ABSTRACT
                Designed to promote the interchange of information
and services among the people of the region, the Eastern Caribbean
Center Telecommunications Project Network (ECCTP) utilizes a network
of both audio and computer-linked nodes connected by telephone lines
to deliver instruction to remote sites. This network has been used by
ECCTP to conduct experiments in long-distance teaching from the
spring of 1986 to the present. Although most of these experimental
classes have consisted of computer oriented content, such as
elementary BASIC programming, classes have also been taught in
biology, English, and remedial mathematics. Classes are taught
simultaneously at a home site and at a distant site, e.g., a class
being presented by an instructor in a classroom on the St. Croix
campus of the University of the Virgin Islands is transmitted to a
classroom on the St. Thomas campus, and students at both sites
participate in the class. A series of four pilot tests encountered
various technical problems and identified a need for more careful
pre-instructional planning than traditional classroom teaching. Areas
that must be considered in planning for the actual provision of
instruction include the relationship of teaching to the instructional
objectives, the motivation of students, the monitoring of student
learning, managing classroom activities, modeling, and technical
capabilities. After the class has been taught, post-instruction
evaluation must also be addressed. (EW)

Pedagogical Considerations for the
Eastern Caribbean Center Telecommunications Project

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PEDAGOGICAL CONSIDERATIONS FOR THE
EASTERN CARIBBEAN CENTER TELECOMMUNICATIONS PROJECT
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Educational telecommunication networks are changing the
way people learn and the opportunities to learn for people
throughout the world. The Caribbean region has not yet
entered the information age to the extent that any
appreciable number of people have been affected. The
University of the West Indies Distance Teaching Experiment
(UWIDITE) is the most notable example of the beginning
efforts made in distance teaching in the Caribbean, but more
must be done.

The potential social, economic, and educational
benefits for the Caribbean from using telecommunications are
urlimited. The technology is presently available to link
the islands of the West Indies together in an network for
the benefit of all. The Eastern Caribbean Center (ECC), a
program funded by the Department of Interior to promote the
interchange of information and services among the people of
the Eastern Caribbean, is becoming the most logical
institution for carrying out this important task. The
Eastern Caribbean Center Telecommunications Project (EECTP)
focuses on establishing a cost-effective medium to
facilitate ECC goals and is the first step by the ECC toward
uniting the various islands, countries, and peoples of this
region through telecommunications for their social,
economic, and educational development.

Telecommunications Media

Education may be delivered using telecommunications to
remote sites either through one-way, two-way, or multiple
interaction of the participants. The transmission of this
instruction may be through audio and/or visual media.

Audio transmission is usually accomplished through
telephone, radio, micro-wave, and/or satellite signals.
Telephone lines are usually used for two-way audio
connections. If more than two sites are to be connected,
then some sort of bridging network becomes necessary.
One-way radio broadcasts can reach large audiences at a
relatively small cost, but this approach does not provide
the interaction which play a vital role in effective
teaching.

Visual images can be transmitted by TV broadcast, slow
scan (freeze frame) TV using telephone circuits, or by
computer interpretation of data transmitted by telephone,
radio, or television. Of these mechanisms, only television
broadcast can carry live moving images of people. Slow scan
offers the ability to transmit static images over telephone
circuits, but usually requires approximately 10 to 35

seconds for image transmission and employs relatively expensive equipment. Computers allow production of static and moving images on relatively inexpensive equipment.

Computers can be used live or asynchronously in distant learning. Electronic mail and bulletin boards are excellent and innovative uses for asynchronous instruction and are presently being widely used. Live distant instruction is very rare and usually limited to text. The telewrite system supports transmission of visual images created by a computer or by a video camera, an the use of a graphics tablet for real time pointing or sketching. This approach is an improvement over specialized slow scan equipment, but does not support simultaneous execution of programs at all sites and hence, does not fully exploit the power of the computer.

