supply may not be entirely *certain*. Power blackouts and "brownouts" are frequent in some countries. Safeguards are available: a standby generator, an "uninterruptable power supply" and/or a "surge suppressor" will be nice to have. But, with a little flexibility in scheduling the video portion of video-based instruction, many of the problems with an uncertain supply of electricity can be avoided.

In many African countries, 220 volt, 50 cycle electrical power is the standard. (Not in the US, however.) Therefore, European video equipment can be used in these countries. Some video equipment is switchable, either manually or automatically, so a separate power transformer is unnecessary if such equipment is used.

The video standard also needs to be considered. Various countries broadcast NTSC, PAL, or SECAM signals (and within each of these there are national varieties). Videocassettes produced in the US are NTSC, those in the UK are PAL, and in France, SECAM. An African training centre wishing to use videocassettes produced in more than one of these countries would need a "multisystem" VCR and TV. We purchased this kind of equipment for the feasibility study in Tanzania even though we used only PAL-format videos in the test. We left the equipment behind at EASTC which can obtain a wide variety of statistics videos from sources in other countries.

The issue of VHS versus Beta one-half-inch videocassettes has been resolved by almost all video producers electing VHS. The American Statistical Association continues to produce its short course videos in three-fourths-inch U-matic.

Finally, a word on security. Video equipment is easy to steal, and stolen video equipment is highly marketable. Many cities (not just Washington) are crime centres. Effective security, such as that used at EASTC, may be needed to ensure that the video equipment stays around to be used in statistical training.

(iv) *Can the equipment be maintained properly and simple repairs done locally? Are the necessary supplies available locally?* I have already mentioned the Philips Service Centre in Dar es Salaam where our equipment could have been repaired if necessary. I

was assured by the EASTC staff that the University of Dar es Salaam (where EASTC is located) has technical support personnel who can make repairs to video equipment.

We did not test this capability during the feasibility study: nothing broke, so there was nothing to fix. Initially, the electrical outlet in the classroom used for the feasibility study was inoperable. A word to the EASTC staff got a repairman and a new electrical outlet was installed and working the next day.

Continued availability of supplies (including spare parts) is crucial to keeping the video equipment usable. Often, this is a problem even with simpler training aids than video equipment. For example, a training centre in an Asian country got a donor agency to purchase porcelain "white boards" rather than the traditional chalkboards. However, the supply of special markers that must be used with white boards was soon finished. No local source of supply is available and there is no foreign exchange for buying markers abroad, so the boards cannot be used.

Time will tell if the EASTC staff can keep the video equipment up and running. That is another reason for our leaving the equipment behind after the feasibility study was completed.

(v) *Is this alternative technology preferable to the traditional teacher and chalkboard method of teaching statistics?* Expert judgement is about evenly divided on this point. In surveying members of the American Statistical Association, Smeltz and Stout (1983) found advantages and disadvantages about equally balanced in the replies from their respondents. Nothing in my experience, based on the 3-week feasibility study, testing just one video-based course at just one training centre, suggests that the situation would be widely different for Africa.

Here are the main conclusions that I drew from the test at EASTC in Tanzania:

- (a) There was initial scepticism (on the part of both teacher and students) about the video component of the course.
- (b) After the students got used to the video presentations they were much more enthusiastic.
- (c) Both students and teaching staff want to see video-based teaching of statistics made more widely available.

(vi) *Will "high tech" teacher aids improve the effectiveness of teachers at African centres?* This is a tougher question than the preceding one. Given that students and teachers like (even prefer, on the whole) video-based rather than traditional classroom instruction, does this new technique for teaching statistics *work*?

Firstly, let us consider what the students at EASTC said about the video-based course that they took. Here are some verbatim responses:

"The course has been very good in the sense that we have had the chance to have the concepts revised and makes understanding better. Perhaps when a situation where the trainees are given the tapes and listen to them at their own time would even be better. One needs to do exercises and listen to the tapes again and again until he gets the concepts properly. Cassette tapes have an advantage over class lectures in that you cannot miss a lecture lesson because you can listen to the tapes another time."

"This course has been very educative particularly in the sense that experiments were being visualised through video cassettes and boosted by the audio-cassettes. I am of the opinion that if this method is introduced throughout the world then so many people would be passing their statistics courses with honors. 'Cos' at present the idea of learning through books is not beneficial, as some of the items mentioned when experiment 'A' was being performed are not known to the students. SEEING or EXPERIENCE is the best teacher. This should be continued but time has to be increased."

"Overall, I would encourage the institute to extend these facilities to other learning institutes; especially here in Africa; statistics is a new science; most people don't seem to understand its importance; I'm sure if they had to be given a chance to see how important it is to our daily life; probably they would even support and encourage such courses. As at now; most don't even want to sponsor their employees to attend courses in statistics; they feel it is a waste of money. As a student it helped me to understand some terms which I just learnt to pass exams without knowing the whole essence of being taught, e.g. Binomial Distribution; Geometric Distribution, etc. Before this session; I simply learnt it; just for that sake but now I know how it can be used on the daily life; as most of the examples in both audio-cassette and video were based on the daily life; it makes the probabilities obtained more meaningful."

These positive responses are encouraging to proponents of video-based training but may be seen to beg a basic question that underlies the training activity: *What are we trying to accomplish when we train?*

Nearly all trainers answer "Performance on the job" (see Hoffman, 1990). But what is it we expect students *to be able to do "on the job"* after they have completed a basic probability and statistics course? (See an example of the task analysis approach to setting instructional objectives in Watts (1981).)

