INFUSING RADIO-BASED COMMUNICATIONS TOOLS INTO THE CURRICULUM

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F O R E W O R D

Two trains of thought have converged in this publication.

First, educators of the 90's are constantly searching for new ways to make school more interesting and relevant to the real world. At the same time, many telecommunications engineers fondly recall the construction of a crystal radio as the event that triggered their lifelong enthusiasm for the field. Packet radio, as a form of computer-based communication, is so affordable and yet so intriguing that it may have the potential for motivating the next generation of would-be telecommunications scientists.

The second school of thought is that it is best to ask educators themselves how they might like to see amateur radio-based communications integrated into education. This booklet contains several examples of technology integration proposals and lesson plans produced by educators who accepted precisely that task. All authors had 45 hours of study in radio applications and theory, and many went on to receive an amateur radio license. It is hoped that other educators will find their work useful and will continue to build upon the initial collection of ideas produced by these pioneers.

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O V E R V I E W

For the past few years, technology educators at the University of North Texas in conjunction with the Texas Center for Educational Technology (TCET) have initiated activities designed to increase K-12 educators' awareness of the potential for using low cost radio and satellite technology to enhance traditional education. Initiatives focus on three areas: 1) evaluation of existing low cost communication technologies, 2) research and development of integrated curricular-radio/satellite technology models to demonstrate feasible scenarios for use by teachers and learners to enhance education, and 3) dissemination and training activities intended to convey the lessons learned to technology coordinators and classroom teachers.

Research has shown that students learn better when motivated by an interest in their subjects. It is generally agreed by teachers who use radio/satellite technology in the classroom that this curricular enhancement can provide students with a fun and practical way to learn traditional content. Radio/satellite technology can be used in many curricular areas, such as General Science, Algebra, Geometry, Physics, Industrial Technology, Language Arts, Computer Literacy, and many others.

This radio infusion guide is a continued effort to disseminate the concepts of using radio/satellite technology in education. The guide is based on selected papers which were submitted by graduate students in a summer institute covering Educational Radio/Satellite Communications which was taught by Gerald Knezek, KB5EWV, Greg Jones, WD5IVD, and Mike Maner, WI5H, at the University of North Texas in the summer of 1991. Additional papers were selected from those submitted in a similar class held the following summer (1992).

The information published in this guide was built upon the following general model of using radio/satellite technology in the classroom. The three modes of the general model are:

1. Monitor Mode (Receive Only)
   The teacher and students receive only; they do not transmit.
   Satellite Telemetry, Weather Imaging, Short Wave Listening, etc.

2. Teacher Licensed
   The teacher acts as the facilitator/operator for transmitting.
   Participation in real-time communication using the radio. ATS-3 Satellite Communications

3. Teacher and Student(s) Licensed *
   The teacher and students are licensed for communications.
   Packet Radio connections to other schools. Amateur TV

* This mode allows more freedom and flexibility; the teacher does not have to spend time monitoring student communications.

Each mode builds on the previous in knowledge and expertise. The monitor mode encompasses the largest group of the model since anyone can receive communications without a license. Any teacher with minimal support and technology can introduce a wide variety of radio/satellite technology in the monitor mode. Educators sometimes do not realize that their classroom and schools are bombarded by millions of information sources daily. The secret is knowing which are useful for education. With a receiver and a way of decoding and displaying the information, these sources can be used directly in the classroom. Examples of the monitor mode might include: Voice of America broadcasts for language arts, reception of NOAA for physical sciences, or the reception of the low-earth satellites for data information that can be used in math and physics courses. In K-12 education, radio/satellite technology is beginning to spread with the reception of weather satellite images. There are now over twenty amateur radio satellites and a score of weather satellites readily available to educators with low cost radio equipment to use their transmitted information in the classroom.

The second mode (Teacher Licensed) assumes that the teacher or some facilitator is licensed, which allows the class to transmit. The major attraction of amateur radio for classroom educators is that the use of the airwaves is free as compared to more traditional telephone communications. Although no license is required to listen, transmission access is controlled by a strict licensing procedure, which means communications inappropriate for an educational classroom (i.e. those often found on CB radio) are unlikely to occur. In the classroom, the amateur radio license is usually perceived as a motivational goal, rather than an insurmountable barrier, by teachers and students. Categories of licenses have been carefully arranged into Novice, Technician, General, Advanced, and Extra, so that each step provides interesting new privileges for the “graduate”, but also leaves an incentive to advance to the next level. Another factor certain to increase the attractiveness of amateur radio for educators is the “no Morse code” license. This new class of amateur license allows educators to pass 2 written exams to gain limited transmission privileges, including voice and packet radio, in the amateur radio frequencies. For example, all 63 members of a middle school amateur radio class in Bardstown, Indiana, recently succeeded in passing their Novice examination , which allowed them to “be on the air” even after this first level of mastery. Persons as young as 7 have succeeded in obtaining a license.

In addition to amateur radio, there are other types of communications requiring alternate forms of licensing. The ATS-3 (Application Technology Satellite #3) requires no test, but does require an experimental license which is obtained from NASA and the FCC. A number of schools have been using this satellite to hold exchanges with the South Pole and many islands in the Pacific. ATS-3 is an FM transponder that receives on the 136 MHz frequency and transmits on a frequency of 149 MHz. This is just one example outside the traditional amateur radio usage.

With radio/satellite technology, an opportunity exists to add a new, highly motivational, thematic tool to the educator's repertoire that can grow with a student throughout his/her educational career. Radio/Satellite technology offers a low-cost method for integrating many curriculum areas. Its incorporation into existing secondary curricula could motivate students to become future scientists and engineers. The future looks bright for having more and more teachers use radio/satellite technology in the classroom.

Greg Jones, WD5IVD

A C K N O W L E D G M E N T

Thanks to Gerald Knezek, KB5EWV, for making low cost radio/satellite technology research a reality and setting a direction for the future.

Thanks to Larry Lucas, N5XRZ, for all of his help and efforts at TCET to continue the work started and ongoing, concerning low cost radio/satellite technology in education, and in supporting educators in their initial attempts at using this technology.

THIS MANUAL'S CONTENT

In this manual, teachers who have learned about various radio communications modes and their applications to education, present their unit and lesson plans for incorporating radio communications tools into a variety of curricula. These plans will need some adaptation to successfully utilize them with different student populations.

Evaluating student progress is addressed by only a few of the authors since criteria for student success must be individually determined.

The purpose of this document is to stimulate thinking about uses of packet radio and other modes of radio communication in the education process. It does not constitute a stand-alone curriculum document. Rather, its purpose is to stimulate thinking about how educators might infuse the use of radio communications into their district curriculum as an alternative means of opening up the classroom to the world.

The near-future of computing is wireless communications. Through the use of amateur packet radio, teachers can introduce students to the world of wireless computer communications today.

PART I:
Proposed Applications of Radio-Based Communications Tools in K-12 Curricula

Part I: K-12

Amateur Radio in the Classroom

Charles R. (Dick) Greene

CONTENTS

Abstract

This paper discusses the use of amateur radio technology in the classroom. Amateur radio can provide the teacher with an effective tool to enhance the teaching of many curricula.

Introduction

Educators are constantly seeking ways to motivate students to become more actively involved in the education process. Amateur radio can provide students with an exciting way to reach out from the traditional classroom into the world around them. It is another teaching tool, but it is one that requires the student to become an active participant. It is a “hands on” activity in which students communicate with others outside of their classroom. The subject of the communication may be related to any traditional course content.

Modes of Operation

A common misconception is that a teacher must have an amateur license before using amateur radio in the classroom. This is not true in all cases. There are at least three modes available for using amateur radio in the classroom, and the first requires no license. Even without a license, the teacher and students may monitor any amateur radio transmissions. The second mode would be if only the teacher has a license. The teacher would be considered the control operator of the station. As long as the teacher is present to operate the controls, the students may communicate using the radio. The third mode would be if the teacher and students were licensed. In this case, the teacher and students would be free to operate the radio (Jones & Knezek, 1989).

