



Chapter 5

INFORMAL EXPERIMENTS AND DEMONSTRATIONS

The purpose of the experimentation was to test the hypotheses, and to demonstrate the RF bandwidth switch within a model for T.B.T. (technology based training) systems.

The experimentation tested the hypotheses positively, and demonstrated that the RF bandwidth switch may be used to obtain the functional requirements of technology based training transmission without reliance on personal computer technology.

The following sections describe the hardware and network infrastructures utilised in the experiments. Each experiment will be dealt with separately, stating objectives on an Outcomes Based principle, with specific reference to the functional requirements of the transmission apparatus discussed in paragraph 2.4.3.

5.1 Experiment 1

Selection and broadcast function

5.1.1 Objective

Considering the typical network used for dynamic system modelling, each individual bandwidth switch should have the ability to *select* any one of a number of four inputs at various formats, and *broadcast* the same via a single output, at the press of a single button.

For experimentation a standardised free format [9] namely PAL system I was employed as the primary transmission format.

5.1.2 Hardware

- i. Inputs: one introduction level PC (personal computer), one VCR (video cassette recorder), one lecturer's PCAM (personal camera), one WCAM (workbench camera) and one RF bandwidth switch.
- ii. Outputs: one audiovisual display unit to display the switched output, as well as one smaller audiovisual display to serve as transmission monitor.
- iii. Format adaption (D) : one SVGA (super video/graphics adapter), to composite video/audio, to ch 33-39 PAL system I

5.1.3 Infrastructure setup

The equipment was set up as indicated in Figure 5.1:

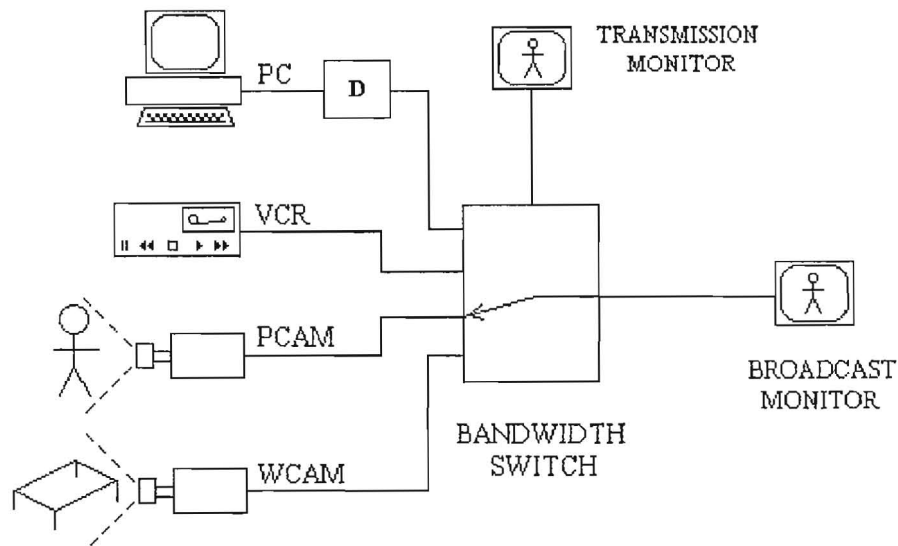


Figure 5.1

5.1.4 Observations

The bandwidth switch enabled the operator to select any one of four inputs at the press of a single button, to be displayed on the broadcast monitor. All inputs were full bandwidth, colour video with corresponding soundtrack. No change in video or audio was observed when the output was respectively compared with the selected input. No audio delay is imposed as is the case with many computer driven systems.

5.2 Experiment 2

Activation function and multiple forward connections

Considering the typical network used for dynamic system modelling, the activation function as well as 4 forward connections had to be obtained.

5.2.1 Objective

The objective of this experiment was the switched simultaneous distribution of the primary transmission format from a single input to four forward connections, by pressing one button.

Activation function switching may be defined as the activation of broadcasting by the operator/lecturer for the 'on' mode, opposed to the termination of broadcasting for the 'off' mode.

In the off mode, a blank raster may be displayed, or a station identification screen from any auxiliary source, eg VCR. The auxiliary input must be in composite video + audio format, which is also a standardised free format but distinguishable from the primary inputs.

5.2.2 Hardware

- i. Inputs: The output of the bandwidth switch as described in Experiment 1, as well as any other input device, eg. a PAL colour bar/pattern generator with modulated sound and separate composite video and audio outputs.
- ii. one four-way distributor.
- iii. Outputs: four audiovisual display units, to display the switched forward connections simultaneously.

5.2.3 Infrastructure setup

The equipment was set up as indicated in Figure 5.2.