Eastern Caribbean Telecommunications Project Network

The ECCTP presently utilizes a network consisting of both audio and computer-linked nodes connected by telephone lines. The advantages of using telephone connections are the initial low cost and widespread general availabilty of the equipment and services. The disadvantages of telephones in distance teaching is the high cost of international calls, the necessity of using bridging services if more than two sites are used, the inferior quality of some connections, and the unavailability of lines, especially in the Caribbean regions with limited local distribution systems.

Audio transmissions utilize Darome conference phones. These conference phones use a series of push-to-talk microphones distributed among the conference participants to address the remote sites and a speaker at each site to amplify the incoming voices.

The computer-link consists of Apple IIe or Apple IIgs computers linked through modems to each other by special telecommunications software developed by the ECCTP and displayed on large screen and/or regular monitors at all sites.

The computer linkage supports two modes of operation: transmission of a cursor position controlled by a "mouse" for pointing or sketching, and simultaneous execution of programs by transmission of all keyboard input. The second mode allows the simultaneous display of images which have been pre-stored at all sites or which are simultaneously generated at all sites. A key advantage to this approach is the ability to run a wide range of instructional support software with the only restriction being that programs must use the standard operating system interface for keyboard input. Examples of this mode of operation include use of specialized programs to create static or animated pictorial material. With the increasing availability of low cost

video input systems for microcomputers, future development
of the system will support slow scan transmissions, real
time sketching and pointing, as well as the linked
simultaneous generation of images/text, giving a single,
integrated work station for distant learning which allows
all forms of visual image creation.

The network can be used to deliver instruction in a
variety of formats. A formal course or program might
originate from a particular educational institution and be
accredited by that institution. Less formal cooperative
efforts might be instituted to provide tutoring or workshops
in basic skills or particular technical areas. The network
might be the sole medium of instruction, or might be part of
wider programs involving site visits, broadcast,
correspondence, etc. Reference materials might be
transmitted over the network, mailed as documents or
microfilm, or be made available through video disk
technology. Effort must be made in specification, planning
and design to insure that optimal delivery mediums are
selected for each area of instruction, and that adequate
supporting resources are made available.

ECCTP Experiments

With this network, the ECCTP has conducted experiments
in long-distance teaching from the spring of 1986 to the
present. Although most of these experimental classes
consisted of computer-oriented content, such as elementary
BASIC programming, there were various classes taught in
biology, English, and remedial mathematics. Classes have
been taught from St. Croix to St. Thomas, St. Kitts, and
Anguilla, from Kingston to St. Croix, from San Juan to St.
Croix and St. Thomas, and from St. Thomas to St. Croix.

Initially, there were four one-hour class sessions
using the network offered free to volunteers on the UVI
campuses of St. Thomas and St. Croix. The original plan was
to have a three-way transmission between St. Thomas, St.
Croix and St. Kitts, but because of transmission
difficulties, St. Kitts could not be included.

There were many problems associated with the
transmission of information in the original field tests of
the equipment. There were many difficulties and delays as a
result of transmission problems. The conference telephone
connections were not suitable and often required the
instructor to restate what had been said and to speak
directly into the conference telephone microphone, which
limited the instructors mobility and ability to face the
homesite class. As there was only one microphone for
everyone to use, student input was somewhat hampered. Many
technical problems relating to the software and transmission
of the signal were encountered and required people familiar

with the system to de-bug and reconnect. Much instructional
time was lost because of these problems, but many of them
have been resolved and others are presently being addressed.
In response to the transmission problems, radio is very
seriously being considered as an alternate to the telephone.
Radio is a very elegant alternative to using the telephone.
The ECCTP participants would not need to use an audio bridge
service, would have a modest capital investment that would
overcome problems of telephone connection availability and
quality, and would offer continuous multi-channel support
without additional operating costs.