Current Usage in the Classroom

Currently, the use of amateur radio in the classroom is not widespread. Typically, the use of amateur radio in the classroom has been implemented by teachers who already have their amateur license. It is from this "grass-roots" base that other teachers and even administrators have seen the benefits to be derived from the educational use of amateur radio. There is an ever increasing interest in using amateur radio technology in education. More and more individual schools, and even whole districts, are in the process of putting amateur radio to use in the classroom. A number of universities and colleges are becoming involved in research on use of the tool in education. All of this is an indication of the growing interest in amateur radio as a communications tool in teaching.

Potential Curricula Applications

Amateur radio can be used across the curricula from the elementary level through the secondary level. A number of different strategies can be used to incorporate amateur radio into the curricula. Some of these are:

- **Language Arts** - Using packet radio, writing skills can be improved by the students exchanging poems, stories, or even their own biography with someone at another school in their city, state, country, or around the world. Listening skills will improve when voice-mode radio communication is used. Students are highly motivated to try to understand what someone is saying when it is a part of a radio transmission. The need for clear, concise oral expression will become evident to the students, and they will have the opportunity to practice this skill while communicating using voice-mode radio.

- **Mathematics** - The Metric System can be the basis for radio frequency calculation. All exercises in determining and reading frequencies can require the students to work with the Metric System. Telemetry informa-

tion received from satellites can be used as a database for the students to work with. An analysis of this information will allow students to determine the status of a number of different elements of the satellite. The database provides an excellent source for chart and graph work.

- **Social Studies/Geography** - After a radio contact, students will want to know exactly where the person to whom they were talking was located. They will need to identify cities, states, countries, and continents. This leads them to using maps and globes to find various locations. They will learn to use latitude and longitude to find a specific place. They will become familiar with using compass headings to express the location of a contacted station in relation to their own station. Time zones become important. They may need to determine when a station in another time zone may be on the air. Students will be exposed to other cultures which will promote a better understanding of the diversity of these cultures.

- **Science** - The emphasis in science education must be to equip the students to identify and solve problems. In order to effectively do this, students must be given the opportunity to question and share ideas with others. Amateur radio allows the science student to collaborate with others on problem solving. Cooperative projects can be worked on between students at different schools. Weather information is readily available from satellites, or from various database services, for use in the classroom. Telemetry information from satellites provides for the study of space technology. The radio equipment itself along with radio theory can be used as a topic of study in physics.

- **Foreign Language** - Amateur radio can give students a chance to speak, read, and write the language being studied. This can be accomplished by making contact with other students studying the language, or with a station operator who lives in a country that speaks the language and who is fluent in the language.

- **Computer Skills** - Computers are a natural for hook-up to a radio. The use of a computer with the radio allows information to be entered into the computer for later “packet” transmission by radio. In this configuration, the students will become involved in the practical applications of computer technology and data communications.

As a teacher becomes more familiar with using amateur radio, he/she will constantly find even more exciting and fun activities in which the students can participate.

Student Motivation

Across the curricula, students are involved in communicating. If they are using "packet" transmission, they are reading information received or writing information to be transmitted. In the voice mode, they are listening or preparing an oral response. The important point is that the student is an active participant. The world outside the classroom is open to them each and every time they use the radio. Each and every contact is an adventure. The purpose may be to once again contact an old radio friend, or the purpose may be to contact a new station. For those students with special needs, activities using amateur radio can be adapted to challenge the student at his level of need. With teacher approval, gifted students can be given the opportunity to explore subjects in more depth than others in a class. Students with learning and/or emotional disabilities are drawn into interacting with others. There is a certain anonymity to communicating over a radio. Students are able to operate in their personal "comfort" zone. The radio acts as a screen between the student and the other person. This gives the students full control over how much they choose to reveal about themselves.

Getting Started

As most teachers do not have a great deal of knowledge about the use of amateur radio, they will need help and guidance in exploring this technology. One of the first places to contact is the American Radio Relay League (ARRL). A large percentage of the active radio amateurs in the United States are members of the ARRL. As a body, this group is interested in the growth of amateur radio usage. They have dedicated a great deal of time and effort to investigating and developing ways to use amateur radio to enhance classroom activities. They can provide various training materials and other services. They may be able to identify a school in the area that is already using amateur radio. Visiting a school already using this technology and having the opportunity to talk to another teacher would be extremely helpful. The ARRL can provide the names of local clubs in the area. In most cases, these amateurs are eager to talk about their hobby, and they are glad to help new people get started. Also check with the closest university or college; they may be involved in activities related to the use of amateur radio communications.

Conclusion

Amateur radio offers the teacher a tool to enhance any traditional course content. It is a "hands on" activity that requires the students to become an active participant in the education process. The walls of the traditional classroom become invisible, and the students are exposed to new experiences in the global world outside of the classroom. Teachers owe it to themselves and their students to explore the usage of amateur radio in their classrooms.

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Amateur Radio and the Writing Curriculum

Sheri Herod

CONTENTS

Introduction

Amateur radio equipment could be purchased for each elementary school in the Dallas Independent School District for a one time low cost. Once purchased, these radios can be used in all grade levels to enhance and extend each subject area. Many of the skills taught in school can be made more interesting using amateur radio. Today many teachers and school systems are moving toward teaching all subject area skills through the writing process. Adding the use of amateur packet radio to this process will allow the instructor to incorporate more interesting "hands-on" activities. If elementary school children had access to this equipment the following activities could be used with the writing process.

Story Writing

During the editing stage of the writing process, students from a lower grade can share their stories with students in a higher grade level. The upper grade students could then critique the lower grade student's story by stating what they liked and disliked about the story and then give helpful suggestions as to how

to make the story better. After writing informative narrative paragraphs (ex. Steps to Making a Peanut Butter Sandwich) students could read their paragraphs to another class (to students on the same level or upper class students) using voice-mode ham radio or send their stories to the other class via packet radio. After receiving the How-To paragraph the class will try to perform the activity and then report, using amateur radio, its ability or inability to complete the task successfully. If the class is unable to perform the task successfully the first class will have to rewrite the procedure using the input from the other class. The classes will continue to communicate until the procedure is completed successfully. This activity could be done whole class, in small groups, or with individual students.

Pen Pals

Amateur radio can make the traditional pen pal activity more interesting. Students can communicate with their pen pal through written and/or voice communication using amateur radio. Students can gather personal information and then write a biography of their pen pal's life or create an autobiography and send it to their pal. Students could also write about their pen pal's classroom, and the weather conditions in their pen pal's geographic area. The students could then make a book that includes all this information about their pen pals. As a culminating activity instructors could schedule a field trip to a place where the pen pals could meet and share their stories and books.

Literature

Integrating literature with writing can be very boring if students are only asked to listen to a story and then write about what they've heard. Stories can almost come alive for students if they are allowed to act out the parts of the characters in some of their favorite stories. An activity can be developed that will allow students to correspond with other students as if they were these characters. After listening and discussing a story, students from two different classrooms could choose a character or be assigned a character to become. These characters can then correspond with each other through amateur radio. The students (in character) can share their feelings, day to day activities and future plans. Working together over the radio, students could develop a sequel to the original story. Each student will then write the sequel to the story and present it to the class.

Show and Tell

With amateur radio a better term would be "tell and tell." During show and tell students bring some item from home to share with the students in their classroom. With amateur radio students can share these items with other classrooms via radio. A student from class A can share an item with fellow classmates and students in class B. The student will be asked to describe the item making

sure they use as many descriptive words as possible and that they indicate size, shape, and color. Students in class A and B can ask as many questions about the item they wish. Students in class A will write a descriptive paragraph of the item. Students in class B will first draw a picture of what they think the item looks like and then write a descriptive paragraph describing their picture. After an actual picture of the item is received by Class B the class will discuss similarities and differences between their pictures and the picture of the actual item.

Conclusion

The activities in this paper are only a few that can be used with low-cost amateur radio. Many more activities have been developed and will be developed that will be effective in increasing student learning. The number of activities that can be developed is only limited to the imagination. Before any of these activities can be implemented, however, instructors will have to work together to modify and extend each activity to meet the needs of their particular group of students.