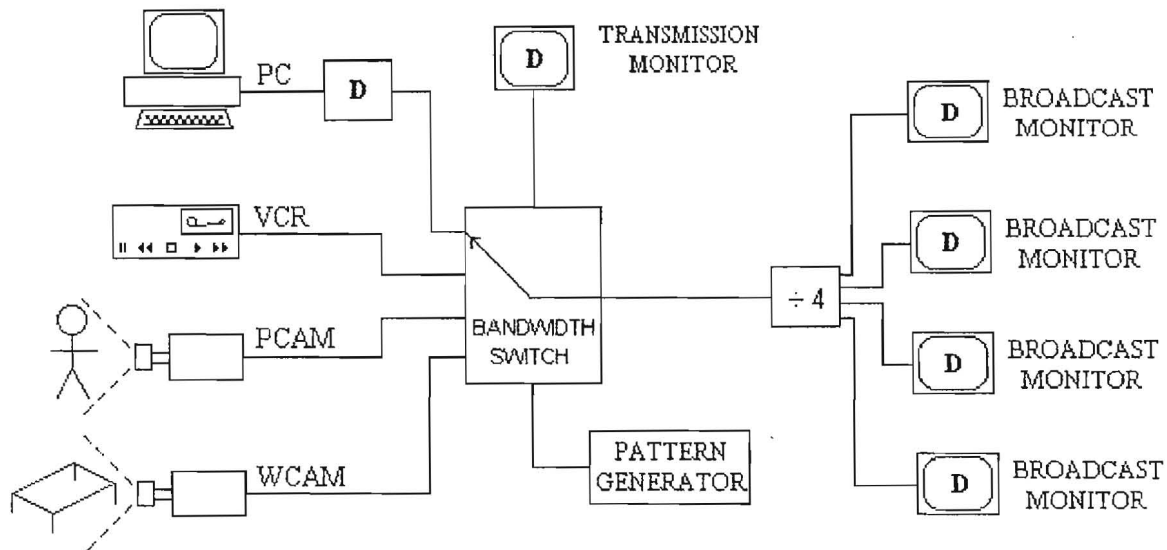


Figure 5.2

5.2.4 Observations

The activation function with multiple (four) forward connections enabled the operator/lecturer to commence or terminate broadcasting of the selected input at the press of a single button. Upon activation the switched output appeared on all four of the broadcast monitors, with no visible difference in video or audio quality. A noticeable difference exists, however, between the SVGA monitor of the PC, and the picture displayed by the audiovisual monitor at the output. Upon investigation it was found that picture quality was already compromised at the input of the bandwidth switch. The input of the format adapter was compared with its output. The difference between formats are noticeable but not unacceptable.

5.3 Experiment 3

Two feedback connections

Considering the typical network used for dynamic system modelling, two feedback connections had to be obtained, in order to fully simulate the T.B.T. dynamic model. The feedback connections are required to effect interactivity between the lecturer and student workstations.

5.3.1 Objective

The objective of this experiment was to devise two feedback connections, or a single connection with combined functions. The operator/lecturer should be able to select any distant workstation, to monitor it constantly, yet be able to configure the distant workstation into broadcast mode, so to enable all other workstations to monitor the selected workstation as well.

Selection of the distant workstation should be effected by pressing a single button, and the re-configuration into broadcast mode by depressing another single button. All bandwidth switches should be situated in the same geographical position, namely with the operator/lecturer.

5.3.2 Hardware

- i. First layer inputs: The output of the bandwidth switch as described in Experiment 1, as well as another input device, eg. a PAL colour bar pattern generator with modulated sound and separate composite outputs.
- ii. One four-way distributor.

- iii. Outputs: four audiovisual display units, to display the switched outputs simultaneously.
- iv. Four colour camera/microphone combinations, each situated at an audiovisual display unit, to capture interactive video and audio input material.
- v. Output layer bandwidth switch's inputs : four camera/microphone inputs situated at audiovisual workstations.
- vi. Output layer bandwidth switch's output reconnected to the WCAM input of the first layer bandwidth switch.

5.3.3 Infrastructure setup

The equipment was set up as indicated in Figure 5.3.