Coordination between the sites was also a problem in
the beginning. If one site had some problem, both sites had
to wait until it could be resolved. All materials had to be
distributed to the sites far enough in advance so that
everyone had them available. If all sites did not have the
proper software, if that software or hardware was not
working, if the lines were not transmitting properly, or if
one class was not ready then the instruction was halted.
Each of these problems were encountered in the initial four
class experimental test of the network, but have created
only very minor problems in the present use of the network.
The University of the Virgin Islands (UVI) is presently
offering a two credit course for its students in BASIC
programming using the telecommunications system. The
students are being periodically assessed at both the St.
Thomas and St. Croix campuses to determine if there is any
significant difference between the performance of the
students at the remote and home sites. These experiences
have demonstrated that a period of development and
establishment of facilities must be expected, before routine
use of systems for remote instruction is possible.

Instruction and the Media

There are several limitations and considerations to
understand when using audio and computer telecommunications
for instruction.

The first problem to be overcome is the establishing of
communications with the remote site. A training manual and
a short training course are presently being developed to
help instructors with the physical components of the system.
With a little experience, instructors should feel
comfortable working with the hardware.

Once instructors have overcome the technical problems
that may be associated with establishing communications with
the distant site, they should experience little technical
difficulty using the media.

The audio aspects of the media are straight forward and
differ little from good pedagogical practice in the
traditional classroom. Some adjustments may be required for

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the instructor. He should direct his comments toward the
microphone so that students at the remote site can properly
hear him. Some experimenting may be needed to determine the
best placement of the microphones. We have found that when
the microphone is placed too closed to the computer that the
noise from the computer is picked up by the microphone.
Lapel or lavaliere microphones that can be wore by the
instructor should help to correct this problem. The
students will need instruction and some reinforcement to
press the button to activate their microphones and to speak
clearly into their microphones. This is especially true for
students at the home site as they can address the instructor
without using the microphone, which results in the students
at the remote site not being able to hear the question or
comment of the student. Use of room mikes controlled by the
instructor at the home site and a course facilitator at
remote sites is planned, and this approach should allow a
more natural format of audio interaction initiated by a
student raising his hand or perception of questions by the
instructor or facilitator. Voice modulation and tone are
not lost using this media.

The main limitation and consideration when using the
computer for distant teaching is the lack of visual cues
between the instructor the class and the necessity of
adapting more traditional visual media to the computer. The
lack of instructor-student visual cues can be somewhat
compensated for by utilizing more oral cues through such
techniques as increased and better questioning.

Computers offer a powerful medium for the visual
display of text, data, graphs, drawings, and pictorial
images. These visuals can be easily changed and can be used
in interactive learning situations through such things as
pointers, games, simulations, and other innovative
techniques. The computer can do the same things that can be
done on a chalkboard, overhead projector, and other media
that display text, data, and other visuals.

The computer-link component lends itself well to the
teaching of programming lectures and computer-oriented
subjects, such as word-processing, spreadsheet and data-base
instruction. With programming lessons, the instructor
produces the program on all computer nodes, asking all
classes to contribute to the development of the program.
All nodes have the same ability to control the network as
the instructor's node, so students at the remote sites can
respond in the same manner as the instructor does.

Pre-instructional Considerations

The preparation or pre-instructional phase of distance
teaching using the ECC computer network requires more
planning, effort, and time than traditional classroom

teaching to be effective. This extra effort results partly from the use of a new medium, and partly from raised student expectations when advanced technology is employed.

Planning

Most instructors can lecture and use the chalkboard without much difficulty. Often the material is presented spontaneously, and these mediums allow for this spontaneity. These methods will need to be adapted to teaching material using audio and computer transmission of the instruction. While the latest versions of the ECCTP system allow the same real time transmission of writing and sketching, student expectations of quality in visual displays are influenced by association with broadcast television, and use of prepared material is more effective. Not only must the lesson be better planned, it must also be planned differently if it is to be as effective as face-to-face teaching. For instance, materials must be prepared far enough ahead of time so that they may be distributed to all the students at all sites. This preparation calls for the instructor to foresee the questions and learning needs of the students, so that he will not need to resort to the chalkboard or some other material he may have available to reinforce his concepts and answer the questions of the distance-site class. The materials should be presented in such a way as to limit confusion and increase understanding.