After deciding what it was we wanted students of statistics to be able to do, we would be in a better position to compare the effectiveness of traditional (teacher-chalkboard) and "high tech" (video-based) approaches to achieve those instructional objectives. At the present time I can only suggest that video-based approaches *should* work better. Look at the responses of students to the video-based course that we tested in Tanzania. Students emphasised that the video-based course helped them to "visualise" statistics concepts: "... seeing and experience is the best teacher". The examples in the video-based course helped students see how statistics could be used in "daily life".

(vii) *Is the improvement in effectiveness worth the cost?* If students fail to develop the knowledge and skills they will need "on the job" the teaching has no value to the students' employers.

The response of one EASTC student suggests that the traditional approach to teaching statistics rewards memorisation of formulas: the student may or may not grasp "the whole essence of what is being taught". Employers of these students therefore "don't even want to sponsor their employees to attend courses in statistics: they feel it is a waste of money".

However, video-based training is expensive, at least in one respect. *Producing* a video-based training package is very costly. The cost of the package cannot be assigned unambiguously to each of the five components listed at the bottom of Section 2: much of the production cost is taken up in concept development and planning of presentation strategies. However, it is evident that if the video component is eliminated from the package there are substantial cost savings.

What, specifically, does TV add to the student's learning experience? Richmond (1989) says:

"Television can be used as evidence, to open debate, create images and perspectives, and give overviews. The wealth of graphics, freeze-frames, overlays, recapitulations, the acceleration or slowing or real time, and many other techniques, can with proper structuring and scripting help to present abstract concepts and to convey the essence of subject matter with a high degree of efficiency."

Lunn (1985) emphasises the presentation of video images of *computer animations* as a powerful way of teaching concepts of probability and statistics.

The student's ability to *visualise* what is being taught is crucial to learning concepts of probability and statistics (and especially to the ability to apply those concepts to the real world). However, in the next section I will argue that there is a lower cost medium that can be very effective in promoting the student's ability to "visualise" statistics.

(viii) *Are other "intermediate" technologies better substitutes for traditional methods and materials for teaching statistics?* It was apparent in the feasibility study of the video-based course that the students needed to learn to watch TV: Tanzania has no broadcast TV service. This is reflected in the reaction of one of the students at the end of the first week of the course.

"The course was made more enjoyable, maybe, by the video which we are used to watch on festive days here in Africa. So whatever is displayed on it, regardless of its purpose, already meets with a jovial psychological feeling which cannot be disputed by its subject purpose."

Very sophisticated video techniques need to be avoided in producing statistics videos for developing countries. Looking at a locally produced UNICEF video in Dar es Salaam, I became aware of a different "visual vocabulary" in use.

Moreover, it seems to me that the verbal is more important than the visual in African cultures. For example, story-telling and speech-making are more prominent in Africa than in Europe or North America.

This suggests that the audiocassette and workbook components of the course may have greater value in developing than in developed countries. Some of the possible advantages are these:

(a) *Audiocassettes can be loaned to the students.* Students can listen to the tapes over and over again until they understand what is being taught (see first quotation in Section 7). One of the students saw the tapes as a patient teacher:

"When the lecturer is teaching he/she is subject to getting tired and not willing to entertain questions from the students." Another student said: "We are free to stop and rewind and listen to the tapes as many times as needed without fear, as would have been the case in the classroom."

(b) *A local announcer can create a "local" version of the audiocassette from the original script.* The accent of a British or American narrator may be difficult for African listeners to follow at first. Moreover, a familiar accent may make the material sound "friendlier".

(c) *Audiocassette players are much cheaper than the videocassette equipment needed.* For the Tanzania test the audiocassette players that I used cost less than US\$15 - about 1 percent of the cost of the VCR and TV.

(d) *Audiocassette production costs are considerably less than the corresponding video production costs.* The course design and planning costs of audio- and video-based training may not be very different, but an audiocassette can be recorded for less than one-tenth the cost of a comparable videocassette.

For more discussion of the value of audiocassettes, see Lunn and Richmond (1982). Crockett, Lunn and Petersons (1987) give an example of the use of audiocassettes and a workbook to teach statistics.

(ix) *How does the teacher at a training centre in Africa benefit by using video-based teaching materials?* Unless teachers at African statistical education and training centres see some benefit *to themselves* of using video-based teaching materials, they will not adopt this alternative technology. This is a fundamental lesson of years of development assistance by "developed" to "less-developed" countries. The initial reaction of the teacher to the introduction of this "high tech" teaching method is anxiety that he or she is being *replaced*. This is not the intent. As Mosteller (1963) said: "I see no threat to the teacher. I see an opportunity to come closer to Hopkins' ideal of personal attention - one student, one teacher, one log."

The threat to the teacher is a more subtle one, I think. The traditional model in classroom teaching of statistics is a *teacher-centred, grading-based* one. The teacher is the expert and commands the respect of the students. The aim of the course is a final examination in which the teacher grades the performance of the students from "outstanding" to "failing".

Video-based (and other "programmed") instruction is a *student-centred, mastery-based* model. Students learn at their own pace. The role of the teacher is to facilitate, coach, and tutor *at the prompting of the student*. The expectation is that all students will master all of the instructional objectives of the course. No one fails, although some may drop out before reaching the end.

Teachers need to be taught how to teach under this new model. The system of rewards for teacher performance needs to be modified to accommodate the differences between the old and new goals of the methods of instruction.

Unless we are willing to retrain the teachers, their reaction to video-based training may be to turn on the TV and walk out of the room.

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