Use of Amateur Radio to Provide Telecommunications in Texas Education

Barbara Wade

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Information processing is becoming more important each day. The development of electronic mass storage of data and the ability of man to communicate rapidly across great distances have created a global society. We have more information available today than ever before. We have become accustomed to having instant access to information such as phone numbers which can be obtained quickly by calling information. It is also common to use the telephone to call for specific information such as the business hours for a company, or to determine if a store has some item in stock. Businesses are also using electronic mail systems and conference calls to increase efficiency. While the private and business sectors have been using technology, schools have typically remained isolated entities which still use paper and pencil for communication. Few classrooms have a telephone.

Telecommunications in Education

Predictions have been made that by the year 2000 between 72% and 95% of students will be involved in information processing (Moore, 1991). For this reason, students need to learn not only how to obtain the information, but what information is available, how to separate the useless from the usable information, and how to use the information. We must have some changes in education that will reflect the Information Age in which we live. Telecommunications is a tool that can help us make some appropriate changes in education. Educational uses of telecommunications are beginning to receive attention. This is evidenced by the recent rulings and mandates from the Texas Legislature. The Texas Education Code has been amended by Senate Bill #351 and House Bill #2885. These address the issue of technology in education. Among the provisions included is the use of telecommunications to provide comprehensive delivery of:

- curricula and in-service training;
- technical assistance;
- instructional software and other text and graphics; or
- audio, video, or digitized communications equipment and services.

In addition, the essential elements for computer science, computer literacy, and microcomputer applications require the use of appropriate technologies, including telecommunications. Telecommunications and distance education are among the top four priorities for educational technology in Texas.

Through use of telecommunications, students can have access to real-life uses of information. Access to current information on many topics and access to experts in various fields all over the world are just two of the educational benefits of telecommunications. In addition, use of this technology promotes student involvement, excitement, discussion and cooperative learning.

When many of us think of telecommunications, we think only of those communications which can be transmitted via phone lines. We may think of voice communications via the telephone or data transmission through a computer, modem, and phone line. And, in education, we always think of the continuous expense associated with the use of the phone lines.

Amateur Radio

There are, however, other options for providing telecommunications. One option is amateur radio. Both voice communications and data transmission communications are possible with amateur radio. Best of all, once the equipment has been purchased, the communications are free.

Three modes for using amateur radio telecommunications in education are monitor/receiver, licensed teacher facilitated transmission, and teacher/student licensed (Jones, 1991).

In the monitor/receive mode, students (and teachers) can receive information from various sources. Through short wave listening, for example, it may be possible to receive transmissions from BBC, Radio Moscow, Voice of America, and Radio Nederland. Transmissions from weather satellites may also be available. An inexpensive receiver and antenna are all that are needed to receive the transmissions, so this is an affordable educational link to the world. With additional hardware, it is also possible to have access to weather satellite imaging.

The teacher facilitated mode allows two-way communication between the classroom and other sites. The equipment required is somewhat more than that required when using the monitor/receive mode. Minimal equipment includes a transceiver and antenna. The cost of equipment is, however, still quite reasonable. In addition to the equipment, a licensed operator must be present when operating the radio transmitter. The teacher can obtain an operator's license by preparing for and passing a test. There is a small fee for the test for each license class. Several levels of licenses are available. The codeless technician class license is the only one which does not require proficiency with Morse code.

If the teacher obtains an operator's license, a wide variety of information access and exchange becomes available. Particularly for rural schools, it is difficult to provide experts in a field as guest speakers. This can be accomplished easily by using the amateur radio waves. For example, the classes at Sanger Middle School were able to communicate with the chief meteorologist at the South Pole via amateur radio. Experts in many fields can be contacted by this method. In addition to the availability of information from experts, the exchange of information can be accomplished by use of the airways. Exchange of information with other sites could provide real excitement in a science class. For students of foreign language, this form of telecommunications can provide the opportunity to speak in the language with a native speaker.

Packet radio can enhance learning, not through voice, but through a computer interface. A computer, an antenna, a terminal node controller (similar to a phone modem), a transceiver, and communications software are required for packet radio. Through packet radio, bulletin boards and electronic mail are available. Other uses of packet radio include local networks, real-time satellite tracking and access to databases.

This two-way communication can also benefit teachers. It allows teachers access to up-to-date information as well as providing communication with their

peers. The peer communication may be more of an advantage in small rural districts where there are not many teachers in a subject area.

The students are able to operate the radio without the presence of the teacher if the students themselves become licensed. This teacher/student licensed mode enables students to access information from sites other than school. Distance education could be supported by this form of telecommunications.

Summary

Technology, including telecommunications, must become a tool in our educational system. Amateur radio is one of several methods which can be used to provide telecommunications. All of these methods have both advantages and disadvantages which should be considered when deciding which method is appropriate. Although the quality of communications may not be as great with amateur radio, it is a cost-effective medium. It is therefore, a viable method for providing telecommunications. We need to remember to include all options when deciding what method(s) to include in education. Perhaps we should not limit ourselves to one method of providing telecommunications, but use each method where it is most appropriate.

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Part I: Pre-K/K

Radio Communications for Pre-K/K Students

Bonnie Adams

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Introduction

Communication Development refers to the child's development of the ability to use and understand language. Language has two major focuses: Listening (receptive language) and speaking (expressive language). Language is the most important vehicle through which the child is educated and serves as the foundation for learning. Because oral language is an outgrowth of experience, and concepts are developed through the use of language, it is essential to teach verbal skills through the use of concrete experiences relative to the child's previous experiences and cultural background.

In addition to the importance of communication development, it is vital that we provide more technological experiences in the schools. Because Pre-Kindergarten and Kindergarten students do not possess the ability to think abstractly, this is very difficult to do. However, my request would incorporate both scientific equipment and language development.

Equipment

Two sets of Fisher Price Walkie Talkies with batteries.

Goal

To incorporate the use of these radios into five of our thematic units. These units include: Space, Monsters, Community Helpers, Spring, and Christmas.

Classroom Use

The Space Unit usually covers a span of two weeks. During this time we make pretend rocket launches to the various planets. Upon our arrival, we look for Martians and discuss the physical environment and special characteristics of each planet. The radios could be used to communicate our findings back to our classroom space station on Earth. They could also be used to talk to any friendly Martians that we may discover.

Our Monster unit is completed in one week. It is centered around the book "Where the Wild Things Are" by Maurice Sendak. In this book a little boy named Max dresses up in a monster costume and travels to where the wild things are. He also becomes their king. In time he decides to return home. The walkie talkies could be used to communicate with his mother during his trip. They could also serve as means of communication between Max and the monsters.

Incorporating the Walkie Talkies into our Community Helpers unit would be quite simple. Students could talk to the different helpers about their roles and responsibilities in the community. The walkie talkies could also be the springboard to several dramatic play situations. These could include: a policeman calling headquarters to describe a lost child, a store owner communicating with a baker concerning bakery needs, a paramedic radioing the hospital to prepare for an emergency patient, and a teacher notifying the office of a stranger in the building. The administrators in our building currently carry walkie talkies throughout the school. Students can compare the two and note their likenesses and differences.

Walkie talkies in our Spring unit could be used to detail the groundhog's position. It could also be utilized for wind and weather conditions for kite flying. This is incorporating the prediction of weather patterns and recognition of the elements. The lion and the lamb could communicate with each other via walkie talkies. The lion could notify the lamb as to when he or she should appear. Because this unit is done prior to our Spring Break vacation, students could use the radios to tell each other their vacation plans.

The radios could be used in various activities centered around the Christmas theme. Santa could be told what specific toys to bring. Elves could be notified as to what items are on sale and therefore shortages of items could be anticipated. Students could discuss the weather conditions and possible problems that Santa may have. Children could also pretend to radio Santa the day after Christmas to thank him for their presents.

Conclusion

Along with the five unit ideas that I have presented here, there are numerous activities that could possibly be utilized in all of the thematic units. I have presented here activities that would allow my students to not only experience technology, but to also enhance their oral language development. Hopefully the students would emerge from these experiences with not only increased verbal skills, but also unlimited creative abilities and an unyielding imagination.

