EVALUATIVE STUDIES AND REVIEW PROGRAM

The State Training Board's Evaluative Studies and Review Program is designed to provide data and analysis to back up the State Training System's planning for and delivery of education and training services.

The program will inform decisions about such major issues as the quality and effectiveness of what is done, the degree to which the State Training System's products and services are made accessible, and the efficiency of service delivery.
This project was undertaken by the Research and Development Department of the Sunraysia College of TAFE, on behalf of the Office of the State Training Board, Victoria.

The Project Manager was Heather Crawley, and the Project Officer was Stan Pietsch.

Publications in this series include:
Cost/Benefit of Training through Live Work - April 1991
Measurement of Completion - February 1992
Alternative Modes of Delivery - August 1992

***

Evaluative Studies and Review Program
Contact: Peter Monie (03) 628 2320

State Training Board, Victoria
P.O. Box 266D
Melbourne 3001

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PREFACE

The State Training Board of Victoria funded the Sunraysia College of TAFE in late 1990 to conduct this project. The aim of this project was to evaluate alternative modes of telematic delivery to assist the State Training System in the planning of delivery of education and training services. To achieve this, three specific aims were addressed. Firstly, to evaluate the educational and training effectiveness of alternative modes of delivery. Secondly, to provide guidelines for the use and suitability of each mode in relation to the type of programs delivered by TAFE, and thirdly, to measure the cost effectiveness of each mode of delivery.

The planning, organisation, implementation, analysis and evaluation of this project has been constantly guided and monitored by a steering committee which was made up of representatives from across the State Training System.

It was decided that three alternative modes of telematic teaching should be evaluated and compared to the conventional classroom-based mode of delivery. Videoconferencing, Talkback Television, and Audiographic Conferencing (refer to definitions on the fold-out flap at the back of this report) were selected as they were considered the most likely alternative modes to be utilised in the future. Three separate experiments were conducted with the conventional classroom-based mode of delivery as the control treatment. The same lesson was taught in each experiment by the conventional and alternative modes, but different teachers and subjects were chosen for each experiment. A lesson in the Automotive area was chosen for the Videoconferencing lesson, Mathematics for the Talkback Television lesson, and Communications was selected for the Audiographic Conferencing lesson. The subjects were also chosen on the basis that they are representative of TAFE courses taught across the State. Each experiment was designed to reflect the attributes of the teaching modes and to simulate a realistic class situation while at the same time being guided by a valid method of research.

The analysis of the experiments was based on quantitative, qualitative and cost-benefit analysis. Tests, interviews and questionnaires completed before and after the lessons and the computation of establishment, preparation and delivery costs provided the data required to evaluate the alternative delivery modes.

The outcomes of this project have shown that considerable benefits could be gained from using telematic technology in education and training. Research demonstrated there was no statistically significant difference in the amount learnt by telematic teaching compared to conventional classroom-based teaching. This was despite the fact that the quality of learning was perceived by the students and the teachers as higher for the conventional classroom-based teaching mode. This was not significant enough to affect the amount learnt in the lessons. The lower quality of the telematic modes was generally associated with restricted teacher-to-student interaction. Teachers commented that student feedback, especially in the Talkback Television and the Audiographic Conferencing lessons, was difficult to obtain. However, the level of student-to-student interaction during all the telematic lessons was greater than in the conventional classroom-based teaching lessons and this appeared to benefit learning. As this was the first time that teachers, technical staff and students had experienced telematic teaching it can be expected that the quality of the learning will increase with improvements to teaching strategies, methods of presentation and student participation.

The use of telematic modes of teaching was dependent on teachers and students being comfortable with their use as it was found that initially they were apprehensive and in some instances uncomfortable with the technology. However, this was for only a short period and they became comfortable after a brief introduction to the technology. At times technical breakdowns also inhibited the learning process, particularly in the Talkback Television lesson. It is concluded that, based on the result of these experiments, professional development for teaching and technical staff would be of benefit to the improvement in teaching by these modes of delivery.
The establishment, preparation and delivery costs for telematic modes of teaching are perceived to be high, but a thorough cost benefit analysis has demonstrated that this is not necessarily the case. Further consideration of issues such as: building and infrastructural costs, the number of students taught and their geographical distribution and the alternative cost of delivering the same lesson by conventional classroom-based teaching are some of the important issues which should be included. It is concluded that although telematic modes of teaching may substitute for conventional modes of teaching, the choice between telematic and conventional modes should be viewed as part of a broader teaching strategy to be employed in a complementary and flexible way. The decision should be made in light of the overall context of each situation, the learning needs and the relative costs of the mode or modes to be employed.

The project was not able to determine all the appropriate applications for specific telematic modes of teaching as this would require many more trials in a wide variety of situations. However, this project has demonstrated that telematics can add to the versatility of teaching.

It is expected that the use of telematic modes of teaching will become more cost-effective and frequent as technology continues to improve and as teachers, students, and technical staff become proficient in its use. This will also be enhanced as infrastructures and dedicated facilities are established and educational institutions support teaching by telematic modes.

The Steering Committee recommends telematic modes of teaching be recognised as viable alternatives to conventional teaching and that facilities and training be made available to providers. It recommends that the State Training Board support the co-ordinated development of alternative telematic delivery modes. This should be partly achieved by offsetting the costs of telematic teaching and encouraging joint ventures to be established to maximise outcomes.

To enhance the use of telematic teaching the Steering Committee recommends that the State Training System’s Centre for Flexible Learning investigate ways of improving the delivery by alternative modes through teacher training, professional development and researching improvements in technology. It also recommends that the State Training Board provide dedicated Videoconferencing facilities in at least two metropolitan and one country location. In the area of curriculum, the Committee recommends that designated providers, in liaison with user consortia, identify modules and segments of courses which are particularly suitable to alternative telematics modes of delivery.

In conclusion, a key value of the project lies in the fact that controlled experiments were carried out to evaluate the different modes of teaching in realistic educational contexts and that the qualitative and quantitative data collected and analysed was a direct result of experience of the participants in each experiment.
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Head, Educational Technology, TAFE Off Campus Co-ordinating Authority

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**Brian Scorgie**
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Assistant Director, Rural, Trades and Technology, Sunraysia College of TAFE

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Teacher II, Automotive Department

**Max Hart**
Head, Automotive Department

**Leo Male**
Head, Further Education Department

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Teacher II, Applied Science Department

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Heather Crawley, Project Manager
Stan Pietsch, Project Officer
SUMMARY

(Note: Reading this report will be made easier by using the mode definitions in the fold-out flap on the back cover.)

THE PROJECT

The State Training Board of Victoria funded the Sunraysia College of TAFE to conduct this research project into alternative modes of telematic delivery of training.

The delivery modes selected for the study were Videoconferencing, Talkback Television and Audiographic Conferencing as these were seen as the modes most likely to be adopted by the system.

The main aims of the project were:

i) To evaluate the educational and training effectiveness of three alternative modes of telematic delivery of training.

ii) To provide guidelines as to the use and suitability of each mode in relation to the type of programs to be delivered by the State Training System.

iii) To measure the cost-effectiveness of each mode of delivery in terms of the costs involved in training staff to use the technology, the time and expertise required by technical staff, and the operating costs of the technology.

In order to achieve these aims the following objectives were set for the project:

i) To test a set of hypotheses which recognise the main issues to be considered in the use of this technology.

ii) To measure the effectiveness of these alternative modes of delivery by comparing the success of delivery with that of traditional classroom-based, face-to-face teaching methods (conventional mode of teaching).

iii) To detail and estimate the establishment and operating costs of presenting a program using the different modes of delivery.

iv) To design a valid methodology to ensure the credibility of conclusions drawn from research.

HYPOTHESES TESTED

It was decided to test the following set of hypotheses to evaluate the different modes of delivery:

Hypothesis 1
There is no significant difference between delivery by conventional and alternative teaching methods in terms of the learning achieved by participants.

Hypothesis 2
The quality of the learning experience is directly dependent on the degree to which personal interaction occurs between the teacher and students and between students, in a way that is provided for in a normal classroom.
Hypothesis 3
Technology should be seen as a supplement to traditional teaching methods, not a substitute.

Hypothesis 4
The effectiveness of the technology is dependent on the degree to which the participants and the teacher feel comfortable using the technology and how skilled they are in its operation.

Hypothesis 5
The usefulness of technology in teaching depends on the nature of the lesson being taught.

Hypothesis 6
Training delivery by alternative modes is less cost-effective than by conventional means in terms of cost per student.

METHODOLOGY

The evaluation of each mode of delivery and the recommendations are based on the results of three controlled experiments, each specific to one of the alternative modes of delivery. A summary of the experiments conducted is presented in the following table:

<table>
<thead>
<tr>
<th>TREATMENTS</th>
<th>NO. OF STUDENT SITES (STUDENT NUMBERS)</th>
<th>LESSON TOPIC</th>
<th>APITUDE SKILLS MEASURED</th>
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<td></td>
<td></td>
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<tr>
<td>A  Conventional</td>
<td>1 (6)</td>
<td>Automotive Area</td>
<td>None</td>
</tr>
<tr>
<td>B  Videoconferencing</td>
<td>1 (6)</td>
<td>- Car Management</td>
<td></td>
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<tr>
<td></td>
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<td>System Diagnosis</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A  Conventional</td>
<td>1 (15)</td>
<td>Mathematics Area</td>
<td>Verbal Reasoning</td>
</tr>
<tr>
<td>B  Talkback Television</td>
<td>6 (49)</td>
<td>Statistics - Random Sampling</td>
<td>Mathematical Ability</td>
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<tr>
<td>EXPERIMENT 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A  Conventional</td>
<td>1 (16)</td>
<td>Communications Area</td>
<td>Verbal Reasoning</td>
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<tr>
<td>B  Audiographic Conferencing</td>
<td>3 (14)</td>
<td>- Summarising</td>
<td></td>
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</table>

For each experiment the content of the lesson and the teacher delivering the lesson under both treatments was the same. However, the experimental designs were not similar with respect to how many sites a teacher would teach to and how many students would be taught at each site as the experiments were designed to suit the mode of delivery being tested. Students in all experiments were randomly placed between treatments after being matched with students of equal ability. A gender balance was maintained as much as possible in these experiments.

The educational effectiveness of the alternative delivery modes was determined for each experiment by using quantitative, qualitative and cost-benefit analysis. This was achieved using a matched-paired difference of means statistical analysis of the results students obtained in a test at the end of each lesson. This included pre- and post-lesson questionnaires, interviews and discussions, equipment establishment costs, preparation costs and delivery cost comparisons of the three delivery modes.

In all the experiments it was considered important to develop a lesson which did not require a significant amount of prior knowledge, which was suited to the technology, which was interesting to the students involved in this experiment and would provide a measurable
improvement in the knowledge and skills of the students. It was also considered important to provide the teacher of each lesson with an opportunity to become familiar with the use of the technology and to become comfortable teaching by this mode of delivery.

This evaluation provides evidence of the cost-effectiveness of each mode of delivery in relation to one subject area. However, as these subject areas are representative of the range of areas taught in the system, teachers should be able to find relevance from the findings of this study to their own situation within reasonable limits. The next logical step in researching these delivery modes would be to test the comparative effectiveness of the three modes of delivery by applying each to at least three programs in different subject areas. As such the potential of each mode of delivery could be recognised in terms of its application to a range of subject areas.

The details of each experiment, including specific details of the methodology adopted, are documented in separate sections of this report for each of the alternative modes of delivery.
THE EXPERIMENTS CONDUCTED IN THE PROJECT

A brief summary of each experiment conducted is provided below.

EXPERIMENT 1 - VIDEOCONFERENCING MODE

The aim of this experiment was to evaluate the effectiveness of the Videoconferencing delivery mode of teaching compared to conventional teaching. This technology involves two-way voice and two-way visual interaction between the teacher and their students, thereby providing teacher/student interaction which attempts to simulate a classroom situation.

The Videoconferencing mode was perceived as the most likely mode to succeed in regard to teaching a practical lesson, so it was decided to teach a lesson on the Diagnosis of a VN Commodore Engine Management System. A second rationale for selecting this subject area was that practical teaching programs make up a large part of the teaching program in the TAFE system and that Automotive Studies is taught in many colleges across the State.

The conventional mode was taught at the Sunraysia College of TAFE, while the Videoconferencing mode was taught from the University College of Northern Victoria at Bendigo to students located at Sunraysia College of TAFE.

The size of the groups was limited to six as the lesson was centred on teaching around the engine of a car. It would have been preferable to have had groups of between ten and fifteen participants for statistical reasons but this would have adversely affected the ability of students to learn in this lesson.

EXPERIMENT 2 - TALKBACK TELEVISION MODE

The aim of this experiment was to evaluate the effectiveness of the Talkback Television delivery mode of teaching compared to conventional teaching. With the use of this technology the students receive an audio-visual message while the teacher can only hear the students via a teleconference link-up of all the sites.

A theoretical lesson on random sampling in statistics was taught as this was considered appropriate to the teaching mode and was a common subject in TAFE. Since satellite television technology would normally be employed to teach to a number of sites to be cost-effective and to demonstrate the use of the potential of the technology, it was decided to teach to six sites simultaneously. There were 49 students in total at the satellite sites which were situated in Sunraysia, Bendigo and Geelong. This was considered to be a realistic representation of the normal conditions that would be experienced by students using Talkback Television technology as there would be a reduction in the amount of individual interaction time that each student could have with the teacher.

In the Talkback Television lesson the teacher required assistance from an audio-visual technician at the studio. A tutor at each receival site provided assistance to both the students and the teacher and was considered essential to the presentation of the lesson.

EXPERIMENT 3 - AUDIOGRAPHIC CONFERENCING MODE

The aim of this experiment was to evaluate the effectiveness of the Audiographic Conferencing delivery mode as a means of teaching a theoretical lesson. In this mode of delivery there is visual interaction (through typing and drawing on the computer) between the teacher and students by linking computers with modems and audio interaction via teleconferencing. It is generally recognised that Audiographic delivery of lessons will usually be used to service three or four students at three to four remote sites simultaneously. This information was obtained by talking to people who have already had experience in its
use throughout Victoria. As such it was decided to teach the Audiographic lesson to three sites for the purposes of this experiment. Sixteen students were taught in the conventional lesson and fourteen in the Audiographic lesson. The entire experiment was conducted at the main campus of the Sunraysia College of TAFE. This was done so that control over the many variables in the experiment could be maintained. For example, it meant that the random placement of the students between treatments and at the different sites could be easily achieved.

It was decided to teach a communications lesson in this experiment on the basis that it would be relevant to many of the students in the TAFE system and that it was also suitable for the type of technology that was being used in the experiment.
MAJOR FINDINGS

1. There is no significant difference in the amount learnt between any of the different telematic modes of teaching compared to the conventional mode of teaching.