The instructor must plan the lesson to be given without the use of visual aids and cues that might be taken for granted in face-to-face teaching.

Pre-assessment. As much as practical, the instructor should try to ascertain what skills and knowledge the students have before instruction, so that the material is neither too difficult, nor too easy. A pre-assessment of the students will enable the instructor to better plan appropriate learning experiences for the students and have a better measure of how much the students learned as a result of the class. Generally, a pre-assessment cannot be carried out before the class begins, but could be done the first or second class meeting.

Setting Objectives. The most important part of planning is establishing clear objectives for the students and creating activities that will lead to the fulfillment of those objectives. Objectives should ideally be stated as much as possible in terms of measurable behavior. The objectives will be based on the overall goals for the course and should be written in terms of what the students will do, not what the instructor will do. The objective should clearly state the behavior expected, under what conditions that behavior is expected, and the standard or level of accomplishment expected for completion of the objective.

These elements can be remembered more easily by using the acronym of ABCD, where A is for audience, B is for behavior, C is for condition, and D is for degree of accomplishment.

Lesson Planning. The heart of the preparational phase of teaching is the actual planning of the activities designed to assist the students to accomplish the goals and objectives. Several factors should be kept in mind when preparing these activities. As the human factor is reduced because of the use of technology, other motivational and instructional aids should be increased. Reinforcement of behavior, pacing, monitoring, interest, and feedback can all be adjusted to increase the motivation and the design of learning materials can be made more interesting and explanatory.

Evaluation. It is helpful to establish the evaluation instruments and procedures at this time so that your evaluation will be tied directly to your objectives and learning activities. By establishing objectives, activities, and evaluation at the same time, you will be better able to evaluate what you are intending to teach.

Briefly stated, the instructor needs to have an idea of where the students are at, where he wants them to go, how he can best get them there, and how to know when and to what extent they have arrived.

Effort and Time

The amount of effort and time required to plan an effective lesson for distance teaching using the ECCTP computer network is increased. Some courses, such as computer science courses that use the computer for class demonstration of learning objective and concepts, can be taught with little adjustment, but other courses, such as psychology or science, will require major changes to make them effective.

Bearing the above in mind, the instructors should adequately prepare and the administration should adequately reward instructors for distance teaching, as poorly planned lessons will result in poor classes and a low evaluation of the telecommunications network.

Instruction

Understanding the limitations and constraints of distance teaching using audio and computer transmission, can help the instructor overcome some problems that will limit the effectiveness of the lesson. Because the student and instructors are so accustomed to face-to-face instruction, some adjustment will have to be made to adapt to the use of telecommunications. Some areas that should be addressed are teaching to an objective, maintaining student interest,

monitoring learning, classroom management, modeling the
concepts, technical limitations, and instructional skills.

Teaching to the Objective

Just as setting good objectives is the most important
part of the pre-instructional phase of the lesson, teaching
to the objective is the most important part of the
instructional phase of the lesson.   Doing a task analysis
of the objective - breaking it down into its component parts
- will help the instructor to teach the lesson in a way that
the students will be able to understand. If prerequisite
skills are missing, the students may not be able to benefit
from the instruction. If steps are omitted in the learning
sequence, then much time may be wasted and little learning
result. If the lesson is focused on the objective, then
time will not be wasted on extraneous or irrelevant
material. It is helpful to share your objective with the
class so that they know where you are trying to go with the
lesson. Maybe they can help you get there.

Motivating

Motivating students is a difficult task when there is
face-to-face interaction, but more difficult when the
physical presence is removed. The less intrinsically
motivated the students are to learn the material, the more
extrinsic motivation needs to be used in its place. The
physical presence of an instructor is an extrinsic motivator
that will be absent at the remote site. Therefore, the
instructor needs to make his presence felt in other ways.
One of the most effective ways is to actively involve the
students in the learning process through interaction.
By frequent questioning, the students are required to
be engaged in the learning process. These questions should
usually be directed to individuals, not to the class in
general. The instructor should first ask the question of
the entire class, give them a moment to think about it, and
then call on an individual. If practical, each individual
should be called upon each class period, but if not the
opportunities to respond should be distributed equally, not
given disproportionately to the brighter students as is done
in most classrooms. This form of questioning was used
effectively in the pilot project to involve all students in
the class, especially the students at the remote site
because they can more easily become disengaged.   At the
beginning of the class, each student was asked to introduce
himself to the people in the other site. These names were
written on the monitor and the instructor made a point to
call on each person using that list. Questioning enables
the instructor to give feedback on learning and positive