Part I: Elementary

An Affordable Approach to Telecommunications in the Elementary School

Larry W. Lucas

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Proposal

A pilot program is proposed which would implement an amateur radio-based telecommunications tool to enhance the teaching of writing in two fourth grade classrooms.

Problem

Telecommunications has been shown to enhance the integrated Language Arts curriculum (more specifically, writing) by allowing students in a school to prepare reports, articles, newsletters, etc. which they can share with classes in other schools. This sharing of written documents with peers via telecommunications provides a motivation factor for students to improve their writing ability (Clark, et al., 1989; Roberts, et al., 1990).

In many cases, however, the cost of having a dedicated telephone line installed in a classroom and the subsequent on-going monthly charges are prohibitive of such an enhancement.

A Proposed Solution

The added value offered by the telecommunications tool can be achieved via amateur radio, a replacement for the expensive telephone line. Once the required equipment has been procured, there are no monthly costs associated with the telecommunications activity (Horzepa, 1989; Seiger, 1988).

There is one requisite: there must be a Federal Communications Commission (FCC) licensed amateur radio operator present to supervise use of the radio equipment during the telecommunications activity. However, in a recent rules change the FCC created a new class of license referred to as a Codeless Technician license. To obtain this class of license, the applicant no longer has to learn the Morse Code. The applicant must study the FCC rules and regulations and basic radio theory necessary to pass 2 written exams in order to be granted the Codeless Technician operating license. (There is an amateur radio club available in most communities that would be willing to assist in training and administration of the qualifying exams.)

Plan Details

Conventional computer-based telecommunications requires a computer, printer, necessary communications software, and a modem which connects to the telephone line. To utilize this system in teaching writing at the elementary school level in its simplest form would require two comparably equipped classrooms (generally assumed to be in two separate schools within a district). Text files prepared by the students in one classroom would be exchanged with documents created by students in the other classroom. Telecommunications transfer of the data could take place on a prearranged schedule.

Since monthly telephone charges (for both schools) would be at a fixed rate regardless of the amount of usage (and would continue during the inactive

summer months), the expense for the curriculum enhancing tool via this communication medium would continue to grow.

A technology called packet radio, which can be used by a properly licensed amateur radio operator employing the required equipment, offers an affordable means of utilizing the telecommunications tool. After an initial one-time investment in the equipment for each participating school, there are no continuing monthly usage costs.

Table 1 compares the costs of telecommunications via the two communications media for a two-year period. Costs for the radio-based station are based on the medium priced system detailed in Table 2. For both systems, the availability of a computer, printer, and communications software is assumed and, thus, is not included in the cost figures. (Keep in mind that the cost in both cases must be doubled, since it requires a minimum of two classrooms to utilize the telecommunications transfer of information.)

Required Equipment for Packet Radio Telecommunications

Packet radio is the term used to refer to the communication of computer generated digital data by radio waves. Table 2 lists all the necessary components of a packet radio system and price ranges.

The Terminal Node Controller (TNC) essentially replaces the Modem required for conventional telephone line telecommunications. (Both the TNC and the Modem connect to the serial [RS232] port of the computer.) The TNC handles communications between the radio and the computer and converts the computer data to a format that can be transmitted via the radio waves.

Special communications software can be obtained that takes full advantage of the capabilities built into the TNC units, but it is not essential. Most communications software used with conventional modem/telephone line telecommunications will work quite well with packet radio systems.

Packet radio system components vary in cost depending on various features. For example, the radio cost may increase with increases in bandwidth and transmitter power output (higher power output from the transmitter can increase the transmission range/distance). Likewise, a better antenna can increase the communications range. More expensive TNC units provide more functions and features.

Advantages of a Radio-Based Telecommunications Setup

Aside from the expense advantages, careful selection of system components could expand the applications of the system. For example, if a sufficiently powerful radio/antenna system is obtained, monitoring and tracking of several orbiting communications satellites is possible.

Through TexNet, a packet radio network covering most of Texas and parts of Oklahoma, it would be possible for a classroom to communicate with more distant schools. Electronic mail and bulletin board systems are also accessible through the network. A weather server on the TexNet network can be contacted to obtain the latest weather information (Jones, 1991b).

Even though the system would not be based on the telephone communications medium, it would introduce the students to the use of telecommunications technology. Since teaching this technology is required in the Junior High School curriculum, it would be beneficial to introduce this technology to fourth grade students to provide an early introduction to telecommunications (Jones, 1991a; Moore, 1991).

The basic technology and techniques of this tool are very readily applied to other curriculum areas: mathematics, science, geography, current events, etc. (Goldberg, 1990; Knezek & Jones, 1990; Schrum, 1990; Stafford, 1990).

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Table 1: Cost Comparisons for Telecommunications Over a Two Year Period

	Telephone Based:		Packet Radio Based:	
Year 1:	Line Installation	$127	Equipment Cost	$700
	Modem	$140		
	Monthly Charges *	$569		
	Total	$836		$700
Year 2:	Monthly Charges †	$569		
	Total	$1,405		
Grand Total:		$1,405		$700

* Based on a monthly charge of $47.41 as quoted by GTE on June 21, 1991.
† Assuming no increase in monthly telephone rates.

Table 2: Packet Radio System Components

Component:	MIN Cost	MED Cost	MAX Cost
Radio (2-meter transceiver)	$250	$350	$600
Power Supply	$90	$110	$150
Terminal Node Controller (TNC)	$60	$120	$300
Antenna	$25	$50	$125
Cables	$50	$60	$75
Cost Totals:	$475	$700	$1,250

A Proposal for Radio Equipment for Elementary School

Dorothy Embry

Getting funds for technology is not always easy. What follows is a hypothetical letter to a school district central administrator, a school board, or a business/industry requesting funding for radio equipment for specific projects. Hopefully the content will assist teachers in successfully presenting their requests for funding support.

Dear Dr. Miller:

Future Elementary School is an inner-city school with a high percentage of "at-risk" students. The teaching staff is constantly searching for innovative ways to reach these kids. We have a need to motivate these students to learn geography and history, and we have discovered a most phenomenal means of doing so using amateur packet radio and NASA's ATS-3 communications satellite. We are asking you to help us purchase the equipment that would be necessary to provide this form of communication to our students.

Our sixth grade students have been inspired to communicate with the rest of the world as a result of a field trip to the University of North Texas. Some of our students were allowed to visit the amateur radio station on campus and observe communication using packet radio. Also with communications via ATS-3 satellite, two of our students were able to talk to students on islands in the Pacific. Student comments went something like this:

"That was so neat - talking to someone so far away!"
"Those kids are just like us!"
"I have to see where Tonga is."
"I have a bunch of questions to ask the next time we talk!"

When we got back to school, our students went scurrying to their text, to maps and other resources to find out about such places as Fiji, Tonga, & Hawaii. They were excited over the prospect of being able to talk with students from other countries as well as in the U.S.A. How nice it would be to have a radio set of our own! Then more students would be able to share this newfound means of communication.

The local Amateur Radio Club has already given us a commitment of help in the way of volunteer man-hours to help us get our program into operation and helping us with any problems we might encounter as the program progresses. These experienced radio “hams” were delighted to hear of our enthusiasm and gladly offered their help in assisting us with our program.

Three of our social studies teachers have become so interested in using the radio with their classes that each is working toward her amateur technician-class license to operate radio equipment (in voice-mode and digital-mode). After seeing the success with these fifth and sixth grade classes, we are sure that other teachers will want to get their license as well, and more classrooms will be able to utilize our investment.

Actually, with radio equipment necessary to communicate via the ATS-3 satellite, an amateur radio license isn’t necessary. The school needs only to apply to NASA and the FCC to get an experimental station license. Then, any teacher trained in operation of the equipment can operate the controls; they don’t need an individual operator’s license for that particular equipment Members of the local ham club are willing to modify inexpensive amateur radio equipment for use with the ATS-3 satellite.