2. In all three experiments it was shown that the quality of learning in the conventional lesson was better than that of the telematic mode of teaching. This was generally because the quality of interaction in the telematic mode of teaching was in some way inferior to that of the conventional mode of teaching. In all cases the level of visual student feedback was not as good as in conventional teaching. From the teacher's perspective, Videoconferencing provided the best visual feedback (where the teacher can actually see the students) followed by Talkback Television (feedback is seen on a computer screen), while Audiographic Conferencing provided no visual student feedback for the teacher other than student responses written on the teacher's computer screen.

From the student's perspective, Videoconferencing and Talkback Television modes provide equivalent feedback although the audio-technology in the Talkback Television teaching mode, which allows students to hear and talk back to the teacher, needs to be improved before this mode of teaching is of high quality. The Audiographic mode of teaching was very effective for the lesson dealing with summarising despite the students and teacher not being able to see each other.

In all the telematic modes of teaching it was observed that there is a higher level of student-to-student interaction as the students are not under the strict control of the teacher. In each case this was considered by observers to be a benefit to the educational process and partly offset the disadvantage of the lower level of student feedback for the teacher.

3. For all three telematic modes of delivery it is concluded from the results of this project that they are able to substitute for the conventional mode of teaching. Despite the fact that it is possible to use any mode as a complete substitute, it would be unsound educational practice to provide any courses of substantial length using only one means of delivery, unless there is no alternative. It would be better to consider the use of all the modes of delivery where their use is appropriate in a particular circumstance to meet the needs of the educational program so that they are utilised in a complementary and flexible way.

4. The three alternative modes of delivery provide a comfortable means of teaching, particularly after the teacher and the students have had some experience in the the use of the technology associated with the teaching mode. In all three experiments conducted, a rehearsal of the lesson using the technology was seen to be very important to provide assistance for both the preparation and the delivery of the lesson. In all experiments this project provided the first opportunity for the teachers and the students to use this technology. In general, it is concluded that it does not take very long for the teacher or the students to feel comfortable in using the technology so that, under normal teaching conditions, comfort with the technology would not be a major concern.

5. It is not possible to conclude from the experiments in this project that the usefulness of the telematic modes of teaching are dependent on the nature of the lesson being taught. Many more trials and the application of different teaching strategies using the telematic modes of delivery need to be carried out before such a conclusion can be made. This project has demonstrated that telematic modes of teaching are versatile in that they were applied to different types of lessons.

6. All the modes of telematic teaching are potentially cost-effective depending on the basis on which they are intended to be used. This has been concluded by comparing what it would cost to teach the telematic lesson by conventional means instead (the opportunity cost).
It was found that Videoconferencing and Talkback Television both have a high establishment cost while Audiographic Conferencing can be established very cheaply by comparison.

The preparation costs are also relatively high for Videoconferencing and Talkback Television but are relatively low for Audiographic Conferencing. It is concluded that these costs would drop significantly as teachers and technical staff gained experience in these teaching modes.

It is very important to note that conclusions about costs take no account of the infrastructure costs for conventional or the telematic modes of teaching. That is, the bricks and mortar and facilities of colleges and other educational establishments are not included in cost estimates and comparisons between the conventional and telematic modes.

Any assessment of the total costs of educational provision would need to take account of infrastructure, course development and course delivery costs. However, the present study recognises existing facilities and attempts to estimate the cost of providing programs requiring resources additional to those that already exist.

The delivery costs are relatively high for Videoconferencing and Talkback Television if delivered by satellite: about $2000 per hour. Videoconferencing in this trial cost about $350 per hour (using a landline rather than satellite) and for Audiographic Conferencing approximately $160 per hour. However, the cost per hour per student for both Videoconferencing and Talkback Television was approximately $20 per hour compared to Audiographic Conferencing which costs about half that of the other modes.

It must be remembered that Talkback Television and Videoconferencing lessons may be received at a potentially enormous number of sites. The other significant conclusion drawn is that the larger the distance the lesson is being transmitted, the more viable the telematic mode of teaching becomes.

It should also be recognised that Videoconferencing and Talkback Television modes in particular, have the potential to bring in expertise to an area which would not otherwise be available to students.

7. It must be remembered that these trials were the first experience that was gained by the teachers and the students involved in this project. It is concluded that with more experience, the lesson preparation time and technical problems experienced would decrease and that the quality of the delivery would increase. Increased usage would result in the development of improved teaching strategies which would in turn raise the student interest and involvement in the lessons and improve interaction between the teacher and students.

It is important to note that these were one-off lessons and were not part of a course where there had been the fostering of a strong relationship between the teachers and the students over a considerable period of time, which is normally the case in the presentation of a course. On the other hand, perhaps the learning experience for the students in the experimental groups was enhanced by their knowledge that they were experimental groups.

For the teachers one can conclude that there is a need to provide more development opportunities both in initial teacher training and as part of ongoing professional development. Perhaps there are applications which could be taught to teachers from the Hawthorn Institute of Education, TAFE Off Campus Co-ordinating Authority or elsewhere to reach more remote locations.
8. The logistical and technical problems of using telematic modes of teaching could be minimised by providing dedicated facilities for transmitting and receiving programs. This would greatly enhance teaching by telematic modes.

9. The real strength of this project lies in the fact that detailed responses were sought from students and teachers of the experiment. Readers are encouraged to consider the raw data presented in this report to gain a full appreciation of the results of this experiment and their implications.
### CONCLUSIONS

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Videoconferencing</th>
<th>Talkback Television</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypothesis 1</strong>&lt;br&gt;There is no significant difference between delivery by conventional and alternative teaching methods in terms of the learning achieved by participants.</td>
<td>No significant difference was observed in the amount learnt by participants.</td>
<td>No significant difference was observed in the amount learnt by the participants.</td>
</tr>
<tr>
<td><strong>Hypothesis 2</strong>&lt;br&gt;The quality of the learning experience is directly dependent on the degree to which personal interaction occurs between the teacher and students, and between students, in a way that is provided for in a normal classroom situation.</td>
<td>Teacher-to-student interaction was inhibited in Videoconferencing. Student-to-student interaction was greater in Videoconferencing.</td>
<td>In the Talkback Television lesson:&lt;br&gt;- student feedback was limited although teacher/student interaction was considered good&lt;br&gt;- technological breakdown adversely affected the quality of the lesson at two of six sites&lt;br&gt;- poor quality of the audio-visual transmission affected the learning of students. However, the student-to-student interaction was higher in the Talkback Television lesson than the classroom lesson.</td>
</tr>
<tr>
<td><strong>Hypothesis 3</strong>&lt;br&gt;Technology should be seen as a supplement to traditional teaching substitute.</td>
<td>Videoconferencing was able to substitute for conventional teaching.</td>
<td>Talkback Television was able to substitute for conventional teaching.</td>
</tr>
<tr>
<td><strong>Hypothesis 4</strong>&lt;br&gt;The effectiveness of the technology is dependent on the degree to which the participants and the teacher feel comfortable using the technology and how skilled they are in its use.</td>
<td>Videoconferencing was reasonably effective and comfortable to use, but both the teacher and students were uncomfortable at the start of the lesson.</td>
<td>Talkback Television provided a comfortable means of teaching for both the students and the teacher. The teacher spent a considerable amount of time practicing to become comfortable and skilled in its use.</td>
</tr>
<tr>
<td><strong>Hypothesis 5</strong>&lt;br&gt;The usefulness of technology in teaching depends on the nature of the lesson being taught.</td>
<td>Videoconferencing was found to be satisfactory for the delivery of a practical lesson but more trials are needed before a proper conclusion can be made. Students considered Videoconferencing would be more suited to theoretical lessons.</td>
<td>Talkback Television was found to be satisfactory for the delivery of a mathematics lesson on statistics, but more trials are needed to conclude whether the success of the Talkback Television is dependent on the lesson being taught.</td>
</tr>
<tr>
<td><strong>Hypothesis 6</strong>&lt;br&gt;Training delivery by alternative modes is less cost effective than conventional means in terms of cost per student.</td>
<td>Videoconferencing can provide a cost-effective means of teaching. Although establishment and delivery costs are relatively high, it may be cheaper in certain instances. Professional development for teachers is needed to support this mode of delivery.</td>
<td>Talkback Television can provide a cost-effective means of teaching, as many students may be taught simultaneously over a large area, although establishment, preparation and delivery costs are high. Professional development is needed to improve the cost-effective delivery of Talkback Television.</td>
</tr>
<tr>
<td>AUDIOGRAPHIC CONFERENCING</td>
<td>GENERAL CONCLUSIONS</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>No significant difference was observed in the amount learnt by the participants.</td>
<td>There was no significant difference in the amount learnt between the telematic modes of teaching compared to the conventional mode of teaching.</td>
<td></td>
</tr>
<tr>
<td>There was less student feedback in the Audiographic Conferencing lesson than the conventional lesson. However, student-to-student interaction was greater in the Audiographic Conferencing lesson.</td>
<td>The quality of learning in regard to student-to-teacher interaction was found to be better in conventional teaching compared to telematic modes, but there was more student-to-student interaction in the trials of telematic modes of teaching. The difference in the quality of learning between telematic and conventional modes of teaching was not great enough to cause a significant difference in the amount learnt by students. Improved interaction could be expected in the telematic modes with greater teacher familiarity with these modes and associated teaching strategies.</td>
<td></td>
</tr>
<tr>
<td>Audiographic Conferencing was able to substitute for conventional teaching.</td>
<td>The three telematic modes of teaching can be used as a substitute for conventional teaching, but within wider teaching programs, telematic modes could be used as complementary components of a broader teaching strategy, rather than as substitutes for conventional teaching. Outside of narrow trial usage, decisions about the mix of teaching modes must be made according to each situation, the relative costs and their different learning requirements.</td>
<td></td>
</tr>
<tr>
<td>Audiographic Conferencing provided an effective means of teaching. The teacher and the students were comfortable after a brief introduction to the technology.</td>
<td>The effectiveness of the telematic modes of delivery is dependent on the students and the teacher being comfortable and skilled in their use. It was found that after a brief period the students and teachers generally became comfortable in the use of the telematic modes of teaching.</td>
<td></td>
</tr>
<tr>
<td>Audiographic technology was found to be effective for a lesson on summarising skills, but more trials are needed before concluding whether the effectiveness of Audiographic teaching is dependent on the nature of the lesson being taught.</td>
<td>All three telematic modes studied were found to be satisfactory for the types of lessons taught (i.e. from practical to theoretical lessons). However, more trials are needed to conclude whether the effectiveness of the telematic mode is dependent on the nature of the lesson being taught.</td>
<td></td>
</tr>
<tr>
<td>Audiographic Conferencing teaching provides a cost-effective means of teaching. Establishment, preparation and delivery costs are all relatively low.</td>
<td>Telematic modes of teaching can potentially provide a cost-effective means of teaching. A thorough analysis of costs is needed before conclusions can be made. Professional development is required to support the cost-effective delivery of telematic teaching.</td>
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</tr>
</tbody>
</table>
GENERAL CONCLUSIONS

There is little doubt that in their present state of development most alternative learning modes are more expensive than their classroom equivalent, and often rather unwieldy.

The results of these three experiments are nonetheless extremely encouraging. Each alternative mode of delivery experiment (Videoconferencing, Talkback Television and Audiographic Conferencing) returned results on skills and knowledge acquisition that were not significantly different from the results achieved by conventional delivery. Furthermore, it was found that technology-based teaching offers the possibility of significantly improved student-to-student interaction.

Hence, alternative modes of delivery are as effective as conventional modes in terms of the acquisition of knowledge and skills and will become even more attractive and more competitive as the following trends occur:

1. The technology becomes easier for the teacher to set up and use.
2. The technology becomes less intrusive for the teacher and student alike.
3. The technology enables "real-life" to be more closely simulated.
4. The technology is more miniaturised and of higher fidelity/resolution.
5. The unit cost of the technology continues to fall as is evident in the development of Videoconferencing and Talkback Television.
6. Students become more accustomed to the use of the technology in their day-to-day learning experiences.
7. Teachers gain experience in the use of the technology and develop new strategies to enable better use of the technology.

Teaching which relies on technological systems depends heavily on proven functioning equipment. Every effort should be made to minimise the incidence of disruption due to equipment failure. Equipment needs to be robust and easily transportable.
RECOMMENDATIONS

On the basis of the findings of this project the following recommendations are made:

1. That telematic modes of teaching should be recognised as a viable educational and cost-effective supplement or alternative mode to teaching by conventional means. The State Training Board should continue to support the drive for more coordinated development and purchasing of educational and training technology in Australia.

2. That since the establishment costs are high for telematic teaching, user groups linked to statewide and national bodies should be established to collectively share and coordinate the use of equipment and facilities efficiently. User consortia should promote the development and use of alternative modes of delivery.

3. That user consortia should investigate the feasibility of joint ventures or partnership arrangements, in order that educational technology developments are undertaken in sympathy with the needs of learner and teacher/trainer.

4. That the Centre for Flexible Learning investigate:
   4.1 the adequacy of initial teacher training in the use of alternative delivery modes
   4.2 the quality and availability of regular professional development programs for teachers in the use of educational technology
   4.3 the adequacy of student preparation for communications technology
   4.4 the configuration and equipment of existing videoconferencing facilities in educational institutions be studied so that recommendations may be provided on the desirable features of facilities to be established in Victoria
   4.5 the possibility of converting existing studio facilities within the State Training System to provide dedicated videoconferencing facilities in at least two metropolitan and one country location
   4.6 the lesson preparation time required for alternative delivery methods.

5. That since initial calculations show that the use of telematics can be cost-effective, it is recommended that a thorough analysis of the cost-effectiveness and the factors involved in these costs should be investigated.

6. That designated providers through liaison with user consortia identify modules or segments of courses which are particularly suitable to alternative delivery modes.
1. THE PROJECT

1.1 PREAMBLE

The State Training Board appointed the Sunraysia College of TAFE to undertake research into alternative modes of delivery of training using new technologies. The project aimed to evaluate the effectiveness of three distinct modes of delivery, to provide the State Training System with guidelines for the potential use, advantages, disadvantages and limitations of each mode of delivery.

The delivery modes selected for the study were:

- Videoconferencing
- Talkback Television
- Audiographic Conferencing

These modes of delivery are now potentially available to educational institutions and are seen as the likely modes of delivery of distance education that colleges in the State Training System could adopt. As the technologies are relatively new they have not been used frequently within the system; consequently, knowledge of their educational effectiveness and appropriate use has not yet been evaluated in a systematic way. Audiographic Conferencing has been used more frequently in the primary and the secondary levels of education in Victoria while Videoconferencing has been used at the TAFE level. Talkback Television has rarely been used in Victoria for educational purposes, except in technology trials and in some TAFE Off-Campus programs.

1.2 DEFINITIONS

Conventional Mode of Teaching

The conventional mode of teaching refers to a classroom-based mode of teaching which may also include the use of audio-visual aids such as an overhead projector, whiteboard, blackboard, video equipment, etc.

Videoconferencing Mode of Teaching

This system provides for two-way visual and audio interaction as both the teacher and the students are able to see and hear each other through the use of television monitors. Video cameras are used to transmit the lesson from both the student and the teacher sites. An optical fibre network or the use of satellite technology is essential for this transmission so that there is sufficient transmission capacity to provide the necessary quality of both picture and sound for the lesson to be conducted satisfactorily.