reinforcement, both important motivators. It also increases the level of engagement in the students and their possibility for success.

Monitoring

In the traditional classroom, the monitoring of student learning and understanding is often done using visual cues, such as students raising a hand or using body language to let the instructor know when they do not understand something or are trying to communicate something to the instructor. These visual cues, which are often taken for granted and unconscious, are absent using the computer and audio transmissions. Therefore, one must compensate for the lack of visual cues by using more audio interaction and maybe some signal to indicate there is a question or comment. The course facilitator can be very helpful in this regard as he can see the students at the remote site and can alert the instructor if he perceives any problems.

Asking frequent questions and directing the questions to different students in the class lets the instructor know how much of the material the students are grasping and where there may need to be further instruction. Frequent assignments, exercises, and other evaluative methods can also be employed to better monitor class learning. Allow the students to practice the concepts in class to see that they understand them, and then give them assignments that require further practice and development of those concepts outside class. Giving pre- and post-assessments will help you to better determine how much the students have learned and are grasping the course content. It also has the added benefit of increasing student motivation. Formative evaluations should be conducted throughout the course.

Managing

Managing classroom activities at the remote site can be a major problem. Without the directive influence of an instructor in the classroom, there is no assurance that students are paying attention, behaving, following the lesson, or even present, unless some special attempt is made to engage the students to monitor the learning. Facilitators will be necessary at remote sites if the students are not mature and self-disciplined. Another consideration is the managing of the students work and assignments. The students will not have direct access to the instructor in class or after class. This limitation will require some support for outside assistance for students and a means for written assignments between instructor and student. Having the course in a form of

programmed learning would be helpful for maintaining student involvement and managing student learning.

Modeling

To be able to model the learning that is expected is important. This modeling can be accomplished through oral examples and pictorial displays that can be transmitted via the computer. This modeling was an integral part of the introductory programming lessons taught in the pilot project. Computer concepts and commands were given in class and demonstrated using the computer. The information the students were to learn was modeled for them. Giving such relevant examples will not be as easy in courses that are not related to the computer or that do not have concrete concepts, but as much as is practical, an attempt should be made to make the concepts as clear as possible. After you have shown the class examples of what you want them to know, it is good to let them try to demonstrate their understanding by doing some activity related to the concepts you have done for the class.

Technical Considerations

There are several adjustments that must be made to effectively teach with computer and audio hook-ups. The presence of an instructor in the classroom taught without the use of telecommunications does not have to deal with hardware, software, or transmission problems. These problems go beyond the effective teaching skills and require an additional skill: operating media.
Typing skill is essential if the instructor is going to use the monitor to display ideas presented in class.   The instructor can prepare the class visuals before hand to avoid the problem of having to type needed information on the monitor. Even those instructors who are used to typing may find it difficult to teach and type at the same time. This problem can be overcome by use of a drawing mechanism that is presently available for the existing network, but written or drawn material is less acceptable than typed notes to students viewing a television monitor.
Some familiarity with computers and microphones will be necessary. The pilot project has experienced many technical problems, and if the instructor is not able to address these problems efficiently, then much instructional time will be lost due to transmission problems. The instructor should know how to establish telecommunication links with the remote sites. He should be aware of the limitations of communicating using a microphone and not forget to speak into it so that the remote site can hear what is being said. The students must also use the microphones properly if they

are going to be heard at the other site, as well as at their own site.