We even envision that some of our students may want to get their own amateur license to operate a station in voice or packet modes. In fact, two boys have found a way to teach each other Morse code with procedures they wrote with LogoWriter. At least the seed has been planted and perhaps some students will become interested in radio as a profession or a hobby as the result of the exposure we have given them in elementary school.

Kid’s Network is a telecommunication system sponsored by the National Geographic Society and gives students an opportunity to do scientific experiments, share data and compare results with students in schools in other parts of the world. Traditionally this program has been available via telephone modem systems. It is possible to conduct a similar program with amateur radio. The advantage to using amateur radio is that there will be no charges for telephone usage, giving us much more time on-line.

Telecommunication is the thing of the future. Radio offers a way to transmit and receive communication from all over the world via satellite communications. The advantage of using radio is that, though the original investment is more, there are no continuing charges for operation: no telephone fees or on-line time charges. Thus, your donation of the moneys required for setting up our radio station will not require further budgeting of monthly costs.

Attached is an itemized list of needed equipment and cost. If you should need any further information, please contact Mr. Sam Smith at (214) 555-1212. He will be glad to answer any questions you might have.

The students and staff of Future Elementary School thank you for considering our proposal. Any contribution toward our own radio station will be greatly appreciated and used.

Sincerely yours,

Mr. Kelly Long,
Principal

Part I: Middle School/Junior High

A Proposal to Create a Global Communications Center

Nancy Hadley
Julie Raymond

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Why create a Global Communications Center?

A Global Communications Center (GCC) would expose both the teachers and students to more than one state-of-the-art telecommunications method, and allow them to choose the most effective and efficient method for a given task. The GCC would be created in a Three Step Plan.

I. **Step One**
   A. Establishes GCC in one junior high that acts as a research and development center for the district
   B. Connects other junior highs to an established GCC BBS with phone lines
   C. Creates a 2 meter radio station for voice communications and packet radio operation
   D. Purchases a Lumaphone
   E. Creates advisory board
   F. Purchases Hyperstudio to create curriculum for elementary schools
   G. Makes application to FCC for satellite station

II. **Step Two**
   A. Creates a packet radio station to collect information from satellites (ATS-1, DOVE, and SAREX II), to receive graphics by FAX, and to connect to TexNet and BBSs
   B. Allows for computer literacy essential elements to be dispersed into other curriculum areas

III. **Step Three**
   A. Links elementary schools to GCC bulletin board system

Introduction

"Telecommunications will be to the 90's, as Computers were to the 70's and 80's." This quote comes from Greg Jones of the Texas Center for Educational Technology. He states, "By using current technology examples in the classroom we may be able to raise the general level of understanding while providing an exciting new delivery mechanism for our kids to learn with and be motivated by." It has been predicted by the Texas Library Association that "...by the year 2000, 71% of the labor force in industrialized countries will work in the information and communications sector of the economy." With these predictions in mind, our school districts must prepare our youth to compete in this high-tech society. We feel that it is important that our children be exposed to multiple telecommunications methods in order to make them productive citizens of the future.

This is a proposal to create a Global Communications Center (GCC) for San Angelo Independent School District with the ability to disseminate computer literacy essential elements into various content areas. Using an authoring system, the GCC students would write software while learning programming skills and developing writing skills to meet essential element guidelines. An authoring system is an educational tool with a new format for providing instruction and information via a computer. The result is a software program customized to fit the needs of the designer.

The GCC would be the "hub" for connecting junior high campuses to the rest of SAISD and to the global educational community. It would act as the Research and Development center for piloting new, low-cost, practical telecommunications technology to be distributed throughout the district. The GCC would use multiple access methods to integrate technology into various content areas, depending on which media suits the curriculum. Computers would be connected by phone lines (land-based communications) or packet radio connections. Other communication methods would include amateur radios, satellite links, and Lumaphones. These multiple access methods would be created in a three-step plan. Step one has a state and local emphasis, Step two has a global emphasis, and Step three would expand the student base.

Why use a multiple access approach?

The computer literacy essential elements related to telecommunications require that a student "demonstrate the ability to select the appropriate tools for given tasks." This ability is also valued in the business world. In providing telecommunications experiences for our children, it would seem to follow that a variety of access methods should be available in order to select the appropriate method for a given task. The most practical means of implementing the various telecommunications modes would be to establish a BBS with minimum phone line installations augmented by a relatively low cost packet radio station and an amateur radio station capable of communication satellite connections. This would provide several "links" to information and students would be able to choose the appropriate method to approach a given task. "Through the use of computers, modems, satellites, ham radios, and Lumaphones, students will utilize the latest in educational and real-world technologies." This quote comes from the "geoInformatics" project description, a highly successful state-of-the-art telecommunications project in Sanger, Texas.

How could an amateur radio station be used?

An amateur radio station sends and receives voice communications to exchange cultural information, experimental information, and to enhance language studies. Amateur radio stations would be used to make initial contacts with teachers and students in other areas which are inaccessible through other means, emphasizing fun, learning, and future career possibilities in electronics.

What is land-based data communications?

Land-based data communications is communications between computers using phone lines and modems.

What is packet radio?

Packet radio systems provide a means of transmitting digital data (computer signals) via radio waves. Packet radio provides "error free" transmission and reception between two stations. It provides access to bulletin board systems and networks (TexNet for example) set up by amateur radio enthusiasts for educational purposes. Once the equipment is purchased, there is no cost for access time to the school district or the connecting campuses.

How are satellites used in the classroom?

Satellites can be used in both the amateur radio setup and the packet radio setup to monitor and receive weather tracking information, receive weather satellite imagery, contact astronauts in flight, determine time zones, establish cultural exchanges through pen pals, study orbital mechanics, and study computerized data-gathering techniques, to name a few.

What is a Lumaphone?

A Lumaphone is a telephone capable of sending a video picture transmission over regular telephone lines. It is a highly motivational device used to personalize communications.

Three Step Plan

I. **Step One: Establish a Global Communications Center (GCC).** This step would establish a Global Communications Center that would act as a research and development clearing house for the district. The GCC would be located at one of the four junior high campuses in the computer literacy lab. The GCC would be linked to the other junior high campuses by dedicated phone lines and all would participate in an existing bulletin board system housed on one of the high school campuses. The junior high campuses would also be able the connect to TENET, the state wide computer network system. The GCC, serving as the "hub", would ultimately gather information by means of amateur radio, packet radio, land based telecommunications, and a Lumaphone to disseminate information to the other junior high campuses. A 2-meter amateur radio station should be set up in the GCC to begin voice transmissions with various campuses. The teacher in the GCC would be required to have a Technician Class Amateur Radio License. He/she could be supported by a Business Partnership Advisory Board. This board would be made up of 5 technology experts (at least one amateur radio operator), the teacher in the GCC, and the Technology Director for SAISD to help write grant proposals, provide technical support and knowledge, and other resources.

This proposal would provide Hyperstudio, an authoring system which would be used in the writing lab portion of the GCC. This system enables the students to produce software that will run on the Apple IIGS for the elementary school campuses. SAISD would need to move or purchase ten Apple IIGS computers to put into the existing GCC computer lab for software development. Application should be made to the FCC for an Experimental Radio Station Construction Permit and License to operate radio transmitting facilities to access NASA communications satellites (specifically, ATS-3).

	Hardware Requirements	Cost
1.	Ten Apple II GS computers (move from within the district)	$0
2.	One Lumaphone	$750
3.	One modem for each Junior High campus @ $100 each	$400
4.	A dedicated phone line for each Junior High Campus	
	installation fee @ $130 each	$520
	monthly charge* @ $35 per month-1 year	$1,680
	* this monthly charge is the only ongoing expense per year	
5.	One Amateur Radio Station	
	HF transceiver with general coverage receiver	$1,500
	35 amp Astron power supply	$170
	2 20 DB antennas @ 250 each	$500
	Amplifier	$100

	Software Requirements	Cost
1.	Hyperstudio Site license including	
	10 microphones and 10 sound digitizers	$1,595
2.	Communications Software (public domain)	$0
	Total Step One Cost approximately	$7,215

II. Step Two: Establish a Packet Radio Station. Step two would establish a packet radio station in the GCC in order to receive satellite transmissions from ATS-1, (Applications Technology Satellites), DOVE, (Digital Orbiting Voice Encoder), SAREX II (Shuttle Amateur Radio Experiment II), bulletin board communications, and network communications using TexNet. With existing equipment and a software package, students could receive graphics by FAX.