Talkback Television Mode of Teaching

Talkback Television enables students to see and hear the teacher on a television monitor from a signal transmitted by landline or satellite, but the students must communicate back to the teacher by using a teleconference link-up. In this trial the television transmission was delivered from Mildura by landline to satellite transmitting station in Sydney and then by satellite to six locations. Using this technology students are able to receive the lesson at many locations simultaneously by using satellite receival dishes at any location, in this case, within south-eastern Australia. The teacher is only able to hear the students in this type of lesson through the use of a telephone link-up. Classes at the remote locations typically use a telephone audio system which allows at least six microphones to be used by students at one site.
Audiographic Conferencing Mode of Teaching

Audiographic Conferencing enables students to be taught at remote sites by the use of personal computers, facsimile machines and a teleconference link-up. It requires the use of two dedicated phone lines to both the student and the teacher sites. The teacher is, firstly, able to talk to students by the teleconference link-up, secondly, able to send messages by computers which are networked by the use of modems connected to the phone line so that all students see the same message simultaneously on their screen and, thirdly, able to send a hard copy of information to students by the use of a facsimile machine. Students are able to communicate back to the teacher in the same way. The teacher typically controls the use of the computer but is able to assign control temporarily to student sites.

1.3 PROJECT AIMS AND OBJECTIVES

1.3.1 Project Aims

i) To evaluate the educational and training effectiveness of three alternative modes of telematic delivery of training.

ii) To provide guidelines as to the use and suitability of each mode in relation to the type of programs delivered by the State Training System.

iii) To measure the cost-effectiveness of each mode of delivery in terms of the costs involved in training staff to use the technology, the time and expertise required by technical staff and the operating costs of the technology.

1.3.2 Project Objectives

i) To test a set of hypotheses which recognise the main issues to be considered in the use of this technology.

ii) To measure the effectiveness of these alternative modes of delivery by comparing the success of delivery with that of conventional teaching methods.

iii) To provide guidelines for the use of each mode of delivery.

iv) To detail and estimate the establishment and operating costs of presenting a program using the different modes of delivery.

v) To design a valid methodology to ensure the credibility of conclusions drawn from the research.
1.4 HYPOTHESES TO BE TESTED

The following hypotheses formed the focus for evaluation of these different modes of teaching:

**Hypothesis 1**
There is no significant difference between delivery by conventional and alternative teaching methods in terms of the learning achieved by participants.

**Hypothesis 2**
The quality of the learning experience is directly dependent on the degree to which personal interaction occurs between the teacher and students and between students in a way that is provided for in a normal classroom.

**Hypothesis 3**
Technology should be seen as a supplement to conventional teaching methods, not a substitute.

**Hypothesis 4**
The effectiveness of the technology is dependent on the degree to which the students and the teacher feel comfortable using the technology and how skilled they are in its operation.

**Hypothesis 5**
The usefulness of technology in teaching depends on the nature of the lesson being taught.

**Hypothesis 6**
Training delivery by alternative modes is less cost-effective than by conventional means in terms of cost per student.

1.5 METHODOLOGY

The evaluation of each mode of delivery and the recommendations are based on the results of three controlled experiments, each specific to one of the alternative modes of delivery. In each case the effectiveness of the telematic mode of delivery was compared with the conventional method of teaching.

A different subject was taught in each experiment. A summary of the experimental design is presented in Table 1.

**TABLE 1: SUMMARY OF EXPERIMENTAL DESIGN**

<table>
<thead>
<tr>
<th>EXPERIMENT</th>
<th>TREATMENTS</th>
<th>NO. OF STUDENT SITES</th>
<th>LESSON TOPIC</th>
<th>APTITUDE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(STUDENT NO'S.)</td>
<td>SKILLS TESTED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A. Conventional Mode</td>
<td>1 (6)</td>
<td>Automotive Area - Car Management System Diagnosis</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>B. Videoconferencing Mode</td>
<td>1 (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A. Conventional Mode</td>
<td>1 (15)</td>
<td>Mathematics Area Statistics - Random Sampling</td>
<td>Verbal Reasoning</td>
</tr>
<tr>
<td></td>
<td>B. Talkback Television Mode</td>
<td>6 (49)</td>
<td></td>
<td>Mathematical Ability</td>
</tr>
<tr>
<td>3</td>
<td>A. Conventional Mode</td>
<td>1 (16)</td>
<td>Communications - Summarising</td>
<td>Verbal Reasoning</td>
</tr>
<tr>
<td></td>
<td>B. Audiographic Mode</td>
<td>3 (14)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The following guidelines were used in conducting the experiments:

1. For each experiment the content of the lesson and the teacher delivering the lesson under both treatments was the same.

2. For each experiment the experimental layout was designed to suit the mode of delivery being tested. This was particularly important in the issue of deciding:
   i) how many sites a teacher would teach to
   ii) how many students would be taught at each site.

   For example, the Talkback Television delivery mode has the potential to allow many more sites to receive a lesson simultaneously compared to the other modes.

3. Students in each experiment were randomly placed between treatments of each experiment after being matched with students of equal ability except in the Videoconferencing experiment where there were too few students in the treatments to enable matching to be achieved. In the Talkback Television and the Audiographic experiment students were matched by assessing the relevant skills of each student by utilising a Differential Aptitude Test produced by the Australian Council for Educational Research (ACER).

   For the evaluation of each mode of delivery the experimental and control groups were carefully chosen with equivalent participants on the following criteria:
   i) male/female ratio
   ii) age
   iii) numbers of participants
   iv) level of educational qualification and background
   v) learning ability.

4. In determining which subject areas to use in the evaluative study, the following requirements were satisfied:
   i) The subject needed to be offered in a large number of TAFE colleges in Victoria to ensure that the research is relevant to the State Training System.
   ii) The topic chosen was one that the teachers were committed to so that their teaching performance would be optimised.
   iii) The topic chosen was considered to be relevant and interesting to the students who participated in the experiment so that their interest would be maintained.
   iv) The topic chosen did not require a significant amount of prior knowledge. The lesson was therefore thought to be a stand-alone lesson.
   v) The subject needed to be feasible in terms of its requirements for funds, resources and time.
   vi) At least one highly practical and one theoretical subject were selected for two of the experiments so that diversity of programs taught in the TAFE system were represented in this study.

The method of evaluation was the same in all experiments except in the Videoconferencing experiment.

In the Videoconferencing experiment detailed teacher and student interviews were carried out, whereas they were not in the other two experiments. However, results of the lessons were
discussed after each lesson with teachers and tutors involved. In the Videoconferencing experiment different pre-lesson and post-lesson questions were given to students in different treatments whereas in the Talkback Television and Audiographic experiments the same questions were presented to both the conventional and the alternative mode being tested.

The details of each experiment, including specific details of the methodology adopted, are documented in separate sections of this report for each of the alternative modes of delivery.
2. **EXPERIMENT NO. 1 - VIDEOCONFERENCING MODE**

2.1 **AIMS AND OBJECTIVES**

2.1.1 **Aims**

i) To evaluate the effectiveness of Videoconferencing as a mechanism for the delivery of a practical program.

ii) To compare the effectiveness of teaching a practical program by Videoconferencing with conventional teaching.

iii) To test the hypotheses stated for the whole project.

iv) To determine the cost and effectiveness of using the Videoconferencing mode of delivery by comparing the costs associated with its use with those of conventional teaching methods.

2.1.2 **Objectives**

In order to achieve the aims the objectives of this investigation were as follows:

i) To develop a practical program which is appropriate to its requirements for funds, resources and technological expertise.

ii) To develop a lesson which is stimulating and beneficial to both treatments.

iii) To provide training for the teacher who will conduct the lesson so that he/she becomes familiar with the operation of the video technology and to feel comfortable teaching in front of it.

iv) To estimate the comparative costs involved in delivering the lesson by the Videoconferencing mode of delivery and by conventional teaching methods.

2.2 **METHODOLOGY - EXPERIMENTAL DESIGN**

2.2.1 **Treatments**

**TREATMENT 1 - CONVENTIONAL CLASS**
Taught at Sunraysia College of TAFE.

**TREATMENT 2 - VIDEOCONFERENCING CLASS**
Teacher based at University College of Northern Victoria at Bendigo.
Class situated at Sunraysia College of TAFE.

2.2.2 **Method of Evaluation**

Conclusions made about the hypotheses are based on both quantitative and qualitative analysis of data collected. Evaluation of the actual success of delivery by both conventional and alternative modes was based on a combination of methods of data collection as listed below.
2.2.2.1 Qualitative Analysis

Pre-lesson and post-lesson questionnaires provided a basis for both statistical and subjective analysis (rated and written responses were asked for). Interviews also provided a basis for subjective analysis.

2.2.2.2 Quantitative Analysis

Post-lesson tests were given to the students of both treatments and provided a basis for statistical analysis.

2.2.2.3 Cost-Benefit Analysis

The cost-benefit of the Videoconferencing mode was analysed by considering the following categories:

i) equipment establishment costs - the actual costs of establishing the equipment to operate the lesson by the telematic mode. This does not include the cost of buildings and rooms for the purpose of this experiment. It does not also include the cost of overhead projector, screens, whiteboard, etc., items which are common in use for both modes of teaching.

ii) preparation costs - the costs involved in preparing the lesson.

iii) delivery costs - the costs incurred in delivering the program on a per hour basis (see Appendix A).

Information about the costs associated with delivery by each mode (conventional and alternative) was obtained from the teaching and technical staff and the Corporate Services and Personnel Officers of Sunraysia College of TAFE and the University College of Northern Victoria.

In terms of the hypothesis to be tested, Hypothesis 1 was tested on the basis of a statistical analysis of the results of the post-test given to the participants. The post-test specifically relates to the content delivered during the lesson (see Appendix A).

Hypotheses 2, 3, 4 and 5 were tested using questionnaires and the interview responses. They therefore have a quantitative and qualitative basis. Both questionnaires and the interview questions were aimed at determining what learning and teaching styles were preferred by the participants and the teacher respectively. They were also aimed at determining how participants in the experimental group and the teacher felt about using the new technology and its potential for future application in a range of content areas (see Appendix A).

Hypothesis number 6 was tested on the basis of cost-effectiveness analysis.

2.2.3 Subject Taught in the Experiment

Title of lesson: Motor Mechanics - Diagnosis of a VN Commodore Engine Management

The rationale for selecting this topic was:

i) It was considered necessary that a practical course be chosen for the evaluation of at least one mode of delivery because practical courses represent a significant component of those offered by TAFE colleges across the State.
ii) Motor Mechanics was considered suitable because it is taught across the State in at least thirty TAFE colleges; therefore, the evaluation is relevant to a significant number of colleges.

The criteria used by the Automotive staff to select the program were as follows:

i) The topic was simple enough, in terms of its physical requirements, to allow feasible filming and observation by the participants.

ii) The topic was reasonable in terms of its requirements for funds, equipment and staff involvement.

iii) The topic is new and relevant to industry so that it is attractive to participants.

2.2.4 Equipment Used in the Experiment

The resources listed below were required for the experiment.

- VN Commodore
- Test equipment: fuel pressure gauge
test light
volume flow test container
fuel pipe clamp
- Hand tools: multimeter
'Tork' bit screwdriver
Phillips blade screwdriver
socket ratchets
- Two-way Videoconferencing unit
- Five cameras (including those at the University College of Northern Victoria).

2.2.5 Students Involved in the Experiment

After due consideration it was agreed that the experimental and control group should be composed of qualified mechanics (post-apprentices of Sunraysia College) rather than apprentices. It was inappropriate to involve apprentices in this experiment because their learning is self-paced. The students are taught on an individual basis and are not taught in groups. The composition of the groups were:

Conventional lesson - 6 post-trade motor mechanics
Videoconference lesson - 6 post-trade motor mechanics

Criteria for Selection of Students

The validity of a controlled experiment depends on very careful selection of experimental and control groups to ensure that all variables of the experiment are constant, except those being tested. In this trial, obtaining equal groups for each treatment was difficult because there was a very limited range of suitable students from which to select the participants. The reasons are as follows:

i) A significant proportion of the post-trade mechanics were not permanently living in Mildura when they attended the College and since finishing their course had returned to their permanent homes out of the area.
ii) The participants had to be drawn from a group of past students who had completed their course in the same year to ensure that the ages and tertiary educational experiences of all the participants were as similar as possible.

iii) It was not possible to maintain a gender balance in the two treatment groups. However, the one female participant was of similar age and possessed the same qualifications as other participants.

iv) The requirement for participants to have similar learning capacities was addressed by selecting participants who had achieved the same level of qualification.

v) The size of the groups was limited to six as the lesson was centred on teaching around the engine of a car. It would have been preferable to have had groups of between ten and fifteen participants for statistical reasons, but this would have affected the ability of students to learn in this lesson.

2.3 RESULTS

The main findings of the experiment are outlined below. The questionnaire responses, interview responses and the post-tests - the source of these findings - are contained in Appendix A.

2.3.1 Results of the Statistical Analysis

The matched paired-difference test showed that there was no significant difference in the amount learnt in the conventional lesson compared to that learnt in the Videoconferencing lesson (see Appendix A).

It can also be seen that the average of the conventional and the Videoconference groups scores are very close, being 18.0 and 18.5 respectively. This supports the conclusion that there is no significant difference in the amount learnt by either group.

2.3.2 Responses to Interview Questionnaire - Videoconferencing Group

Personal Interaction

Four participants commented that interaction between a teacher and his/her students enhances learning because it provides the opportunity for students to discuss their misunderstandings or problems more adequately. Of these one felt that the interaction was personal enough because the teacher knew the participants' names and referred to each participant by name every time he/she asked a question or gave an instruction.

Two participants felt that personal interaction between a teacher and his/her students was not always necessary. One of these felt that the necessity depended on the nature of the lesson, for instance, whether it was a lecture or a tutorial. The other felt satisfied with having a reference such as a manual or a book to consult if in need of help, rather than depend on a teacher. Both these participants felt that the workshop was personal enough.

Comfort of Using the Technology

None of the participants in the Videoconferencing group had experienced two-way videoconferencing before and did not know a lot about it. This may explain to some extent why all participants, bar one, commented that initially they felt uncomfortable using the technology to interact with the teacher.

Of the six participants four gained considerable confidence during the program, one gained a slight amount of confidence and one did not manage to develop a positive attitude towards the technology at any stage of the program. The two who were not positive about
the technology felt that their uneasiness in dealing with it prevented them from interacting as well as they would have liked.

Four participants dealt more successfully with the technology than they expected, or just as well as they expected, with all aspects of the two-way Videoconferencing mode of delivery. Their responses indicated that they either felt very comfortable or fairly comfortable with these aspects.

One participant felt that the one thing she was dissatisfied with - more than she expected - was her lack of understanding of the teacher's instructions. This participant also indicated in both the pre-survey and the post-survey that she felt uneasy or uncomfortable with all aspects of the delivery apart from the length of it (her capacity to concentrate). With regard to this aspect she was indifferent. The sixth participant felt worse than he expected with the working environment of the studio and the presence of the cameras and other technology. He had a positive attitude to all other aspects of the delivery.