The greatest weakness in the initial developmental phase of the ECCTP has been the inability to make and keep contact with the various sites. If the electricity goes off in one site, if a cord becomes disconnected, if the transmission lines are not available, or if the transmissions are not clear, the lesson is halted and learning stops. These problems can be overcome with the establishment of reliable audio and data connections, as has been demonstrated by the computer programming course that is presently being taught between the two campuses of the University of the Virgin Islands.

Post-instruction

After the class has been taught, there are other unique concerns that must be addressed in student evaluation and support. How should evaluation of student's progress be handled and how can the effectiveness of the course be evaluated?

If the preparation and instruction for the class has been well planned, then the evaluation of the students' learning should be easy. The evaluation of the students should be based upon the objectives of the course and the material that was covered in the course. Several formative evaluations are necessary for the instructor to monitor the students' progress. If a programmed learning or a mastery learning approach are used, then evaluation can be based on the students' work. Research suggests that programmed and mastery learning are among the most effective teaching methods. Consideration will have to be given for the supervising of examinations at remote sites and for the moving of examination papers between teacher and students.

Evaluating the effectiveness of the instruction will be especially important in the ECCTP, because it will give some measure by which to compare instruction via telecommunications and traditional or home-site instruction. Little evaluative data was able to be collected during the initial pilot testing of the system. This evaluation was based upon instructors and students' subjective view of the effectiveness of the learning via the computer and audio media. The evaluation of the learning was positive, but there were problems with the transmission of the classes that resulted in long delays or classes being postponed. These problems will need to be corrected if the system is to be a viable teaching tool.

The basic programming course (CSC 101) presently being taught on both campuses of the University of the Virgin Islands using the ECC telecommunications network is an excellent opportunity to evaluate the effectiveness of

distance teaching via computer and audio hook-ups.
Comparisons will be made between pre- and post-test results
of the students to see if students taught by the same
instructor at the home site perform differently from the
students at the remote site. Periodic assessment can be
made to determine if there is a difference between home site
and remote site achievement and attitudes. Also,
observations of classroom behavior can be analyzed to get
measures of student and instructor learning and teaching
differences to see if different teaching approaches result
in different behaviors or attitudes from the students.
Comparing the material learned with the various teaching
variables, i.e. home vs. remote site, high student
involvement vs. low student involvement, etc., will give us
some data upon which to evaluate the variables related to
the project.

Summary and Conclusion

The Eastern Caribbean Center Telecommunications Project
(ECCTP) was initiated in the summer of 1985. The goal is to
establish a network facility for exchange of instruction
among island nations in the Caribbean. The approach
selected uses two way audio conferencing for transmitting
the voices of the instructor and students, and
microcomputers for creating visual images. The network is
symmetrical and allows instruction or student response from
any node.

The ability of this technology to deliver instruction
has been demonstrated. Several improvements and extensions
are under development, but the system can be, and is being
used in its present form. Regular classes are being
delivered over this medium between the St. Thomas and St.
Croix campuses of the University of the Virgin Islands
(UVI), and trial sessions have been conducted from the
Virgin Islands and St. Kitts, and the Virgin Islands and
Anguilla.

The potential for an educational telecommunications
network in the Caribbean is great. Instructors must be
trained to use the technology if the courses are to be
effective. The traditional lecture method will not
generally be the best method of instruction. The
preparation for teaching is more time consuming and more
necessary because of the need to present the materials
through computer and audio transmissions. The instruction
phase of the lesson requires more skill and organization if
it is to be effective.

In general, this system for delivery of instruction
coupled with use of facilitators at remote sites allows
almost all the traditional instructional techniques to be
used, though the operation of the medium places an

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additional burden on the instructor. Raised student
expectations associated with the use of television display
and computer technology, coupled with the necessity to give
extra attention to motivation and interaction make
preparation and planning more important than normal
situations.   Students will generally be less tolerant of
poor teaching when the instructor is remote. The use of
these distant learning techniques makes it possible to
deliver instruction to remote sites, but makes preparation,
planning, attention to student responses, and a variety of
other considerations associated with good teaching even more
important.