The Computer Literacy Essential Elements could be dispersed into other curriculum areas. The computer is a communications tool and not just a subject to study. The GCC teacher and classroom teachers could co-design curriculum units that incorporate technology. The GCC teacher

and the classroom teachers could co-teach the units designed to meet the essential elements of computer literacy and the essential elements of the classroom teacher's subject area. The GCC teacher would be training the teacher in the use of technology in his/her subject area and together they would instruct the students. The teacher would be modeling to his/her students one of the computer literacy's essential elements, demonstrating the ability to select the appropriate tools for given tasks. These curriculum units could be posted on the district's bulletin board system for use throughout the district. The junior high students could apply telecommunications by developing units, possibly co-authored with high school students. These units could be published on the bulletin board system.

Hardware Requirements	Cost
Packet Radio Station	
Terminal node controller	$300
2-meter FM transceiver	$300
Antenna	$50
Software Requirements	$100
Total Step Two Cost	$750

III. Step Three: Link Elementary Schools To the GCC and BBS. Step Three would link the elementary schools to the GCC bulletin board system (BBS). The Business Partnership Advisory Committee would determine the selection of telecommunications method for each campus, either packet radio or phone line. At this point, a menu of student and teacher developed curricula would be available on the BBS for the junior high and high school students. The computer software developed using HyperStudio in the GCC would be available for the elementary school students in a variety of subject areas.

Hardware Requirements	Cost
One modem or TNC for each elementary campus lab @100 each (For modems, the dedicated phone line installation would have to be included)	$2,100
Total cost for Step Three	$2,100

Summary

This proposal attempts to provide a starting point for SAISD to begin using multiple telecommunications methods in the classroom in order to establish global communications. By creating a central location (the GCC) for telecommunications, these efforts can be coordinated and dispersed throughout the district. By linking the four junior high schools by direct phone lines, all junior high school students will have access to the same information with only one teacher per junior high trained and licensed initially in amateur radio. The district could tap into the resources available in the amateur radio community. The GCC also provides a starting point for establishing a district wide bulletin board system, linking high schools, junior highs, and elementary schools. The most practical and cost efficient means of communicating can be explored by providing both packet radio and land-based connection to the bulletin board system.

In the meantime, vast sources of information can be tapped by using radio frequencies with only minimal initial cost and no ongoing cost to the district. This investment would expose both the teachers and students to more than one state-of-the-art telecommunications method, and allow them to choose the most effective and efficient method for a given task. It also provides a highly motivational tool for the teachers to use in the classroom. With these tools, students are talking to other students around the corner and around the world, talking to shuttle astronauts in flight, talking to Soviet cosmonauts aboard the space station Mir, receiving images from national weather satellites, monitoring daily reports from a joint Canadian/Soviet ski expedition across the North Pole, participating in roundtable discussions with meteorologists and other experts, to name only a few.

If the predictions of the Texas Library Association come true, by the year 2000, our youth will need communications and information accessing skills for 71% of the jobs available and we have less than 6 years to implement programs in our schools to address this need. Using telecommunications in the classroom is not only an exciting and motivating tool for the teacher, it is a vital skill to be acquired for all students if they are to be active participants in tomorrow’s communications-oriented society.

Use of Packet Radio in Junior High Computer Literacy

Douglas Rowe

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Introduction

Seven years ago our committee approached the school board for possible adoption of an exploratory block of classes to be offered as a segment of the 7th grade curriculum. The block of four classes, each for nine-weeks, was a combination of industrial art, home economics, art, and computers. As you are well aware, this exploratory block has been extremely successful and has generated a positive consensus among the students, parents, and teachers.

Five years ago, due to the success of this exploratory block, a semester of computer literacy was developed and approved by you for the 9th grade. Two years ago, it was the students and parents who approached you to expand the computer program to the 8th grade. Likewise, that program has been extremely positive and successful.

During this span of seven years, I have been asked repeatedly by the students in the gifted and talented program if there was a computer activity be-

yond the regular computer classes that they could become involved with. It wasn't until this summer when I completed a special telecommunications class at the University of North Texas, that a perfect solution emerged for these students. The solution to their inquiries also will benefit the other students as it will both provide enhancements to the curriculum of the existing computer classes as well as to other subject areas. Adoption of this proposal would be a perfect match in educational philosophy that will be implemented when our school district changes from the junior high concept to that of the middle school concept. Indeed, one of the goals of the middle school concept was to involve the students with activities and functions of the community. Again, this proposal is a perfect and a meaningful match with that philosophy.

Proposal

Thus at this time, I propose that West Junior High pilot a program that develops an amateur radio station, with emphasis on packet radio. It would be a perfect addition to our curriculum program. In order to show you its advantages and features, a rather lengthy background of this proposal is included.

Background

School systems throughout the United States are recognizing the need for educational instruction to expand beyond the parameters of the school building. It has become essential with our emergence into the "Information Age" that our concept of education broaden to include the resources that are available outside of our immediate vicinity.

Sometimes we get so caught up in the new or recent developments in technology that we overlook the possibilities of past technologies which have been updated in capability with the advances in technology. With the increased sophistication of amateur radio technology and with the increased number of satellites using amateur radio frequencies, the value of this technology as a teaching resource should not be overlooked. Indeed, the usefulness of incorporating amateur radio into the educational system has become quite advantageous.

The purpose of this proposal is to clearly outline how amateur radio technology can easily, effectively, and inexpensively enhance the educational environment of our students. Is there an actual need for the integration of information technology into the classroom curriculum as implied in this proposal? Yes indeed, it is important to familiarize our students with the rapidly advancing technologies of telecommunications and data handling which are in the process of transforming our lives. Implementation of this proposal would provide sufficient hands-on time to enable this technology to become meaningful and understandable within their environment.

Packet radio and other modes of amateur radio should be considered as a valuable solution to the problems associated with providing communications within and beyond our sparsely populated state. Its technology makes distance teaching and learning truly interactive in every sense. Its costs are certainly competitive with any present-day delivery system and its future is ensured because of a strong satellite program utilizing amateur radio. That is, what has always hampered the incorporation of telecommunications into our school system before has now been eliminated by radio communications.

Location and Operation Analysis

At West Junior High, an amateur radio station, emphasizing packet radio, would be established in the library. A mobile packet radio unit would be used throughout the building. This would allow the classrooms to be connected to the majority of the world. A whole new frontier beyond the classroom is now within our reach.

Probably your first impression is that this proposal sounds quite expensive and would also require extensive modifications to the building. However, the low costs associated with packet radio and other segments of amateur radio have made it possible for the adoption of this proposal to easily fit within Rapid City's financial budget.

First, let's look at the expenses of other telecommunications systems that packet radio has eliminated. What has kept us from integrating telecommunications into the curriculum in the past has been both the high cost of telephone installation within the building and the high, ongoing monthly costs associated with connect-time via phone communications. Providing an independent phone line and the installation of a phone jack to each classroom desiring to use telecommunications was quite expensive. Likewise because of the installation cost, the number of classrooms available to use telecommunications was usually limited to one or two. And needless to say, you as a school board member were not thrilled with the idea of a continuous cost associated with a monthly phone bill. Because of the remote location of South Dakota, we were all aware that this monthly phone bill would probably be in the range of one hundred dollars.

This proposal would eliminate all of the above costs. First, there would be no monthly phone bill as communications over the radio are free. With our main unit set-up in the library as a repeater-type system, every classroom could use the mobile packet radio unit without additional wiring or phone installation. That is, installation costs and ongoing monthly costs have been eliminated through the use of radio communications.

Since the library's unit and the mobile unit at West Junior High would require only about the space of an average teacher's desk, no building modifications or additions would be needed. Because of the library's location on the second floor, installation of an antenna and then wiring the library's unit to the antenna would be minimal in both installation effort and cost.