**Enjoyment of the Lesson**

One participant found the workshop to be a little less enjoyable than expected, two enjoyed it more than they expected and three had the same attitude before the program as they had after it.

**Success of the Lesson**

Three students considered that they learnt more from the lesson being taught by this mode against what they thought they would learn by conventional mode. Three students thought that the amount learnt was normal.

The Level of Interaction between Students in the Videoconferencing Class

Four participants believed that the interaction between individual participants was better in the videoconference class than in the normal classroom because they were forced to work together and assist each other in order to successfully carry out the teacher's instructions. One felt that the interaction was the same as normal and another that it was worse than normal.

**The Quality of Delivery of the Videoconference Lesson**

There were mixed reactions from the participants to the quality of the delivery.

**Assistance from the Teacher**

Participants felt that the teacher was very helpful, or just as helpful as normal. Four students thought that individual assistance was satisfactory if not more than satisfactory, while two students commented that it was limited.

Time of Delivery

One participant felt that delivery by the Videoconferencing mode caused the teacher to take a significantly longer time to successfully convey an instruction than he would normally need, three participants felt that he took a bit longer than normal and two participants felt that the mode of delivery had no impact on the time the teacher required to convey a message.

The Amount Learnt from the Lesson

All participants felt that they gained some knowledge, skills and understanding from the workshop.

**Technical Problems**

The main problems associated with the quality of the delivery were identified as being technical ones. For instance, all participants commented about the inadequacy of the audio system and how this affected communication with the teacher. The participants were forced to communicate with the teacher by a hand-held microphone which they felt considerably hindered their ability to carry out instructions and communicate at the same
time. They also commented that it was difficult to hear the teacher, particularly when the car engine was turned on. Another problem raised was the presence of too many cameras in the studio which obstructed the progress of the lesson.

The Adequacy of the Technology
Three participants felt that the detail on the screen was difficult to see and that the teacher's movements were difficult to follow. As a result one of these participants felt that the technology had only limited potential in distance education, one felt that it had great potential and another felt that it had some potential under certain circumstances.

Another participant considered that the detail on the screen was adequate although the teacher's movements were difficult to follow. He also felt that the technology had great potential under certain circumstances.

Two participants had no problem at all with the quality of the transmission. One felt that the technology had great potential and one other felt that it had some potential under certain circumstances.

The Type of Lesson Suited to Videoconferencing
All of the participants who commented that the technology had potential under certain circumstances elaborated on this in the interview and said that the alternative mode of delivery would be more suited to the delivery of theoretical programs rather than technical ones. One participant commented that the development of the potential of the technology would depend on the money made available to improve it.

None of the participants considered that they would be deterred from enrolling in a course which required them to attend some sessions delivered by the Videoconferencing mode of delivery.

2.3.3 Responses from the Teacher Interview - Videoconferencing Lesson

Personal Interaction with Students
In the interview the teacher commented that personal interaction between a teacher and his/her students is very important. He considered that the type of interaction that took place during the workshop was personal. He attempted to refer to each student by name.

Teacher Comfort with the Technology
Despite the fact that the teacher had not previously delivered a program by the Videoconferencing mode of delivery he felt at ease and taught naturally during the lesson.

The teacher looked forward to delivering the session with some reservations. He enjoyed delivering the lesson and felt comfortable with talking to the television monitor both before and after the lesson.

Overall the teacher dealt with most aspects of the alternative mode of delivery as well as he expected. One aspect which he dealt with more easily than he expected was the time limitation specified for the delivery.

Problems Experienced with the Delivery of the Lesson
The teacher experienced more discomfort than expected from the presence of the cameras and other equipment in the studio.

Aspects that he felt uncomfortable with, both before and after the program were:

i) He had less opportunity to offer participants individual attention and assistance.

ii) He had to supervise the participants with limited ability to view student activity.
iii) Having limited student feedback meant that the ability of students to cope with the lesson could not be assessed during the lesson.

iv) He felt that interaction between the students was poor and the atmosphere in the studio was uncomfortable.

**Picture Quality**
With regard to the quality of the picture transmitted to the studio in Bendigo, the teacher commented that detail was difficult to see and that the viewing scope was just satisfactory.

**Lack of Experience with the Technology**
In the interview the teacher commented that with experience in using the technology he would be better prepared in the future to deal with some of his concerns described above.

**The Success of the Delivery**
Compared with the delivery of the same session by conventional teaching methods the teacher considered that delivery by the Videoconferencing mode was less successful.

**Time of Delivery**
The teacher felt that delivery by the Videoconferencing mechanism had no impact on the time he required to convey an instruction.

**Potential of the Technology**
The teacher considered that Videoconferencing has some potential but only under certain circumstances. For instance, he commented that the alternative mode of delivery would be more appropriate to programs based on simpler practical demonstrations or theoretical lessons. He also suggested that if he was offered the opportunity to deliver sessions by this alternative mode of delivery on a regular basis he would be inclined not to accept, due to the substantial preparation and rehearsal time it would require, particularly where practical workshops were concerned.

**The Success of the Lesson**
The teacher could not estimate how successful the delivery was in terms of the amount the participants learnt. He did comment in the interview, however, that if the lesson had been delivered in a normal classroom the participants would have gained broader knowledge due to the informal or anecdotal discussion which normally occurs in such a situation between teacher and students.

### 2.3.4 Questionnaire Responses of the Students Involved in the Conventional Lesson

**Teacher/Student Interaction**
All of the participants considered that personal interaction between a student and the teacher was very important and that learning is enhanced through it because it provides the opportunity for students to discuss their misunderstandings or problems more adequately. Two of the participants commented that interaction with the teacher during the workshop was not as personal as it would normally be due to the fact that there was a lot of work to get through and, therefore, it limited time to ask questions and receive lengthy and detailed responses.

**Enjoyment of the Lesson**
Of the six participants one found the workshop to be slightly less enjoyable than expected.

**Coping with the Lesson**
Overall the participants dealt better than they expected, or just as well, with all aspects of the delivery which were listed in the survey.
These were:

i) concentrating for the duration of the lesson
ii) understanding the teacher’s instructions well enough to carry them out
iii) personal interaction with the teacher and receiving individual attention.

All the participants stated in the pre-survey that they felt fairly confident about all aspects of the program. Three of these stated in the post-survey they felt very comfortable with all aspects of the program. For other participants their attitudes to all aspects of the program after it was conducted were similar to those before the program.

Atmosphere in the Classroom
Of the participants four said that the atmosphere in the workshop was normal and two said that it was more relaxed than normal. They all agreed that interaction between individual participants was as normal as expected.

Quality of Delivery
Three participants said that the teacher was helpful and three said he was very helpful. Furthermore, four participants felt that the time he required to convey an instruction was the same as normal and two said it took less time than normal.

Amount Learnt from the Lesson
All six participants thought that they received some knowledge, skills and understanding from the workshop.

2.3.5 Questionnaire Responses of the Teacher Delivering the Conventional Lesson

Comfort with the Delivery
The teacher felt that the workshop was personal and that the atmosphere was very comfortable in the lesson.

Expectations of the Delivery
The teacher looked forward to delivering the session without any reservations at all. He was also very satisfied with his delivery.

Time of Delivery
The only aspect of the delivery which was a little more difficult to deal with than he expected was completing the session within the specified time.

Success of the Lesson
The teacher generally thought that the workshop was as successful as he expected it to be.

Amount Learnt from the Lesson
From the teacher’s own evaluation of the success of the workshop he considered that the participants gained a satisfactory amount of knowledge, skill and understanding.

2.3.6 Questionnaire Responses of Students Involved in the Videoconferencing Lesson

Enjoyment of the Lesson
All of the students stated that they enjoyed the lesson.
Comfort of the Lesson
Four of the students felt comfortable during the lesson while two students felt uncomfortable. All of the students found it easy to talk to the television screen except for one student. The technology in the studio, such as cameras, bothered two students.

Interaction
All the participants found it easy to interact during the lesson except for one student. Four students stated that interaction during the lesson was actually improved by using this type of teaching mode.

Immobility of the Teacher
The participants stated that this did not affect the delivery of the lesson.

Talking in front of the Group
Only one student found it difficult to talk in front of the rest of the group.

Technology
The participants commented that fine detail was difficult to see on the television screen.

Potential of the Technology
All participants except one felt that this technology has potential for teaching. All the students commented that they would be prepared to enrol in a course using this technology although two commented that it would cause them a little concern.

Type of Lesson Suited to the Technology
One student commented that a theoretical lesson would be more appropriate for delivery by this technology.

Comparison with a Normal Lesson
Two students indicated that they thought that they would learn more by being taught by conventional means; the others thought it would be about the same.

2.3.7 Questionnaire Responses of the Teacher Involved in the Videoconferencing Lesson

Enjoyment of the Lesson
The teacher indicated that he enjoyed teaching the lesson.

Comfort of the Lesson
The teacher thought that the lesson was not comfortable for the students.

Interaction
The teacher indicated that personal supervision of students was difficult and that attempting to obtain student feedback was also very difficult.

Technology
Detail was difficult to see on the television monitor and the audio facility was not adequate in the Mildura studio for the students.

Potential of the Technology
The teacher stated that he would be inclined not to teach by this mode as rehearsal and preparation time were both considered too high.
2.4 ANALYSIS OF RESULTS

Each hypothesis is considered in respect to the observations made in this experiment.

**Hypothesis 1**

*There is no significant difference between delivery by conventional teaching methods and alternative modes in terms of the learning achieved by participants.*

The statistical analysis of the post-lesson test results showed that there was no significant difference in the amount learnt by either mode of delivery.

**Hypothesis 2**

*The quality of the learning experience is directly dependent on the degree to which personal interaction occurs between the teacher and students, and amongst the students themselves, in a way that is provided for in a normal classroom situation.*

The evidence from the experiment showed that:

1. limited student feedback during the lesson made it difficult for the teacher to guide and control the lesson
2. individual supervision and attention of the students was difficult from the teacher's point of view but students perceived that assistance from the teacher was good
3. detail was difficult to see on the television screen
4. the audio problems were noticeable at the student end of the lesson
5. student interaction was improved by the Videoconferencing mode of delivery
6. students thought that a theoretical lesson would be better taught by this mode than a practical lesson.

It appears that, in general, the quality of learning was not quite as good in the Videoconferencing lesson as the conventional lesson although this was not enough to affect the amount learnt. The quality of the lesson was actually increased by the Videoconferencing mode by encouraging more student-to-student interaction. The lower level of student feedback which the teacher experienced during the Videoconferencing lesson appears to have had little effect on the learning of the students.

In the experimental group the high level of interaction developed probably because the participants were unable to rely as heavily on the teacher as they could in a normal situation. The least confident of the participants tended to carry out instructions with assistance from the more confident.

While the majority of participants involved in the experiment valued personal interaction with their teachers and felt it was necessary in order to learn effectively, the importance of this personal interaction was perceived differently to some extent by different individuals. For instance, one participant felt that the level of necessary personal interaction depends on the complexity of the lesson being delivered; for example, whether the lesson intends to provide basic factual information, technical skills or whether it requires students to grasp complex concepts. The degree of necessary personal interaction would also naturally depend on the learning capacity of each student. Those participants who depended on personal interaction with the teacher and were dissatisfied with the level during the workshop possibly could have performed better on the post-test had their desired level of interaction been satisfied.

The importance of effective interaction between teacher and student, from a teacher's point of view, is significant. The teacher depends on eye-to-eye contact with individual students to gain an impression of their ability to understand and carry out instructions.
Another relevant comment made by the teacher was that the success of delivery by the alternative mode would depend not only on the experience of the teacher and the participants but also on the experience of technical staff. He felt that to be able to communicate more effectively with the participants he would need to be able to focus more on their faces and body language than on their activities. He thought that if the camera people at Mildura were experienced in filming for a video conference they would have understood the importance of this.

Hypothesis 3

Technology should be seen as a supplement to conventional teaching methods, not as a substitute.

The results of this experiment indicate that this teaching mode could substitute for the conventional teaching mode as there was no significant difference in the amount learnt by the Videoconference mode, although it would probably be better considered as a supplement to the conventional teaching mode so that the problems of the quality of learning expressed above under Hypothesis Two could be overcome.

Hypothesis 4

The effectiveness of the technology is dependent on the degree to which the participants and the teacher, particularly, feel comfortable using the technology and are skilled in operating it.

From the interview and questionnaire responses made by the participants and the teacher a generalisation may be made that the effectiveness of technology is dependent to some extent on user comfort and how skilled they are in operating it.

It was evident from witnessing the rehearsal of the delivery to the experimental group, and the actual delivery, that even with one informal practice a teacher's ability to deal comfortably with the alternative mode of delivery is improved. The teacher also commented that if he needed to deliver a program by two-way video interaction again, his delivery would be improved significantly. He felt that he would make better use of the cameras and be more conscious of the needs of the students.

The participants' comments supported those of the teacher. They stated that once they became familiar with the technology they felt more comfortable using it. From an observation of the whole delivery this change in the participants' attitudes was obvious. All the participants enjoyed the lesson except for one student. They felt that the technology had a great deal of potential once teachers were trained and experienced in using it and once students were also familiar with it.

Hypothesis 5

The usefulness of technology in teaching depends on the nature of the lesson being taught.

Past studies have indicated that tasks which involve giving and receiving information, asking questions, exchanging opinions and problem solving can be carried out as effectively via technological mediums as they can by face-to-face communication. It is suggested, however, that practical lessons are more effectively carried out in settings where there is opportunity for interpersonal communication between student and teacher.

The responses of the participants and the teacher support this hypothesis. The participants of the experimental group commented that although the workshop was successful the Videoconferencing mode would have been more suited to the delivery of a theoretical lesson. They felt generally that in a normal practical workshop the teacher would have had the opportunity to offer more assistance and guidance which is necessary for a practical lesson.
Hypothesis 6

Delivery of training by alternative modes of delivery is not cost-effective in terms of cost per head of the recipients.

The analysis of the cost-effectiveness is presented in Appendix A. The results are summarised in Table 2.

It can be seen from Table 2.1 that there is a high establishment and preparation cost for videoconferencing. The teacher supported these comments by indicating that he would be reluctant to deliver practical programs by this alternative mode of delivery in the future due to the considerable planning time it requires. He felt that the workshop involving the experimental group was not as successful as it should have been given the time and effort put into its planning. It must be remembered though that this was the first experience in using this mode by the teacher.

