PACKET RADIO FOR DISTANCE TEACHING IN THE THIRD WORLD

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Abstract

How Packet Radio could greatly improve the interactive capabilities of Distance Teaching. Some views on how Packet Radio could improve the delivery and efficiency of Distance Teaching in Less-Developed Countries.

Definition

One problem every nation faces is delivering *some* sort of education to its citizens no matter where they are: those in remote or sparsely-populated areas; "those severely constrained by religious or other traditional social factors (e.g., women, or members of low caste in some countries)."[1]; the handicapped; refugees; prisoners; etc. One means of dealing with this situation is the use of Distance Teaching. Distance Teaching is defined by Joseph N. Pelton as a "multimedia educational process in which the teacher and learner may never meet face-to-face. . . . This form of education has emerged largely because society has not been able to satisfy needs through traditional educational structures."[2] Distance Teaching is not new--even to this country--but it seems to be gaining renewed prominence, especially with the advent and promise of satellites. (The reader is referred to OSCAR 10 experiments last year,[3] and the UoSAT-OSCAR 11 proof-of-concept demonstration in January this year.[4]) While Distance Teaching is of increasing importance in the Developed Countries, this report is aimed at the Less-Developed Countries.

Interactive Distance Teaching

For Distance Teaching to really reach its full power, it needs to approach as near as possible the face-to-face, interactive conditions of teacher-to-student. Packet Radio makes this goal the most affordable yet. Because of the following important features, I believe Packet Radio can bring interactive Distance Teaching to a point educators never even *hoped* for before:

1. Costs can be held down with the bare bones, minimum components as follows: a personal computer and display of some type, a Terminal Node Controller, a transceiver, and an antenna.

2. Brands of computers can be mixed because the use of ASCII code is the great equalizer between computers of different types.

3. Enough Digipeaters (Packet Radio stations as detailed in the first item, above) can make the system's range nearly limitless.

4. This medium is digital, almost 100% error-free communication. This opens up whole aspects of information transfer that were simply not feasible prior to this time. Today, if it can be digitized, it can be sent and, if it can be sent errorlessly, then data transfer suddenly becomes a far more valuable and cost-efficient exercise than before.

Price

Cost of a minimum Packet Radio system will vary according to hardware sophistication, features, and whether peripherals are added. I am currently conducting a survey of Packet Radio users, but it is too soon to publish any reliable information. However, the cheapest arrangement reported so far was $525 with some used components and the most expensive was $2,125. The average--again, from a very small sample--is $1,025.

It should be noted, too, that a savings can be made if the Terminal Node Controllers are purchased in kit form and assembled on site. This would be an excellent exercise for a science or electronics class. For nations that permit amateur radio activity, it might be possible to obtain volunteer time and equipment such that initially only the Terminal Node Controllers need be purchased. This would be an especially good approach if a government wished a trial of the Packet Radio concept before committing to it.

One of the nice surprises in store for an agency considering the costs of a Packet Radio installation is no new facilities need be constructed. A Packet Radio station requires no more space than a large closet--so any packet station could reside in the main ministry of the capital as well as the smallest classroom in the country.

Lastly, when calculating costs, it must be remembered that once the Distance Teaching chores are over for the day, the equipment should never sit idle. The hardware can be utilized in many additional, exciting, and valuable ways. For a classroom entering the electronic age, here are two perfect instruments to be considered as tools, as objects of study themselves, and as assistants in the classroom: the computer/display and the transceiver/antenna.

Applications: Interactive

Here are but some of the possible uses of Packet Radio for interactive Distance Teaching:

--Upgrading, improving, or enhancing the skills of the teacher/aide already on site. A master teacher in the central district could provide lessons for presentation by an instructor in some isolated area. This could inject new ideas *or* skills into the repertoire of a teacher/aide/tutor. The person in the remote part of the country would receive instant feedback regarding the correct use or presentation of the lesson prior to giving it to the class. This is the type of interaction that improves teaching efficiency: sort of a "remote in-service."

--Monitor students' academic progress with daily or hourly checks for rapid diagnosis and remediation. Again, the experienced teacher interacts from a distance to assist the new or unsure teacher on how best to proceed with a student's lessons.

--Personalized lessons based on students' performance (with individualized instruction on subjects as varied as reading or engine repair).

--Academic credit. Students could "take classes from schools all over the country . . . even earn high school, college, and graduate level credits through the system."[5]

--Timely contact with the teacher from the provincial or capital offices. This would facilitate important information reaching the teacher quicker than the postal system (which is slow enough in Developed Countries!). Bulletins, pertinent literature reviews, even disaster warnings could reach the school with ease and reliability.

--Sending up-to-the-minute information from the teacher back to the central office. This would provide the up-country instructor with a means to obtain advice, support (moral or pedagogical), or emergency assistance in a most expeditious way.

--Teacher-to-teacher contact and support. Communication with one's colleagues is important in any endeavor and especially when one is new or inexperienced to the job. With Packet Radio, an opportunity to seek the company of someone else "in the trenches" is readily available 24 hours a day. For this (and for digipeating), a Packet Radio station ideally should remain up-and-running every hour of the day where possible.