You are probably in agreement that this proposal is sounding better and better already. Undoubtedly by now, you are starting to wonder whether or not there's a high cost associated with the initial purchase of this equipment. In actuality, you will soon learn that the cost is quite modest. In addition, there are possible resources within our community that could significantly reduce even these costs. Now that you are starting to become more interested, let's examine the potential that radio and satellite communications can offer toward enhancing the curriculum at West Junior High.

Curriculum Benefits

The ability to move this unit to other classrooms without having to worry about a phone jack is very important and greatly increases its usefulness. For in situation after situation the value of using microcomputers and modems was always limited or restricted to the nearest phone. Another major advantage of this proposal is that satellite time is also available at no cost. Yes, it will be possible to integrate satellite technology and data beamed directly from space into our curriculum. As you are beginning to see, the excitement and potential that can be generated via amateur radio is immense.

Indeed, packet radio is ideally suited for use in remote, sparsely populated areas. South Dakota fits that description to a tee. Although Rapid City is the second largest city in South Dakota with its population of about 60,000, there isn't a similarly-sized city or town within a three hundred mile radius.

Satellite and radio communications can be used both as an object of study and as an enhancement to many different subject areas. However, my proposal has this technology initially beginning with the talented and gifted students (TAG). Let me explain the rationale behind this suggestion and how it in turn would branch off to the other curriculum areas.

In order to use radio telecommunications, the operator must have a FCC license. If I was the only one having a license, then operation of the amateur radio station would be limited to before and after school and also a limited segment of the school day when I wasn't teaching. Although a unit on amateur radio would be presented in my computer literacy classes, the implementation of this technology into the curriculum of other subject areas couldn't be accomplished.

Since this technology would serve as a valuable enhancement to other subjects, there needs to be a way it can be incorporated. Thus, by having gifted and talented students earn their amateur radio license, this equipment could be officially operated by them throughout the school day. That is, instead of having just one class being able to use this technology, the entire school has the potential of using this technology. What exactly could happen if radio communications were incorporated into our school's environment?

Imagine the thrill and educational value of the French, Spanish, and German classes communicating with someone fluent in the language they are studying. Yes, we should be able to reach segments of the society that have these languages as their native tongue. Okay, perhaps some of these contacts might reside right here in the United States. But either way, this technology, without any additional cost, has extended our resources beyond the regular classroom.

Obviously Math and Science classes would benefit from this technology. Appropriate, meaningful, and relevant problems are abundant and easily accessible with this technology. The ability for students to gather data transmission directly from current sources and then to analyze this data has tremendous potential. That is, by utilizing this technology, students would be doing the type of problems frequently encountered in the work environment.

Geography and history classes would be enhanced. When you can actually communicate with someone that is residing in the area being studied, it generates enthusiasm and interest. Also by having access to bulletin boards and databases via this technology, students would be able to gather pertinent data about related topics. Indeed, learning about the daily environments and activities of these people far exceeds the value gained merely by textbook reading.

One of the primary goals of the QUEST class is to promote communication and to develop communications within the community. This is one of the major operating functions of amateur radio communications. Thus, using this technology without any additional costs, the students can expand their communications skills with people scattered throughout the country. Again, all of this communication is free. No huge phone bill to be received and thus no reason for us to attempt to limit the students talking to others.

The fact that this technology could even be used by the typing classes shows the multiple facets of this technology. With the technology proposed, not all communication has to be transmitted and received via voice. Connecting the packet radio to the computer would establish the keyboard as the mode of communication. This would provide useful and meaningful typing practice for these students.

Because this technology is a natural lead-in to various segments of the community (e.g. National Guard; Civil Defense; Ellsworth Air Force Base; weather, radio and television stations) both the students and the community can benefit in numerous ways. As school board members involved in the community, a lengthy discussion of the benefits of such activities is not needed as you can easily recognize the merits of this interaction. Included as part of the curriculum for the gifted and talented students will be field trips to different segments of our society.

Costs

Okay, you are now convinced that this is an extremely worthwhile project that should be adopted for use in the educational setting. Exactly what are the costs involved in the adoption of this proposal?

First of all, before purchasing this equipment, I would need to expand my present level of knowledge regarding this technology. Contacts could be made with Big Sky Telegraph of Montana, Frank and Reggie Odasz from the University of Wyoming, and Dave Hughes of Colorado Springs.

Total cost of the two stations will be approximately $1,200.

Using Weather Satellite Images in Middle School Science

Debra Bennett

CONTENTS

Introduction

The Sanger School District is located approximately 12 miles north of Denton, Texas. Sanger is trying many innovative new techniques for reaching its students. Among these are the geoInformatics project and a discovery lab for the intermediate school. The geoInformatics project is centered in the middle school and will eventually be expanded to the other schools in the district.

GeoInformatics is an integrated telecommunications project. Using satellites, lumaphones, computers, and land-based lines we hope to have our students exchanging information with others from around the globe. This information will be utilized in several subject areas including science, language arts, math, geography, and computer literacy. Phase 1 of the geoInformatics project

will be centered in the middle school science classes. The establishment of a worldwide weather study center is a subproject to be included through geoInformatics .

The National Weather Service has already installed a weather station at the middle school. As an official volunteer weather reporting station, the school reports the temperature and rainfall on a daily basis. The information is also sent to the NOAA for use in climatological studies. This enables us to give the students a hands-on experience in the collection and organization of data on a long term basis. It also introduces them to the different methods of distributing this data.

The integration of other aspects of the geoInformatics project into the weather studies program would greatly enhance the students' motivation and understanding of the weather data they are collecting. Specifically, the use of satellite picture images viewed live or recorded would be of great use. Much of the equipment needed for this task is already included in the geoInformatics project and it would be relatively simple and inexpensive to include the remote imaging with the rest of the package.

Educational Objectives for Remote Imaging

1. Expand students' knowledge about how weather data is collected using a hands on method.
2. Give students the opportunity to see first hand the usefulness of satellite imagery in scientific studies.
3. Expand students' geographical knowledge.
4. Introduce students to remote sensing and its many uses.
5. Introduce students to the use of computer enhancement of satellite images.
6. Determine if the use of video can enhance the students' motivation towards and understanding of telecommunications.
7. Develop a curriculum plan for using satellite images in science and geography classes on the middle school level.

Classroom Strategies

In our world of fast moving technology, it is an increasingly difficult task to keep the students interested. The use of a hands on science program can greatly enhance the students' motivation and interest. It is important that students begin to actually use scientific data and instruments instead of simply reading about them. When students are actively involved in their learning they are more successful.

The use of remote imaging would be a beneficial expansion of the current geoInformatics project. It would give students the opportunity to view and work with meteorological data used by scientists around the world. The project will also provide them with a unique opportunity to see how advanced satellite technology has become and how it can be used with video as well as voice correspondences. It is difficult for students to grasp the importance of these technologies without using them. In the classroom, the live satellite images would provide a motivational tool.

The first phase of this project would be implemented in the 8th grade earth science classes. These classes range in size from 18 to 28 students. Each class will include a wide variety of students and ability levels. One of the five classes will be participating in the F.A.S.T. program. This is a laboratory oriented program developed by the University of Hawaii.

The remote imaging equipment would be used by the students during the study of meteorology and as an example of remote sensing. Meteorology is a major component of 8th grade earth science. The remote images would be used at the beginning of the year when discussing methods of obtaining data about the earth, atmosphere, and other planets. It would then be reintroduced and utilized further during the meteorology unit.

The satellite images would give the students a first hand opportunity to recognize weather patterns, track their movement, and try to predict their effect. The imaging technology can be utilized in geography classes as well. Students can learn to identify places by shape and proximity rather than simply reading a name on a map. Another use could be in demonstrating how accurate maps can be made using remote images. Eventually techniques for using this technology could be developed for other areas such as history, math, and language arts.

Evaluation

During the first phase of this project, the evaluation will be relatively informal. In the beginning, the equipment will be new to both the teachers and the student so there will be a period of mutual learning. Later, the remote imaging will be evaluated along with the rest of the geoInformatics project. Dr. Knezek, Assistant Professor of Technology and Cognition at the University of North Texas, has been asked to assist in the development of an effective means of evaluating the entire project.