### Table 2.1: SUMMARY OF COST-EFFECTIVENESS ANALYSIS

<table>
<thead>
<tr>
<th>COST ($)</th>
<th>CONVENTIONAL MODE</th>
<th>VIDEOCONFERENCE MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Equipment establishment cost</td>
<td>Note 1</td>
<td>318,900</td>
</tr>
<tr>
<td>(b) Preparation cost</td>
<td>220</td>
<td>1435</td>
</tr>
<tr>
<td>(c) Delivery cost</td>
<td>47</td>
<td>362.5</td>
</tr>
<tr>
<td>(d) Opportunity cost</td>
<td>540 (note 2)</td>
<td></td>
</tr>
<tr>
<td>(e) No. of student contact hours</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>(f) Cost per student contact hour</td>
<td>(47 + 15 = 3.13) 3</td>
<td>(362.5 + 15 = 24.17) 24</td>
</tr>
<tr>
<td>(g) Cost of student contact hour except (a) and (b) but including (c) and (d)</td>
<td>(587 + 15 = 39.13) 39</td>
<td>(362.5 + 15 = 24.17) 24</td>
</tr>
<tr>
<td>(h) Cost of Student Contact Hour except (a) but including (b) + (c) + (d)</td>
<td>(807 + 15 = 53.8) 54</td>
<td>(1797.5 + 15 = 119.8) 120</td>
</tr>
</tbody>
</table>

(Refer to Appendix A for calculations.)

Note 1: Equipment establishment cost only includes the cost of equipment not common to both modes of delivery. It does not include therefore the cost of buildings, infrastructure or commonly available audio-visual equipment such as overhead projectors and white boards, etc.

Note 2: Opportunity cost represents the cost of the teacher teaching by classroom-based mode by travelling to Mildura from Bendigo compared to teaching a class in Mildura by Videoconferencing from Bendigo.

When only considering delivery cost, however, it can be seen that it may be economical to teach by Videoconferencing as the opportunity cost of travelling from Bendigo to Mildura and teaching by conventional mode is $540 compared to the cost of $362.50 by Videoconferencing.
Once established with equipment and experienced staff it may be economical to teach by Videoconferencing mode particularly if the teacher is teaching from a more remote site and if more than one site is taught simultaneously so that the opportunity cost of teaching by conventional means is increased. Another consideration which needs to be made is that for a particular program it may be more cost-effective and practical if one part is delivered by an alternative mode of delivery and the other part by conventional methods.

2.5 CONCLUSIONS

1. There is no significant difference in the amount learnt between the conventional mode and Videoconferencing mode of teaching.

2. The quality of the learning experience is apparently better in a conventional lesson compared with a Videoconferencing lesson because of the more effective teacher student interaction although there seemed to be greater student-to-student interaction in the Videoconferencing lesson than in the conventional lesson.

3. Videoconferencing can be used as a substitute for conventional teaching although it is probably better used to supplement conventional teaching.

4. Videoconferencing provides a comfortable means of teaching.

5. Videoconferencing was found to be satisfactory for the delivery of a practical lesson. However, in the opinion of the students, it seems that it would be better suited to theoretical lessons. More trials are needed before a proper conclusion can be made.

6. Videoconferencing could be cost-effective once established and if the lesson is taught from a large enough distance and particularly if two or more classes are taught simultaneously. The cost of establishment and preparation of the lesson to be taught are relatively high compared with the conventional lesson.
3. EXPERIMENT NO. 2 - TALKBACK TELEVISION MODE

3.1 AIMS AND OBJECTIVES

3.1.1 Aims

i) To evaluate the effectiveness of Talkback Television delivery mode as a means of teaching a theoretical lesson.

ii) To compare the effectiveness of teaching a practical program by Talkback Television with conventional teaching.

iii) To test the hypotheses stated for the whole project.

iv) To determine the cost-effectiveness of using the Talkback Television mode of delivery by comparing the costs associated with its use with those of conventional face-to-face mode of delivery.

3.1.2 Objectives

In order to achieve the aims the objectives of this study were as follows:

i) To develop a lesson which does not require a significant amount of prior knowledge.

ii) To develop a lesson which is suited to the use of Talkback Television technology and the conventional mode of delivery.

iii) To develop a lesson which is interesting to the students involved in this experiment.

iv) To deliver a lesson which provides a measurable improvement in the knowledge and skills of the students.

v) To provide the teacher with an opportunity to become familiar with the use of Talkback Television and to become comfortable teaching by this mode of delivery.

3.2 METHODOLOGY - EXPERIMENTAL DESIGN

Since Talkback Television would normally be utilised to teach to a large number of sites to be cost-effective and to demonstrate the potential of this technology it was decided to teach to six sites simultaneously. As a result it was intended that there would be 65 students in total at the receive sites. This was considered to be a realistic representation of the normal conditions that would be experienced by students using Talkback Television as there would normally be a reduction in the amount of individual interaction time that each student could have with the teacher.

3.2.1 Treatments

TREATMENT 1 - CONVENTIONAL CLASS

This lesson was taught at the Sunraysia College of TAFE to students in a normal classroom used for teaching mathematics.
TREATMENT 2 - TALKBACK TELEVISION CLASSES

Talkback Television may be delivered by satellite or terrestrial links or a combination of the two. In this study the lesson was taught from the television studio of the Sunraysia College of TAFE. The lesson was then sent to Sydney via Melbourne by the optical fibre link. From Sydney the lesson was beamed to the Aussat 1 Satellite which in turn delivers the message to south-eastern Australia. This means that the students receive an audio-visual message while the teacher could only hear the students via a teleconference link-up of all the sites.

The sites chosen for this experiment were:

Sunraysia College of TAFE and local sites:

Site 1 Mildura main campus  
Site 2 College Farm - Agriculture Laboratory  
Site 3 College Farm - Horticulture Laboratory  
Site 4 Robinvale Secondary College

Distant Locations:

Site 5 University College of Northern Victoria, Bendigo  
Site 6 Gordon Technical College, Geelong

3.2.2 Subject Taught in the Experiment

The lesson taught was called 'Statistics in Action'. This was a lesson about random sampling (see Lesson Plan in Appendix B). This lesson was selected on the basis that it did not require very much prior knowledge of the subject, that it was a subject that the students were going to study in their course, and that it was likely to be of interest to them.

3.2.3 Equipment Used in the Experiment

As much as possible the same audio-visual equipment was used in each lesson so that the presentation of each lesson was as similar as possible to the other. The equipment used at each site was:

(i) Conventional lesson:

. VHS video  
. IBM computer

(ii) Talkback Television Lesson

Teacher site -

. 1 presentation camera  
. 1 ELMO tabloid overhead camera  
. 2 preview TV monitors  
. 1 program TV monitor  
. 1 video mixer  
. 1 VCR  
. 1 dual tapedeck  
. 2 lapel microphones  
. 1 video codec

At each student site -

. 1 TV monitor  
. 1 DUCT audio-telephone system  
. 1 demodulator.
3.2.4 Staff Used in the Experiment

(i) Conventional lesson:

The teacher was able to conduct this lesson without any assistance from any other staff.

(ii) Talkback Television lesson:

The teacher required assistance from:

- an audio-visual technician at the studio
- a tutor at each receive site.

3.2.5 Students Involved in the Experiment

The students who participated in the experiment and the courses that they were from are listed below:

(i) Conventional Lesson

<table>
<thead>
<tr>
<th>SITE</th>
<th>TYPE OF STUDENTS</th>
<th>NO. OF STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunraysia College of TAFE</td>
<td>Return to Learning</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Diploma of Tertiary Studies</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Year 1 Associate Diploma of Accounting</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Year 1 Bachelor of Business</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

(ii) Talkback Television Lesson

<table>
<thead>
<tr>
<th>SITE</th>
<th>TYPE OF STUDENTS</th>
<th>NO. OF STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunraysia College of TAFE</td>
<td>Return to Learning</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Diploma of Tertiary Studies</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Year 1 Associate Diploma of Accounting</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Year 1 Bachelor of Business</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>19</strong></td>
</tr>
<tr>
<td>University College of</td>
<td>Diploma of Tertiary Studies</td>
<td>18</td>
</tr>
<tr>
<td>Northern Victoria, Bendigo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gordon Technical College,</td>
<td>Year 1 Associate Diploma of Accounting</td>
<td>12</td>
</tr>
<tr>
<td>Geelong</td>
<td>completing Applied Business Mathematics</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>49</strong></td>
</tr>
</tbody>
</table>

As for all the experiments a gender balance was maintained as much as possible in the experiment.
3.2.6 Method of Evaluation

The experiment was evaluated quantitatively and qualitatively. Because a quantitative analysis was performed it meant it was necessary to select the students at random into treatments and to place the students at random at the different sites. This in turn meant that any quantitative analysis could only practically be performed at the Sunraysia sites. Otherwise students would have had to been transported between the institutions involving considerable expense and time.

Conclusions made about the hypothesis are based on the following analysis:

3.2.6.1 Qualitative Analysis

Pre-lesson and post-lesson questionnaires. Questionnaires were completed immediately before and after the lesson to provide data for this analysis by all participants from all institutions (see Appendix B).

3.2.6.2 Quantitative Analysis

Post-lesson tests. A test was completed immediately after the lesson to provide data for a quantitative analysis of how much students had learnt from the different teaching methods in the different treatments (see Appendix B).

Matched paired-difference of means test. A matched paired-difference of means test was used to analyse the post-test results of the two different treatments. This meant that students had to be matched into pairs of equal learning ability. This was achieved by giving each participant an aptitude test.

The aptitude tests used were a Differential Aptitude Test produced by the Australian Council of Educational Research, Melbourne (see Appendix B). As the lesson on statistics required both verbal and numerical skills, two separate tests were given to each student: a Verbal Reasoning Test and a Numerical Ability Test.

The tests were completed according to the specified standard conditions. Students of the same sex and approximately the same age were then paired with the closest matching scores for both the numerical test and the verbal test.

3.2.6.3 Cost-Benefit Analysis

The establishment costs and the operating costs were used to determine the cost-effectiveness of the different teaching modes (see Appendix B).

3.3 RESULTS

The main findings of the experiment are outlined below. The questionnaire responses, interview responses and the post-tests - the source of these findings - are contained in Appendix B.

3.3.1 Result of the Statistical Analysis

The matched paired-difference test showed that there was no significant difference in the amount learnt in the conventional lesson compared to that learnt in the Talkback Television lesson (see Appendix B).
The average of the conventional and the Talkback Television groups, scores are very close, being 20 and 18 respectively. This supports the conclusion that there is no significant difference in the amount learnt by either group.

3.3.2 Results of Discussion with Tutors after the Experiment

Personal Interaction
A meeting of the tutors and all staff involved in the lesson from each site was held after the experiment was completed. They were asked to raise any issues of concern and of benefit which they experienced from participating in the experiment and from observing the participants of the experiment. The results of this meeting are presented below:

Technology
The main emphasis of their comments related to the technology of the Talkback Television lesson. The main points mentioned were:

Visual Interaction
i) Lighting in the studio was inadequate making the picture too dark.

ii) The colour of the picture received at all monitors was too red.

iii) The picture was breaking up with quick movement of the teacher’s hands.

Audio Interaction
i) The DUCT systems should have been turned down as there was interference from the DUCTs at other sites so that there was sound coming from both the DUCTs and the television monitor simultaneously. The speech from the different sources was not synchronised.

ii) The questions being asked from other sites were not loud enough via the satellite transmission. This made it difficult to have ‘normal’ interaction for the lesson. The volume of the DUCTs from student sites was being transmitted back to the student sites via satellite at the maximum volume but this was inadequate.

Malfunctioning Equipment
There was some malfunctioning equipment during the experiment which affected the success of the lesson. The problems experienced were:

i) The demodulator at the Robinvale Secondary College broke down five minutes before the start of the lesson. After attempts to rectify the problem failed it was decided to move the class to the Robinvale Community Resource Centre. This occurred approximately one third through the lesson and the class was not able to be linked to the teleconference so they were not able to interact in the lesson.

ii) The DUCT at the Sunraysia College of TAFE main campus was not able to have the volume turned down due to a malfunction of the volume control knob. After several attempts at rectifying the problem the DUCT was placed outside the room so that the sound did not affect the lesson. The lesson at this site then continued successfully.
Student Interaction
It was observed that there was considerable student interaction at each site of the experiment while the lesson proceeded.

Student Interest
It was commented that student interest was a problem in this experiment. Some students failed to arrive at the class they said they would attend. This was particularly noticeable at the Robinvale site where only three of seven students arrived for the class. This was probably due to the fact that they had to be bussed to this site, a forty-five-minute trip each way. It must be remembered that this was a separate event to their normal classes and therefore it was difficult to gain a solid commitment from the students to be involved in the experiment. The other problem that was identified was that students really didn't understand what was going to occur in the Talkback Television lesson despite having this explained at previous meetings and being shown the equipment that they would be using during the lesson. It was observed that they really did not understand the process until they had actually been through it.

Rehearsal
It was considered that a rehearsal of this lesson was absolutely essential for the success of the lesson. This was particularly important for the co-operation of the teacher and the technologist who assisted the teacher.

Teaching Style
It was generally remarked that the teacher had done an excellent job in delivering this lesson and that interaction was encouraged with the students. It was suggested, however, that the teacher needs to introduce him/herself at the start of the lesson and ensure that all the sites are connected by the teleconference link-up and receiving the transmission via satellite.

Lack of Experience with the Technology
It was commented that the lesson would have been smoother if the people involved in the lesson had been experienced in the use of the technology. It was commented that it would not have taken so long to produce this lesson in future with greater experience.

The Need to Train Staff in the Use of Talkback Television
It was considered that there is a pressing need for the training of staff in the use of the Talkback Television teaching mode.

Potential of the Technology
People commented that, if they had experience in the use of the technology there would be considerable effective use for this type of teaching mode.

3.3.3 Questionnaire Responses of the Students Involved in the Conventional Lesson

The results of the questionnaire responses are presented in Appendix B.

Interest in the Lesson
Of the fifteen students in the lesson only two stated that they were not interested in the lesson before its delivery. After the lesson only three students commented that they did not enjoy the lesson and found it interesting. One student commented that it bored him/her to tears.

Prior Knowledge of the Subject
Only one student commented that they knew a lot about the subject of random sampling before the lesson, three commented that they knew something about the subject while the rest stated that they knew very little about the topic.
Expectation of the Lesson
Two students commented that the lesson was not what they had expected.

Duration of the Delivery
There was no concern expressed before or after the lesson about the length of the delivery of the lesson except that one student commented that the lesson was half an hour too long and that the same amount could have been taught in a shorter lesson.

Understanding the Teacher
There was no concern expressed by the students about understanding the teacher's instructions to carry out a task either before or after the lesson.

Personal Interaction with the Teacher and Receiving Individual Attention
Students did not anticipate any problems interacting with the teacher and receiving individual attention before the lesson. After the lesson five students stated that they were comfortable with the personal interaction and attention received in the lesson. However, six students could not, or did not, comment either way.

Interaction in the Lesson
The students perceived that the atmosphere in the lesson was normal although one student felt uncomfortable during the lesson. Students felt that the interaction in the lesson was generally normal although two students commented that the atmosphere in the class restricted interaction. One student elaborated by commenting that students in the group did not know each other and that this hindered interaction within the group.

Time for the Teacher to Give an Instruction and Make it Understood
Six students thought that it took a normal amount of time for the teacher to give instructions and make them understood, but three stated that they thought it took more time to achieve this than normal.

Assistance from the Teacher
Six students felt that the teacher was as helpful as normal in this lesson while six considered that she was more helpful than normal.