--Bulletin board service. With the availability of a BBS, many of the above types of communication would be enhanced.

Applications: The Computer

No matter what make or model it is, there are a myriad of things a personal computer can do for the teacher. As a tool (depending upon configuration, memory, and time available for use) it can inventory, keep records and grades, perform EMAIL and store and forward messages, store programs, control environmental conditions of the classroom/school, and word process. "Information retrieval may be used . . . directly by students as a quasi-library facility. . . . [And, not least,] students interact with the computer without intermediaries for the express purpose of increasing their knowledge or skills in some school subject."[6]

As an object of study, there are spreadsheets and word processors, programming languages, input/output, data retrieval or computer-to-computer communications, simulations, graphics, artificial intelligence, etc.

It can become an assistant to the teacher by taking small groups of students aside to work or play while the teacher does large-group instruction with the rest of the class. It can also free the teacher by providing tutoring, drill, and practice or review, not to mention administer tests of placement or comprehension.

Applications: The Radio System

Here--to a much lesser extent--we also have a tool (depending upon the electronic skill and confidence of the operator). It can locate other sites, page people, perform RTTY and Slow Scan Television, etc. As an object of study it is perfect for analog and digital electronics, antenna theory and construction, Orbiting Satellite Carrying Amateur Radio (OSCAR) and the necessary tracking (great for applied math), etc. As an assistant it too can separate a small group of students off to entertain or instruct.

It must be mentioned this new wonder of our lives--Packet Radio--need not, indeed *should* not, be limited to use only by educators in the school. Presentations could be done after hours that offer courses, lectures, or updated developments of interest to other members of the surrounding area such as farmers, merchants, hobby groups, investors, etc.

Other Considerations

Before embarking on this path for improving Distance Teaching, three factors must be considered: environmental, sources of power, and human resources.

Environmental: As great and wonderful as computers are, at this stage in their evolution, they can quickly be felled by

> heat, dust, humidity, vibration, and mechanical shock. . . . they are not often moved, and when they are, are moved with care. . . . Environmental constraints can be compensated for in two ways: the environment itself can be controlled by means of air conditioning, etc. or computers that are more resistant to environmental hazards can be purchased; such computers are available, having been developed for the Armed Forces for use in uncertain field conditions, but are quite expensive in comparison to the commercially available computers.[7]

On the other hand, lap board computers, such as the Radio Shack Model 100 which have all the

necessary components enclosed, could be a distinct possibility. The only drawback is a small display and limited memory for storage, but even the *memory* can be expanded with cassette tape and recorder.

Sources of Power: Many schools in remote areas of the world are without power. Those that are blessed with it often find it unreliable or fluctuating more than computers can tolerate. Alternatives have been studied, especially in regard to "appropriate technology.** Agencies such as the Peace Corps, Volunteers in Technical Assistance, and the Amateur Radio Relay League actively seek new and inexpensive designs and creations in the area of power supplies for electronic equipment. Various types of generators, battery configurations, and solar panel arrays exist now and the market grows at a rapid pace.

Human Resources: Whether it is the instructors themselves, aides, or dedicated operators, some sort of training must occur before a system such as this could be put in place. A way to forgo this expense of time and money would be to limit the placement of the hardware to the classroom or school which had a science teacher on site. Even so, I contend the training necessary does not have to be extensive or lengthy because, as hardware engineering continues to output more and more sophisticated equipment, the operator needs to know and do less and less. Add to that a good software program to achieve minimum levels of operator interaction and the prerequisite skill (if not anxiety) levels would further reduce.

Conclusions

Packet Radio most certainly should be considered as a delivery system for Distance eaching. Its technology could make Distance Teaching truly interactive in every sense. Its costs are certainly competitive with any present-day delivery system and its future use via satellites is ensured. Added to that, a Packet Radio station site has a computer and transceiver as tools and teaching aids when not in use with Distance Teaching. Most Distance Teaching projects are aimed at adults, but I must emphasize there's no reason primary-age students could not be well served by the equipment and concepts in this proposal.

References

[1] M. W. Neil (Ed.)., *Education of adults at a distance: A report of the open university's tenth anniversary international conference* (london: Kogan Page, Ltd., 1981), p. 65.

[2] J. N. Pelton, & R. T. Filep, Tele-education via satellite. In W. T. Blume & P. Schneller (Eds.), *Toward international tele-education* (Boulder, CO: Westview Press, p. 158), p. 158.

[3] QEX, *The ARRL Experimenter's Exchange* 26 (April 1984): 1.

[4] UoSAT-OSCAR 11 demos PACSAT concept, *Amateur Satellite Report* (January 28, 1985; No. 94/95): 1.

[5] R. Cordon, Welcome to the electronic university! *The Electronic Catalog* (Fall 1984): 3.

[6] J. Friend, *Classroom uses of the computer: retrospective view with implications for developing countries,* unpublished paper (December 1984): 2.

[7] Ibid., p. 23.