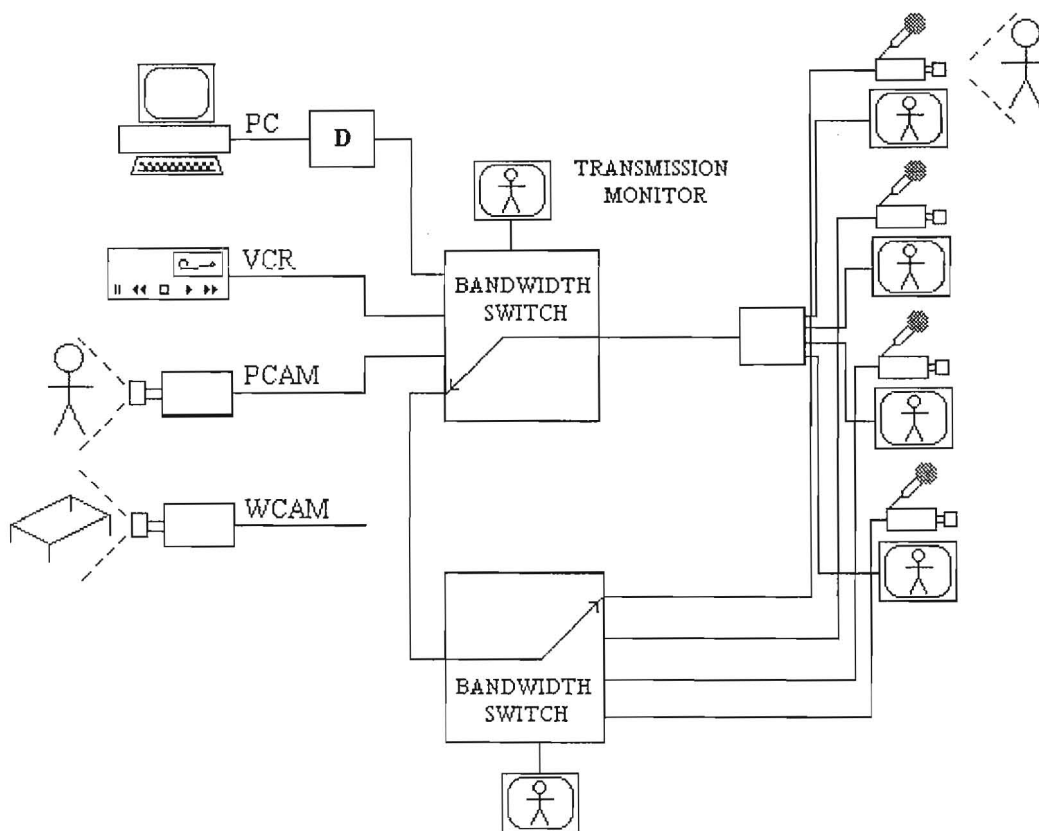


Figure 5.3

5.3.4 Observations

The second bandwidth switch enabled the operator to select any distant workstation and monitor it constantly. By presenting the output of the second bandwidth switch to one of the primary switch's inputs it was possible to configure the distant workstation into broadcast mode, so to enable all other workstations to monitor the selected workstation as well.

Selection of the distant workstation was effected by pressing a single button on the second RF bandwidth switch, and the re-configuration into broadcast mode by depressing another single button on the primary switch. Both bandwidth switches were situated in the same geographical position, namely with the operator/lecturer.

The activation function with multiple (four) forward links still enabled the operator to commence or terminate broadcasting of the primary bandwidth switch input at the press of a single button.

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE WORK

The dissertation described an RF bandwidth switch applied in an informal experimental model for technology based training systems.

The experiments tested the hypotheses positively. The study has revealed a method to obtain the functional characteristics of technology based training systems, without reliance upon personal computer technology, resulting in a start-up model for future research. This method may be used to enable T.B.T. for a broader spectrum of students within the South African context.

The dissertation briefly discussed important non-technical aspects of technology based training systems. The successful use of these systems requires understanding of the benefits of having value added by audio, video and integrated computer applications. The perception amongst participants was that the proposed model concentrates on the spoken word of teaching, supported by applicable multimedia. One of the problems solved, compared with compressed data PC driven systems, was facilitation of effective audio communication, free from echo's or delayed reception.

During the development of the electronics, recently developed ferrite technology was merged with previously developed circuit techniques, that made it possible to extend the bandwidth capabilities of hybrid power combiners.

During the development of the hybrid combiner, an interesting phenomenon was observed, and termed *recurring pattern mismatch* for the purposes of the dissertation. Searches conducted on the internet did not reveal a detailed description of the phenomenon, only a reference reporting its effects [13]. In experiments conducted on MediaTwist™ cable, by Belden Cable Inc., the UHF band was observed for picture quality when transmitted across substantial lengths of cable. It was observed that alternative channels may differ substantially in output signal strength and obvious picture quality, even when just two channel spacings apart within the same frequency band. The problem was solved for continued testing by broadband amplification of the entire frequency band, in order to improve marginal signals. No explanations were discussed. The observed phenomenon (*recurring pattern mismatch*) may be used within an alternative method to match broadband circuits for optimised signal power transfer.

The positive testing of the hypotheses should serve as an inspiration for continued experimentation with this technology. Future experiments should involve a larger number of participants that may be more remotely situated. Alternative frequency plans up to 2,4-GHz may be considered to extend available bandwidth.

The bandwidth switch performed satisfactory across several metres of interconnecting cable, considering that the expected overall S/N ratio of 40-dB was not obtained. Continued experimentation may investigate matched hybrid combiners or dividers with 0-dB transformation loss by low noise broadband amplification, in order to improve cable transmission capabilities.