The Amount Learnt from the Lesson
Half the students commented that they acquired some knowledge from the lesson while the other half considered that they acquired a good amount of knowledge from the lesson. One student commented that he/she had learnt very little from the lesson. Another student considered that the Bead Experiment performed in the lesson should have been completed on an individual basis.

3.3.4 Questionnaire Responses of the Teacher Delivering the Conventional Lesson

Looking Forward to the Lesson
The teacher looked forward with enthusiasm to delivering the lesson.

Completing the lesson in the Required Amount of Time
The teacher was confident of completing the lesson in the required amount of time. After the lesson the teacher commented that she was dissatisfied with the lesson from the point of view of completing it in the required time.

Providing Individual Attention and Clear Instructions
The teacher felt confident before the lesson to provide individual attention and clear instructions to the students. After the lesson the teacher commented that she was dissatisfied with providing students with individual attention and clear instructions.
Likely Success of the Lesson
The teacher felt fairly confident before the lesson that it would be interesting, generate enthusiasm and that students would learn some knowledge and skills from the lesson although she commented that she did not know the background of the students and that this made it difficult for her to predict.

Success of the Lesson
The teacher stated that she was fairly happy with the delivery of this lesson and that she thought the participants had learnt a satisfactory amount of knowledge, skill and understanding.

Atmosphere in the Lesson
The atmosphere was perceived as being normal.

Interaction between the Teacher and the Students
The teacher commented that she considered that teacher/student interaction was extremely important for the success of the lesson. After the lesson the teacher thought that the interaction was normal as for any classroom situation.

3.3.5 Questionnaire Responses of the Students Involved in the Talkback Television Lesson

Interest in the Lesson
Of the forty-four students in the lesson only four stated that they were not interested in the lesson before its delivery. Thirty-three stated that they were interested or better while seven said they were indifferent.

After the lesson eight students commented that they did not enjoy the lesson and did not find it interesting. The students from the Bendigo site seemed to be less interested in the lesson than those from other sites. Two commented that the lesson was very boring with one suggesting that this affected his/her concentration. A student from Sunraysia (Robinvale site) said that it would have been more interesting if there had been no technical problems. Some of the students from Geelong stated that they thought the lesson was very interesting.

Prior Knowledge of the Subject
Only two students commented that they knew a lot about the subject of random sampling before the lesson, seventeen commented that they knew something about the subject while the rest stated that they knew very little about the topic.

Time of the Delivery
There was no concern expressed before the lesson with regard to the length of the delivery of the lesson. After the lesson eleven students commented that the lesson was too long.

The Adequacy of the Technology
Two students commented that the speech was fuzzy at the Geelong site as though the teacher was talking too close to the microphone. Two other students at the Sunraysia site made similar comments. A Sunraysia student commented that he/she does not like television and that this affected his/her concentration span. This particular student thought the picture and the sound were of inadequate quality.

Understanding the Teacher
There was no concern expressed by the students with regard to understanding the teacher's instructions before the lesson. However, after the lesson 25% of the students considered that they they had problems in carrying out the teacher's instructions. The other 75% stated that they were happy with this aspect of the lesson.
Personal Interaction with the Teacher and Receiving Individual Attention
Nineteen students did not feel capable of making a comment before the lesson with regard to the expected personal interaction and individual attention received during the lesson. Twelve students were confident or better in this regard while seven were not confident. After the lesson, twelve students stated that they were comfortable with the personal interaction and attention received in the lesson. However, twelve students commented that they were not happy with the individual attention received and with the personal attention with the teacher, and twelve said that they were indifferent.

One student from Geelong felt that it was difficult to know when to ask questions during the lesson.

Atmosphere during the Lesson
The lesson overall seemed to be fairly relaxed with only six students suggesting that they felt uncomfortable during the lesson while thirty-four stated that they were relaxed or very relaxed.

Interaction in the Lesson
Twelve students commented that discomfort in the lesson restricted interaction. Students generally felt that the interaction in the lesson was normal with twenty-seven students suggesting that the interaction was normal and four students commenting that it was very high. One student commented that the technical barriers limited student/teacher interaction. Two students thought that the teacher could have asked more questions of the students throughout the lesson and paused more frequently for questions to be asked.

Time for the Teacher to Give an Instruction and Make it Understood
Students generally thought that it took a normal amount of time for the teacher to give instructions and make them understood, but six stated that they thought it took less time to achieve this than normal. One student commented that because of technical problems they felt that they were not able to comment on this question.

Assistance from the Teacher
Thirty-eight students felt that the teacher was helpful as normal in this lesson while three considered that she was less helpful than normal.

The Amount Learnt from the Lesson
Twenty-eight students commented that they gained some knowledge from the lesson, while only one student commented that they learnt an enormous amount. Thirteen students considered that they learnt very little from the lesson.

Potential of the Technology
One student volunteered a comment that the technology had a lot of potential.

Presence of Tutors
One student commented that the tutor at his/her site was very helpful.

3.3.6 Questionnaire Responses of the Teacher Delivering the Talkback Television Lesson

Looking forward to the Lesson
The teacher looked forward to delivering the lesson with enthusiasm. After the lesson she was very happy with the delivery of the lesson.

Completing the lesson in the Required Amount of Time
The teacher was confident in completing the lesson in the required amount of time. After the lesson the teacher commented that she was very happy with the lesson from the point of view of completing it in the required time.
Providing Individual Attention and Clear Instructions
The teacher felt fairly confident of providing individual attention and clear instructions to the students in this lesson. She expressed some concerns however, that she would have difficulty in obtaining feedback from the students as she was not going to be able to see their faces. The teacher also expressed concern over her ability to elaborate and clarify points that the students wished to raise.

Likely Success of the Lesson being Interesting and Generating Enthusiasm
Before the lesson the teacher thought that the lesson would be interesting, generate enthusiasm and was optimistic that students would gain some knowledge and skills from the lesson. The teacher commented that the lesson had to be designed to suit the needs of the majority of the students and that it was likely that some of the minority groups' interests in the lesson might not be catered for.

Success of the Lesson
The teacher stated that she was very happy with the delivery of this lesson although she was not prepared to comment on the success of the lesson until a statistical analysis had been completed. The teacher commented that she was aware of technical breakdowns during the lesson and suggested that all equipment should be thoroughly checked before the lesson was conducted in the future. The teacher also felt that the results of the statistical analysis would be biased due to the technical breakdowns.

Atmosphere in the Lesson
The teacher did not feel capable of commenting on the atmosphere at the student sites as she was not able to gain enough feedback of the students' reaction to the lesson. This is a very important observation to make in the use of this technology.

Interaction between the Teacher and the Students
The teacher commented that she considered that teacher/student interaction was extremely important for the success of the lesson. After the lesson she thought that the interaction was normal as for any classroom situation.

3.4 ANALYSIS OF RESULTS

Each hypothesis is considered in respect to the observations made in this experiment.

Hypothesis 1

*There is no significant difference between delivery by conventional teaching methods and alternative modes in terms of the learning achieved by participants.*

The statistical analysis of the post-lesson test results showed that there was no significant difference in the amount learnt by either mode of delivery.

Hypothesis 2

*The quality of the learning experience is directly dependent on the degree to which personal interaction occurs between the teacher and students, and amongst the students themselves, in a way that is provided for in a normal classroom situation.*

The evidence from the experiment showed that:

i) Student feedback was difficult to determine for the teacher using the Talkback Television compared to the conventional lesson as she could not see the students.
ii) The interaction from the students' point of view in the conventional lesson was considered to be good; however in the Talkback Television lesson approximately 25% of students suggested that interaction was not as good as a normal lesson.

iii) The quality of the Talkback Television lesson was adversely affected by the clarity of the sound and the picture which the students received by satellite. A number of students commented on the inadequacy of this aspect of the presentation claiming that it made concentrating on the lesson difficult.

iv) Technological breakdowns adversely affected the quality of the Talkback Television lesson at two sites due to the malfunction of a demodulator at the Robinvale site and the DUCT at the main campus of the Sunraysia College of TAFE. This made interaction between the teacher and the student difficult if not impossible.

v) The teaching style of the teacher was good in both lessons.

vi) The atmosphere in the classroom was generally relaxed in both lessons and, therefore, did not seem to affect the quality of the lessons.

vii) A high level of student interaction was observed at the student sites in the Talkback Television lesson. It seems the reason for this is that students are not seen and heard by the teacher. In this sense the teacher does not have significant control over the interaction which is occurring compared to the conventional lesson.

viii) It would be possible to have more effective interaction in another lesson delivered by Talkback Television as students suggested changes that could be made to enhance interaction. A more systematic approach to communication of the sites by better naming of sites is one example of this.

ix) The number of students in the Talkback Television lesson did not affect the students' perception of being able to interact with the teacher. It appears that the main reason for poor interaction was the quality of the picture and sound received at the student sites.

Despite the problems with the interaction that were evident during the experiment it must be remembered that this did not affect the measurable level of learning which occurred in the satellite lesson. However, it must be concluded that the quality of the learning experience was not as high in the Talkback Television lesson as it was in the conventional lesson mainly due to the quality of the picture and sound received at the student sites, the technical breakdowns and the lack of student feedback received at the teacher site. It would seem quite probable that after more experience in the use of Talkback Television teaching and with the introduction of better equipment, the quality of the lesson delivered by Talkback Television could be improved significantly. Already there is an improved audio telephone system available to replace the DUCT system presently in use. This is called a Harvard Elite. It has an audio auto-synchronisation facility for use with satellite transmissions which would have overcome some of the sound problems experienced in this lesson. The teacher's teaching style could also be improved to encourage and improve interaction when using Talkback Television technology through staff development and further experience. More student experience in the use of the technology would also enable students to participate in a lesson using this technology more effectively so that the quality of the learning experience could be improved significantly by this avenue also. It must not be forgotten that there is a higher level of student interaction at the student sites which effectively increases the quality of the learning experience. This factor could be used to greater advantage in the future.
In summary it appears that most of the negative points raised concerning the quality of delivery could be overcome given appropriate experience and training.

**Hypothesis 3**

*Technology should be seen as a supplement to conventional teaching methods, not as a substitute.*

The results of this experiment indicate that the Talkback Television teaching mode could substitute for the conventional teaching mode as there was no significant difference in the amount learnt by either the conventional or the Talkback Television teaching modes. This would particularly be the case if the problems of quality of the learning experience could be improved as indicated in the discussion of Hypothesis 2.

**Hypothesis 4**

*The effectiveness of the technology is dependent on the degree to which the participants and the teacher, particularly, feel comfortable using the technology and are skilled in operating it.*

From the questionnaire responses of the participants it is possible to determine that the effectiveness of technology is not dependent on user comfort and how skilled they are in operating it. Generally, participants in the Talkback Television lesson said that they were comfortable during the lesson with only six out of forty participants expressing concern about not feeling comfortable.

From the perspective of the teacher on the other hand there is definitely a need for user comfort and the development of skills to use Talkback Television technology. The teacher spent quite a lot of time rehearsing and learning how to use the technology and needed an educational technologist to assist in the delivery of the lesson by operating equipment in the studio. The lesson would not have been as successful if the teacher had not rehearsed the lesson. With more experience and training in the use of the technology and with more experience in preparing classes for this mode of technology the teacher would be able to reduce the time taken to produce a successful lesson.

**Hypothesis 5**

*The usefulness of technology in teaching depends on the nature of the lesson being taught.*

The lesson on statistics was suited to the Talkback Television mode. There were no comments registered to suggest that this lesson was not suitable. In conclusion, however, it is not possible to suggest that the usefulness of the technology depends on the nature of the lesson being taught as it would require many more trials to establish this.

**Hypothesis 6**

*Delivery of training by alternative modes of delivery is not cost-effective in terms of cost per head of the recipients.*

The analysis of the cost-effectiveness is presented in Appendix B. The results are summarised in Table 3.1.
TABLE 3.1: SUMMARY OF COST-EFFECTIVENESS ANALYSIS

<table>
<thead>
<tr>
<th>COST ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONVENTIONAL MODE</td>
</tr>
<tr>
<td>(a) Equipment establishment cost</td>
</tr>
<tr>
<td>(b) Preparation cost</td>
</tr>
<tr>
<td>(c) Delivery cost per hour</td>
</tr>
<tr>
<td>(d) Opportunity cost</td>
</tr>
<tr>
<td>(e) No. of student contact hours</td>
</tr>
<tr>
<td>(f) Cost of student contact hour</td>
</tr>
<tr>
<td>(g) Cost of student contact hour except (a) and (b) but including (c) and (d)</td>
</tr>
<tr>
<td>(h) Contact hour except (a) but including (b) + (c) + (d)</td>
</tr>
</tbody>
</table>

(Refer to Appendix B for calculations.)

Note 1: Equipment establishment cost only includes the cost of equipment not common to both modes of delivery. It does not include therefore the cost of buildings, infrastructure or commonly available audio-visual equipment such as overhead projectors and white boards, etc.

Note 2: Opportunity cost represents the cost of a teacher teaching by conventional mode by actually travelling to the six sites rather than teaching at the sites simultaneously by Talkback Television. In this case the costs incurred in travelling from Mildura to the six sites listed below is calculated and presented in Table 3.1 (for a further detailed presentation see Appendix B). Sites where the lesson was conducted to calculate the opportunity cost are: Bendigo, Geelong, Robinvale, Werrimull, Walpeup and Sea Lake.

It can be seen from Table 3.1 that there is a high establishment and preparation cost for Talkback Television teaching compared to conventional teaching. It appears that the establishment cost of Talkback Television technology will be soon significantly reduced as the price of a Codec, for example, is predicted to drop to between $4000 and $7000 from approximately $70,000 within the next year or so. However, the real strength of Talkback Television teaching is the ability to teach to many sites at the same time and not just a single site as in conventional teaching. The opportunity cost of $1810 of teaching what is likely to be taught by satellite by conventional mode instead demonstrates that Talkback Television teaching can be used to provide an economical alternative to the conventional mode of teaching particularly when there are a number of sites which may be taught simultaneously which are spread over a large area. If only the opportunity and the delivery costs are considered the delivery cost of Talkback Television is very inexpensive in this analysis. It could be assumed that once teaching staff are experienced in the preparation and teaching of lessons using satellite technology the preparation cost of Talkback Television lessons would be reduced to the level of preparing for a conventional lesson. As the network of optical fibres and ISDN...
lines is increased Talkback Television can be conducted with widely dispersed groups for a much lower cost than through satellite transmission.

In conclusion, this analysis has shown that Talkback Television teaching can be economical if there are enough classes with enough students far enough apart being taught simultaneously, particularly if terrestrial links are used. The opportunity cost of teaching by conventional mode as opposed to Talkback Television needs to be calculated before a decision may be made.

3.5 CONCLUSIONS

1. There is no significant difference between the teaching modes in the amount learnt.

2. The quality of learning is generally better in a conventional lesson compared to a Talkback Television lesson because of the more effective teacher/student interaction although there seems to be greater student-to-student interaction in the Talkback Television lesson. Student feedback is significantly reduced in the Talkback Television teaching mode. With improved technology the quality of the teaching by Talkback Television could easily be improved with better audio and visual interaction.

3. Talkback Television teaching can be used as a substitute for conventional teaching.

4. Talkback Television is a comfortable means of teaching for both the student and the teacher.

5. There were no comments registered to suggest that Talkback Television was not suitable for the lesson taught. More trials are required to conclude whether the success of talkback television is dependent on the lesson being taught.

6. Talkback Television teaching could be cost-effective once established and if the lesson is taught to enough sites over a large enough distance. The costs of establishment and preparation of the lesson to be taught are relatively high compared to that of conventional teaching, but these should be significantly reduced within a year or so. It therefore lends itself to State-wide or regional development. Expertise from distant places such as interstate or even from overseas could economically be brought to Victoria or a region of the State which otherwise would not have been possible at all.

7. Staff development and teaching experience is needed to improve the efficiency of delivering lessons by Talkback Television, to reduce the preparation costs of lessons and to improve the quality of teaching by this mode.

8. Technical breakdowns are a concern in the use of Talkback Television teaching. Precautions need to be taken to minimise the incidence of technical disruption.
4. EXPERIMENT NO. 3 - AUDIOGRAPHIC CONFERENCING MODE

4.1 AIMS AND OBJECTIVES

4.1.1 Aims

i) To evaluate the effectiveness of the Audiographic Conferencing delivery mode as a means of teaching a theoretical lesson.

ii) To compare the effectiveness of teaching a program by Audiographic Conferencing mode compared to conventional teaching.

iii) To test the hypotheses stated for the whole project.

iv) To determine the cost-effectiveness of using the Audiographic Conferencing mode by comparing the costs associated with its use with those of the conventional mode of delivery.

4.1.2 Objectives

In order to achieve the aims the objectives of this study were as follows:

i) To develop a lesson which does not require a significant amount of prior knowledge.

ii) To develop a lesson which is suited to the use of Audiographic Conferencing and the conventional mode of delivery.

iii) To develop an interesting lesson to be taught in this experiment.

iv) To deliver a lesson which provides the opportunity for a measurable improvement in the knowledge and skills of the students.

v) To provide the teacher with an opportunity to become familiar with the use of the audiographic technology and to become comfortable teaching by this mode of delivery.

4.2 METHODOLOGY - EXPERIMENTAL DESIGN

It was established in consultation with experienced users of audiographic technology that audiographic conferencing delivery of lessons will usually be used to link three or four students at three to four remote sites simultaneously. It was decided to teach to three sites for the purposes of this experiment. The whole experiment was conducted at the Sunraysia College of TAFE, at the main campus. This was done so that control of the many variables in the experiment could be maintained. For example, it meant that the random placement of students between treatments and at the different sites could be easily achieved.

4.2.1 Treatments

TREATMENT 1 - CONVENTIONAL CLASS

This lesson was taught to students in a normal classroom setting in a conventional situation at the Sunraysia College of TAFE.
TREATMENT 2 - AUDIOGRAPHIC CONFERENCING CLASS

This lesson was taught from the office of the Curriculum Research and Development Unit to three other sites situated throughout the Sunraysia College of TAFE.

The sites chosen for this experiment were:

<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference Room</td>
<td>Amenity Horticulture Wing</td>
<td>College Audio Visual Studio</td>
</tr>
</tbody>
</table>

4.2.2 Subject Taught in the Experiment

The aim of the lesson taught in this experiment was to teach summarising skills. The lesson was called 'Australia a Republic?' (see Lesson Plan in Appendix C). It was decided to teach a communications lesson on the basis that it would be relevant to many of the students in the TAFE system and that it was also suitable for the type of technology that was being used in the experiment. This topic was also selected on the basis that it did not require much prior knowledge about the subject and that it was likely to be of interest to the students.

4.2.3 Equipment Used in the Experiment

As much as possible the same audio-visual equipment was used in each lesson so that the presentation of each lesson was comparable.

(i) Conventional lesson:

The equipment used was:

- Over-head projector
- Tape recorder

(ii) Audiographic Conferencing lesson:

The equipment used at the teacher site was:

- 1 Macintosh Plus computer
- 1 DUCT audio phone system
- 1 tape recorder
- 1 copy of Electronic Classroom - Version 'Radish'
- 2 NEC modems (1500 baud)

The equipment used at each receival site (3) was:

- 1 Macintosh Plus computer
- 1 DUCT audio phone system
- 1 copy of Electronic Classroom - Version 'Radish'
- 1 NEC Modem (1500 baud) at two sites but two at the Studio Room.

A layout of the equipment can be seen in Appendix C.

4.2.4 Staff Used in the Experiment

(i) Conventional lesson:

The teacher conducted this lesson with some help from another teacher who performed the role of an assistant.
(ii) Audiographic Conferencing lesson:

The teacher required assistance from a tutor at each receiveal site to enable the lesson to be conducted as no students in the lesson had had any previous experience in the use of the technology.

4.2.5 Students Involved in the Experiment

The students who participated in the experiment and their course of study are listed below:

(i) Conventional lesson:

<table>
<thead>
<tr>
<th>Type of student</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return to Learning</td>
<td>7</td>
</tr>
<tr>
<td>Pre-Victorian Certificate of Education</td>
<td>5</td>
</tr>
<tr>
<td>Associate Diploma of Applied Science</td>
<td>4</td>
</tr>
</tbody>
</table>

TOTAL 16

(ii) Audiographic Conferencing lesson:

<table>
<thead>
<tr>
<th>Type of student</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return to Learning</td>
<td>6</td>
</tr>
<tr>
<td>Pre-Victorian Certificate of Education</td>
<td>3</td>
</tr>
<tr>
<td>Associate Diploma of Applied Science</td>
<td>4</td>
</tr>
<tr>
<td>Certificate of Reception Practices</td>
<td>1</td>
</tr>
</tbody>
</table>

TOTAL 14

As for all the experiments a gender balance was maintained as much as possible in the experiment by ensuring that overall there were equal numbers of males and females in the classes selected.

4.2.6 Method of Evaluation

The experiment was evaluated quantitatively and qualitatively in the same way that the Talkback Television experiment was evaluated. Because a quantitative analysis was performed it meant it was necessary to select the students at random between treatments and sites.

Conclusions made about the hypotheses are based on the following analysis:

4.2.6.1 Qualitative Analysis

Questionnaires were completed immediately before and after the lesson to provide data for this analysis by all participants (see Appendix C).

4.2.6.2 Quantitative Analysis

A test was completed immediately after the lesson to provide data for a quantitative analysis of how much students had learnt from the different teaching methods (see Appendix C).
A matched paired-difference of means test was used to analyse the post-test results of the two different treatments. This meant that students had to be matched into pairs of equal learning ability. This was achieved by giving each participant aptitude tests.

The aptitude tests used were a Differential Aptitude Test produced by the Australian Council of Educational Research, Melbourne. As the lesson on summarising required verbal skills only, the Verbal Reasoning Test was given to the students.

The tests were completed according to the specified standard conditions. Students of the same sex and approximately the same age were then paired with the closest matching scores on the verbal test.

4.2.6.3 Cost-Benefit Analysis

The equipment establishment, preparation and operating costs are used to determine the cost-effectiveness of the different teaching modes (see Appendix C). The operating costs are calculated on an hourly basis so that a fair comparison could be made between the different teaching modes.

4.3 RESULTS

The main findings of the experiment are outlined below. The questionnaire responses and the post-test results - the source of these findings - are contained in Appendix C.

4.3.1 Result of the Statistical Analysis

The matched paired-difference test showed that there was no significant difference in the amount learnt in the conventional lesson compared to what was learnt in the Audio-graphic Conferencing lesson (see Appendix C).

4.3.2 Results of Discussion with Tutors after the Experiment

Personal Interaction
Discussions with the tutors and all staff involved in the lessons and from each site was held after the experiment was completed. They were asked to raise any issues of concern and positive issues which they experienced from participating in the experiment and from observing the participants of the experiment. The results of these discussions are presented below.

Technology
The main emphasis of their comments related to the technology of the Audiographic Conferencing lesson. The main points mentioned were:

Visual Interaction
There were no problems identified with the visual interaction except that four to five people viewing the one monitor made it difficult at times for all the students to see easily.

Audio Interaction
There were no problems experienced with regard to the audio interaction between sites during the Audiographic Conferencing lesson; the quality of the sound was excellent.
Keyboard Interaction
There were slight difficulties experienced with the students using the keyboard as the students had to share the one keyboard during the Audiographic Conferencing lesson. This may have hindered some students from coming forward and writing on the screen voluntarily. This was overcome by the teacher asking individual students to respond by using the keyboard. The teacher kept a record of interaction of individual students as the lesson progressed so that participation could be encouraged equitably (see Appendix C).

Malfunctioning Equipment
There was no malfunctioning equipment during the lesson.

Student Interaction
Considerable student interaction was observed at each student site of the experiment while the lesson proceeded. Students felt free to talk amongst themselves, particularly when the teacher was trying to gain feedback from the students.

Student Interest
It must be remembered that this was a separate event to the students' normal classes and therefore it was difficult to ensure that all the students had an interest in the experiment. However, they did appear to be interested in both the conventional and the Audiographic lesson. A problem that was identified was that students really didn't understand what was going to occur in the lesson.

Rehearsal
It was considered that a rehearsal for the teacher before the Audiographic Conferencing lesson was essential for refining and improving the lesson, but unfortunately, due to time and difficulties setting up the equipment for this experiment, it was not possible to rehearse any part of the lesson. The students involved in the Audiographic lesson were shown the equipment before the lesson to introduce them to the technology and its potential use. The teacher had had some staff development and experience with the computer and operating the software before the lesson.

Teaching Style
It was generally agreed that the teacher had done an excellent job in delivering this lesson with the audiographic technology in an appropriate style for the technology and that class interaction was encouraged. The conventional lesson was also conducted very well with a high level of interaction being encouraged.

Lack of Experience with the Technology
Considering the lack of experience in teaching by this mode, the lesson went extremely well. It was suggested, though, that the lesson could have been even better if the teacher and the students had had some prior experience in the use of the technology. The teacher believed that, with greater experience of the technology, it would not take as long to produce similar lessons in the future. It is likely that staff development would significantly increase the efficiency of delivery by this mode of teaching, and training of staff in the use of the Audiographic Conferencing teaching mode is considered essential if this technology is to be used on a regular basis.

Potential of the Technology
Students and teachers commented that there could be considerable effective use of this teaching mode particularly because of its low establishment and delivery costs.
4.3.3 Questionnaire Responses of the Students Involved in the Conventional Lesson

The results of the questionnaire responses are presented in Appendix C.

Interest in the Lesson
Of the sixteen students in the lesson three stated that they were indifferent about being interested in the lesson before its delivery, while thirteen commented that they were moderately interested or interested in the lesson.

After the lesson two students commented that they thought the lesson was average in terms of interest and enjoyment, five commented that it was fairly interesting and enjoyable, five found it very interesting and two students thought it was extremely interesting and enjoyable.

Prior Knowledge of the Subject
Three students claimed that they knew something about summarising techniques before the lesson, nine said that they knew a small amount about it and four suggested that they knew nothing of significance about the topic.

Length of the Delivery
There was no concern expressed before the lesson with regard to its proposed length. After the lesson two students stated that they were uneasy about the length of the lesson, one could not decide and eleven commented that they were fairly comfortable or very comfortable with the length of the lesson and felt that they were able to concentrate during that time.

Understanding the Teacher
One student expressed concern about understanding the teacher, five students said they were indifferent and ten stated that they were confident of understanding the teacher before the lesson. After the lesson all the students commented that this was not a problem.

Personal Interaction with the Teacher and Receiving Individual Attention
Three students were not confident about interacting with the teacher and receiving adequate attention. After the lesson one student stated that he was not comfortable with the personal interaction of the teacher and receiving individual attention, another student could not decide one way or the other, while twelve students felt comfortable with the situation.

Interaction in the Lesson
Six students commented that the atmosphere in the lesson was normal while eight stated that they felt very relaxed during the lesson. As a result seven students commented that the level of interaction was normal and the other seven that the level of interaction in the lesson was very high.

Time for the Teacher to Give an Instruction and Make It Understood
All the students thought that it took a normal amount of time for the teacher to give instructions and make them understood except for one student who thought it took more time than normal.

Assistance from the Teacher
Two students felt that the teacher was as helpful as normal in this lesson while twelve considered that he was more helpful than normal.
The Amount Learnt from the Lesson
Generally the students felt that they had learnt something from this lesson. However, two of the students commented that they learnt very little from the lesson while seven students considered that they gained some knowledge, skills and understanding from the lesson. Five students commented that they learnt a substantial amount from the lesson.

4.3.4 Questionnaire Responses of the Teacher Delivering the Conventional Lesson

Looking Forward to the Lesson
The teacher looked forward to delivering the lesson but with some reservations.

Completing the Lesson in the Required Amount of Time
The teacher was fairly confident of completing the lesson in the required amount of time. After the lesson the teacher was fairly satisfied with completing the lesson in the required amount of time.

Providing Individual Attention and Clear Instructions
The teacher felt fairly confident before the lesson to provide individual attention and clear instructions to the students. After the lesson the teacher commented that he was fairly satisfied with providing students with individual attention and clear instructions.

Likely Success of the Lesson
The teacher expected that the lesson would be successful.

Success of the Lesson
The teacher stated that he thought that the students gained an adequate amount of knowledge, skills and understanding from the lesson.

Atmosphere in the Lesson
The atmosphere was perceived as being very comfortable.

Interaction Between the Teacher and the Students
The teacher commented that he considered that teacher/student interaction was the same as interaction in a normal classroom situation.

Special Comment
A blown globe in the overhead projector unsettled the start of the lesson. Also some students arrived late for the start of the lesson so that questionnaires had to be filled in causing disruption to the start of the lesson. It would appear though that this did not affect the success of the lesson.

4.3.5 Questionnaire Responses of the Students Involved in the Audiographic Conferencing Lesson

Interest in the Lesson
Of the fourteen students participating in the lesson only one stated that he/she was indifferent about the lesson while one student said that he/she was moderately interested, six commented that they were interested and six that they were very interested in the lesson. So students started this lesson with a positive attitude.

The lesson was very successful from the point of view of interest and enjoyment as after the lesson two students commented that they were fairly interested in the lesson and the rest of the students commented that they were either very interested (three) and enjoyed the lesson or that they were extremely interested (ten) and enjoyed the lesson.
Prior Knowledge of the Subject
No students commented that they knew a lot about the subject of summarising before the lesson, five commented that they knew something about the subject while the rest stated that they knew very little about the topic. Prior knowledge therefore should not have played a significant role in this experiment.

Time of the Delivery
There was no concern expressed before or after the lesson with regard to the length of the delivery of the lesson. This would also not have influenced the experimental results.

The Adequacy of the Technology
There were no comments made in reference to the adequacy of the technology other than from two students who commented that it was easy for other students to withdraw into the background and not be noticed. One suggested that this could be overcome by the use of microphones on the students' lapel so that they could talk more easily than through a DUCT microphone. The other problem identified was that some of the students were hesitant about using the keyboard to interact with the teacher. This may have been because all the students in group had to share the one keyboard. In general, however, the technology seemed to be perceived as adequate by the students.

Understanding the Teacher
There was no concern expressed by the students with regard to understanding the teacher's instructions before the lesson. Three of the students commented that they were indifferent about this whereas the rest of the students commented that they were confident of understanding the teacher.

After the lesson two of the students were indifferent about this issue and the rest of the students were confident about it. This suggests that the students were able to understand the teacher just as well by this mode of teaching as the conventional mode.

Personal Interaction with the Teacher and Receiving Individual Attention
Only one student did not feel confident about interacting with the teacher and receiving individual attention before the lesson, four were indifferent about it and the remaining nine felt confident about it.

After the lesson four students were indifferent about whether they felt comfortable with interacting with the teacher while the other eleven students felt fairly comfortable (six) or very comfortable (five) about interacting with the teacher and receiving individual attention. None indicated that they were not confident on this issue.

Atmosphere during the Lesson
The lesson was very relaxed with only one student commenting that he/she was uncomfortable during the lesson, four stated they were as comfortable as in a normal class and eight commented that they felt very relaxed during the lesson. One student was obviously nervous about this teaching mode at the start of the lesson but commented that with experience he/she would gain confidence using this technology. Another student commented that this was an exhilarating way to learn.

Interaction in the Lesson
By answering the set questions only one student claimed that the atmosphere in the class affected the level of interaction while eight claimed that this was normal and six claimed that the level of interaction was high. One student commented that 'this was a great way to learn' and felt it was like one-to-one interaction with the teacher. However, in response to being asked to make additional comments, three students felt that some of the other students were too reserved to participate in this lesson. There seems to be some evidence to suggest that interaction is limited by this teaching mode.
from the students' perspective although in general it does not appear to be so. Two participants considered that some other students dominated the discussion which is supported by the interaction data presented in Appendix C. This data supports all the comments made above in reference to interaction during the lesson.

Time for the Teacher to Give an Instruction and Make It Understood
Students generally thought that it took a normal amount of time for the teacher to give students instructions and make them understood using this technology. One student thought it took less time than normal but two students considered it took more time than normal.

Assistance from the Teacher
Eight students felt that the teacher was very helpful during this lesson, six thought that he was helpful and one student thought he was as helpful as in a normal lesson. In summary, this technology seemed to allow the teacher to assist students very well.

The Amount Learnt from the Lesson
Five students commented that they gained some knowledge from this lesson, while ten students commented that they learnt a substantial amount of knowledge, skills and understanding from this lesson. The students therefore perceived this lesson to be a success.

Potential of the Technology
Five students commented without prompting by a question that this was a very good way to learn which would seem to indicate that this mode of teaching has significant potential.

4.3.6 Questionnaire Responses of the Teacher Delivering the Audiographic-Conferencing Lesson

Looking Forward to the Lesson
The teacher looked forward to delivering the lesson with some reservations. After the lesson though the teacher was very happy with its delivery.

Completing the Lesson in the Required Amount of Time
The teacher was confident of completing the lesson in the required amount of time. After the lesson the teacher commented that he was fairly satisfied with the lesson from this point of view.

Providing Individual Attention and Clear Instructions
The teacher felt confident of providing individual attention and clear instructions to the students in this lesson. After the lesson the teacher felt fairly satisfied that he was able to provide individual attention and clear instructions to the students.

Likely Success of the Lesson being Interesting and Generating Enthusiasm
The teacher felt that the lesson would be a success. He thought it would be interesting, generate enthusiasm and that students would learn some knowledge and skills from the lesson. The teacher's main concern was that the technology might break down and that there was no time to rehearse the lesson.

Success of the Lesson
The teacher stated that he was very happy with the delivery of this lesson commenting that he thought the participants had learnt a satisfactory amount of knowledge, skills and understanding from the lesson.

Atmosphere in the Lesson
The teacher did not feel capable of commenting on the atmosphere at the student sites as he was not able to gain enough feedback of the students' reactions to the lesson. This is a very important observation to make in the use of this technology.
Interaction between the Teacher and the Students
The teacher commented that there was normal if not more than normal interaction during the lesson suggesting that because of the technology there was greater effort put into balancing the interaction between the teacher and the students. He believed that experience would have improved the delivery in terms of timing the interaction with the students, particularly with respect to the time to talk and to remain silent to allow students to work.

4.4 ANALYSIS OF RESULTS

Each hypothesis is considered in respect to the observations made in this experiment.

Hypothesis 1
There is no significant difference between delivery by conventional teaching methods and alternative modes in terms of the learning achieved by participants.

The statistical analysis of the post-lesson test results showed that there was no significant difference in the amount learnt by the classes taught by either mode of delivery.

Hypothesis 2
The quality of the learning experience is directly dependent on the degree to which personal interaction occurs between the teacher and students, and amongst the students themselves, in a way that is provided for in a normal classroom situation.

The evidence from the experiment showed that the quality of the learning experience was very good in both of these lessons:

i) Students had no trouble understanding instructions given in the Audiographic Conferencing lesson in the same amount of time that would be devoted to instructions in a conventional class.

ii) Students felt that they were receiving individual attention and were interacting successfully with the teacher in the Audiographic Conferencing lesson.

iii) Student feedback was difficult to determine for the teacher using the audiographic technology compared to the conventional lesson as he could not see the students.

iv) The interaction with the teacher from the students' point of view in the conventional lesson and the Audiographic lesson was considered to be normal if not high in both cases.

v) The teaching style of the teacher was considered to be good in both lessons from questionnaire responses.

vi) The atmosphere in the classroom was generally relaxed in both lessons and, therefore, it did not seem to affect the quality of the lessons. In fact, in the Audiographic Conferencing lesson it appears that the learning environment was actually enhanced by the technology as the students were excited about using it.

vii) A high level of student-to-student interaction was observed at the student sites in the Audiographic Conferencing lesson. It seems the reason for this is that students are not seen and heard by the teacher. In this sense the teacher does not have significant control over the interaction which is occurring compared to the conventional lesson.

viii) It seemed that a high level of individual assistance can be provided in the Audiographic Conferencing lesson and in the conventional lesson.
It appears that the Audiographic Conferencing lesson was at least of equal quality to the conventional lesson and was possibly of higher quality because of the higher level of student-to-student interaction which occurred in the lesson. The interaction between the students and the teacher on the other hand did not appear to be as good in the Audiographic Conferencing lesson as in the conventional lesson, as the teacher had difficulty in gaining feedback from the students. However, it was not a significant enough problem in this lesson to affect the amount learnt in the Audiographic Conferencing lesson compared to the conventional lesson.

In conclusion, it appears that the quality of the learning experience is dependent on the level of interaction between the teacher and the students and between the students themselves. In this experiment the quality of the learning through the Audiographic Conferencing lesson was equal to that achieved by conventional teaching except for the lack of student feedback to the teacher, but, as the teacher remarked, this deficiency could well be overcome with more experience in using this teaching mode. The development of additional teaching strategies not used in this experiment could be expected. For example, the facsimile machine could have been used to obtain more student feedback.

One of the advantages of the Audiographic Conferencing mode of teaching is that students can be forced to interact on an individual basis. The teacher can ask the student to respond to a question on the computer, assign control temporarily to the student and wait for a response.

**Hypothesis 3**

*Technology should be seen as a supplement to conventional teaching methods, not as a substitute.*

The results of this experiment indicate that the Audiographic Conferencing teaching mode could substitute for the conventional teaching mode for theoretical lessons as there was no significant difference in the amount learnt by either mode.

**Hypothesis 4**

*The effectiveness of the technology is dependent on the degree to which the participants and the teacher, particularly, feel comfortable using the technology and are skilled in operating it.*

The students felt comfortable using the audiographic conferencing technology as indicated by the replies to the questionnaires completed after the lesson. They were not asked to perform very extensive or complicated responses by using the computer during the experiment so they were not put in an uncomfortable position. Also they all had a tutor present with their group who was able to assist if they were having difficulty using the computer. It is evident from the experiment that this mode of teaching does rely on having people who are comfortable with the technology. They must be able to handle the basic functions of a computer to be able to interact with the teacher.

The teacher indicated that he would have preferred to have had a rehearsal before the lesson in the experiment because initially he felt uncomfortable about the technology. The teacher had completed some staff development before this trial and knew the basic operations of the computer in order to teach the lesson. He thought that he could have made substantial improvements to the lesson, particularly with respect to interaction with the class had he had a rehearsal before this lesson. In summary, the effectiveness of the technology is dependent on the students and the teacher being comfortable with the audiographic conferencing equipment.
Hypothesis 5

The usefulness of technology in teaching depends on the nature of the lesson being taught.

The lesson on summarising was suited to the audiographic conferencing mode. There was not a comment registered to suggest that this lesson was not suitable. This mode of teaching is suited to situations where a high level of interaction is required.

It cannot be concluded that the usefulness of the technology depends on the nature of the lesson being taught as it would require many more trials to establish this.

Hypothesis 6

Delivery of training by alternative modes of delivery is not cost-effective in terms of cost per head of the recipients.

The analysis of the cost-effectiveness is presented in Appendix C. The results are summarised in Table 4.1

**TABLE 4.1: SUMMARY OF COST-EFFECTIVENESS ANALYSIS**

<table>
<thead>
<tr>
<th>COST ($)</th>
<th>CONVENTIONAL MODE</th>
<th>AUDIOGRAPHIC CONFERENCING MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Equipment establishment cost</td>
<td>Note 1</td>
<td>19,184 (3 sites)</td>
</tr>
<tr>
<td>(b) Preparation cost</td>
<td>420</td>
<td>575</td>
</tr>
<tr>
<td>(c) Delivery cost</td>
<td>47</td>
<td>168.50</td>
</tr>
<tr>
<td>(d) Opportunity cost</td>
<td>340 (Note 2)</td>
<td></td>
</tr>
<tr>
<td>(e) No. of student contact hours</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>(f) Cost of student contact hour</td>
<td>(47 + 15 = 3.13)</td>
<td>(168.50 + 15 = 11.23)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>(g) Cost of student contact hour except (a) and (b) but including (c) and (d)</td>
<td>(387 + 15 = 25.8)</td>
<td>(168.50 + 15 = 11.23)</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>11</td>
</tr>
<tr>
<td>(h) Cost of student contact hour except (a) but including (b) + (c) + (d)</td>
<td>(807 + 15 = 53.8)</td>
<td>(743.50 + 15 = 49.57)</td>
</tr>
<tr>
<td></td>
<td>54</td>
<td>50</td>
</tr>
</tbody>
</table>

(Refer to Appendix C for calculations.)

Note 1: *Equipment establishment cost* only includes the cost of equipment not common to both modes of delivery. It does not include therefore the cost of buildings, infrastructure or commonly available audio-visual equipment such as overhead projectors and whiteboards, etc.

Note 2: *Opportunity cost* represents the cost of a teacher teaching by classroom-based mode by actually travelling to the three sites, rather than teaching at the sites simultaneously by Audiographic Conferencing technology. In this case the costs incurred in travelling from Mildura to the three sites listed below is calculated and presented in
Table 4.1 (for a further detailed presentation see Appendix C). Sites where the lesson is conducted to calculate the opportunity cost were: Robinvale, Werrimull and Walpeup.

It can be seen from Table 4.1 that there is a substantial establishment and preparation cost for Audiographic Conferencing teaching compared to conventional teaching. The opportunity cost of $340 of teaching what is likely to be taught by Audiographic Conferencing mode by conventional mode instead demonstrates that Audiographic Conferencing mode of teaching can be used to provide a very economical alternative to the conventional mode of teaching as the operating cost is only half of the opportunity cost. If more than three sites were taught simultaneously over a larger distance, the advantage would be even greater. The other significant point which is made from this analysis is that the preparation costs are also very similar for the conventional mode and the Audiographic Conferencing mode. This contrasts with the analysis for the other modes examined in this report.

In conclusion, this analysis has shown that Audiographic Conferencing teaching can be an economical method of teaching compared to the conventional teaching method from the point of view of relatively low establishment costs, equivalent preparation costs and low delivery costs.

4.5 CONCLUSIONS

1. There is no significant difference in the amount learnt between the teaching modes.

2. The quality of learning is generally about the same in a conventional lesson compared to an Audiographic Conferencing lesson except for a lower amount of student feedback that a teacher obtains from the students in the Audiographic Conferencing lesson. There seems to be greater inter-student interaction in the Audiographic Conferencing lesson than in a conventional lesson.

3. Audiographic Conferencing teaching can be used as a substitute for, but preferably should be used as one component of a broader teaching strategy.

4. Audiographic Conferencing teaching provides a comfortable means of teaching for both the student and the teacher after there has been a relatively brief introduction (staff development and training) to the use of this technology for both the teacher and the students.

5. The lesson on summarising was suitable for delivery by Audiographic Conferencing technology where it demonstrated that a high level of interaction between the teacher and the student is possible. Before concluding the success of Audiographic Conferencing teaching is dependent on the nature of the lesson being taught, more trials would be needed.

6. Audiographic Conferencing is a very cost-effective method of teaching compared to teaching by the conventional method. The establishment cost is relatively low for Audiographic Conferencing teaching compared to teaching by the other telematic modes, the preparation cost is much the same as for conventional teaching and the delivery cost is relatively low for Audiographic Conferencing teaching compared to conventional teaching.

7. Once Audiographic Conferencing equipment is set up and operating it is relatively free of technical problems. (However, it must be stressed that modems of the same kind should be used so that they will 'talk' to each other.)
DEFINITIONS OF MODES

Conventional Mode of Teaching
The conventional mode of teaching refers to a classroom-based mode of teaching which may include the use of audio-visual aids such as an overhead projector, whiteboard, blackboard, video equipment, etc.

Videoconferencing Mode of Teaching
This system enables both the teacher and the students to see and hear each other through the use of television monitors. Cameras are used to transmit the lesson from both the student and the teacher sites. This information is sent by satellite or encoded into digital form to be sent by optical fibre link or other terrestrial means and it is decoded at the other end to provide the picture and sound.

Talkback Television Mode of Teaching
Talkback Television enables students to see and hear the teacher through a television monitor and the students communicate back to the teacher by using a teleconference link-up. This means that the students can see and hear the teacher but the teacher can only hear the students. The lesson is transmitted by satellite that is broadcast (so that the students are able to receive it at many locations simultaneously), or narrowcast via optical fibre or other terrestrial link. The trial in this experiment was via satellite. Classes at remote locations typically use a telephone audio system with a number of microphones to talk back to the teacher.

Audiographic Conferencing Mode of Teaching
Audiographic Conferencing enables students to be taught at remote sites by the use of personal computers, facsimile machines (fax) and a teleconference link-up. It requires the use of two dedicated phone lines to both the student and the teacher sites. The teacher is able to talk to students by the teleconference link-up and send messages by computer. The computers are networked by the use of modems so that all students see the same message simultaneously on their screen. Hard copies of information are sent by fax.