Because the remote imaging is being used as a motivational tool, one of the indicators of success will be the time students spend on task. An interested student is not as easily distracted. In order to evaluate if the equipment has enhanced the content itself, the students will be pre-tested and post-tested over the

meteorology unit to check for improvement. Eventually an improvement in the science portion of achievement tests should be seen due to the fact that the students themselves are doing the research and experiments. Due to time factors as to when the satellites can be reached, some classes may not be able to receive live images. This will provide a control group to which the groups can be compared.

Budget Breakdown

This budget does not include equipment already covered by the geoInformatics budget.

PRE-AMP	$150
BOX	$300
SOFTWARE	$99
TOTAL COST	$549

Summary

The methods used to teach our students science are rapidly changing. More practical methods of teaching research and development techniques are being constructed all the time. The geoInformatics program is one way to accomplish this constantly changing goal of giving students a real taste of how exciting and interesting true science can be. The remote imaging would add a new dimension to this project. It would give the students the opportunity to see actual pictures along with hearing words bounced off a satellite. In this age of video technology, this is an important aspect of this project.

As the cost breakdown shows, it would be relatively inexpensive to add remote imaging. The main problem we must overcome is the type of computer used. Even if an IBM-PC must be purchased, the cost is still reasonable for the overall effect the remote imaging will have on the classroom. The exact cost of the converter box for the Apples is not yet known because the technology is currently being developed. Hopefully by the end of the summer it will be available.

Sources Of Information

F.A.S.T Program:
Foundational Approaches in Science Teaching, Curriculum Research and Development Group, University of Hawaii.

Satellite Imaging:
Wallach, Jeff, Chairman Dallas Remote Imaging Group
PO BOX 117088
Carrollton, TX., 75011-7088.
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Integrating Packet Radio into the Computer Literacy Curriculum

Deedra Griffin

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The project I am proposing is one using packet radio to communicate with other packet radio stations in schools across the state of Texas. I am continually amazed about how little my middle school students in Plano know about other regions and people of their own state. Since Texas is such a large state, there are many varieties of people and lifestyles. I teach in a fairly affluent area and even so, many of my students have never traveled significantly in their own state. Using packet radio I hope to help my students learn about other people and their regions. While learning about telecommunications and packet radio, the students would also be reinforcing the other topics taught in computer literacy: word

processing, spreadsheets, and databases. The things to be learned about different areas of the state are limitless. Some ideas include the following: climate of area including temperatures, rainfall, snowfall, and humidity; hobbies and activities; typical jobs held in that area; population statistics; and types of industry in that area.

The project would be successful because of significant planning by the teachers involved. A very rigid time schedule would need to be established and followed closely by each teacher involved in the project.

A brief description of the project will be given in this paper. The actual lesson plans will need to be extremely detailed and cover specifics of time and the means of presenting and evaluating the objectives.

This project would be utilized as a telecommunications unit as well as a review unit for the final exam. It would most likely be scheduled as the last unit of the semester. The other units that are incorporated in this project (word processing, spreadsheets, and databases) have been previously learned in the semester so this would serve as a great review.

Lesson 1: Introduction to Packet Radio

The first lesson would of course have to be an introduction of packet radio. It is not necessary for the students to know many details of packet radio, but they do need to have a general understanding of how it works and of what it is capable. This would help to meet essential elements involving telecommunications.

The students will need very detailed instructions and a strict timeline to follow. They need to know exactly what is expected of them so they can be as efficient as possible. My idea is to have three students per group, but this number could be adjusted according to the number of schools participating in the project. Each group would communicate with another group of three from each of the other schools in the project. Throughout the semester each group will communicate with the same group.

Lesson 2: Word Processing

The second lesson centers on word processing. The topic the students will be writing about is a typical Friday night in each town. The students will communicate with the other groups from each school through packet radio. Each group will exchange descriptions of what they would do for entertainment on a Friday night. Then the students would be responsible for summarizing the information in

a report. The students would be reviewing the word processing concepts learned earlier in the semester.

Lesson 3: Spreadsheets

The third lesson would be on spreadsheets. The students would be responsible for two different spreadsheets. One would cover hobbies and activities of the students and the other one would cover weather statistics. The students would again have to communicate via packet radio. But before they did the actual communicating, they would have to do some research about weather statistics of their area. This might be done during part of a class period in the library. Once the information is accumulated, communicated, and received, the students would be responsible for designing two spreadsheets that would display this information.

Lesson 4: Databases

The fourth lesson teaches the use of databases. The database might include the following: student's name, school name, city, number of students in your grade, population of city, dad's job, and mom's job, etc.

These items would begin to show the students a little more about the different areas of Texas. Knowing the jobs of the parents might give an idea of the kind of industry in the area or whether this is a metropolitan or a rural area.

Lesson 5: Drawing Conclusions, Making Comparisons

After all the information has been received and put in a report, spreadsheet, or database, the students should begin to draw some conclusions about the different areas of Texas. The main differences will probably be between the very small schools and the larger schools. There will also be differences between metropolitan schools and rural schools. For example, the Friday night activities will probably be significantly different between the metropolitan schools and the rural schools.

Lesson 6: Practicing Computer Literacy Skills

Students are asked to perform certain commands on each of the reports. The students bring their Friday night activity reports onto their screen and the teacher instructs the students to spell check, italicize the title, search and replace a particular word, or move a certain paragraph to a different position in the report. On the spreadsheet the teacher can ask students to put the activities in alphabetical order. In the database, the teacher can require the students to search for all those schools having less than 20 students in their class or all schools that are in a city

of more than 100,000 people. Alphabetizing student names and creating reports focused on different features of the database are two additional practice activities.

Lesson 7: Reporting on Project Activities

As a wrap-up of the project, I would have each group of three students give an oral presentation on its findings. For the most part, the information of all the groups should be similar but since the groups did only communicate with one group from each school, some of the findings may vary a little. With so many different groups communicating with each other across the state, packet radio provides a low cost alternative to using a modem. By using "free" radio waves, we no longer have to worry about the high cost of telephone lines. After the initial cost of packet radio equipment, there are few additional costs involved. Therefore, students and teachers can use the system as much or as little as they wish without incurring more costs. Packet radio is definitely a great method of telecommunicating.

Using Packet Radio to Teach Telecommunications

Diane Case

CONTENTS

Introduction

The following is a proposal for using packet radio as a means of teaching seventh and eighth grade computer literacy students about telecommunications. Telecommunication (telecomputing) involves two computers communicating with each other at a distance. The most common method of communications is the telephone/modem system. Packet radio is an alternate method. Packet radio involves using a computer and an amateur radio system to transmit and receive "error-free" messages, data, or programs between two stations. Error-free means that all transmitted "data" will be received 100% intact or the transmission will be aborted. Many different types of telecommunication services can be accessed via packet radio: electronic mail, bulletin board services, data transfers, program transfers, file transfers, and database access.

Justification

Beginning in 1991, telecommunications was established as a required unit of study in Computer Literacy. The new essential element requires that the student be able to define related terminology, perform basic operating procedures and techniques, perform storage and retrieval of information, perform data entry, and demonstrate the ability to use the appropriate tool. A simulation of a telecommunications system will not meet all these requirements. The services that can be accessed via packet radio will allow students the opportunity to complete each requirement.

Packet radio is an economical method for teaching telecommunications. After the initial investment in equipment, the only on-going cost to operate the system is the electricity that is used (and that is very little). No fees are required to use the amateur radio airwaves. All services that can be accessed via packet radio are free. In contrast, telephone line bulletin boards and electronic mail services require a payment of a monthly basic fee, plus fees for any long distance usages.

The current trend in education is the use of new and innovative technology. Unfortunately, technology requires large budgets that most school districts are unable to provide. Packet radio is a good example of a new and innovative technology. As mentioned above, other than the initial setup costs, the cost to operate and use the system is very low.

The final reason for using packet radio is community involvement and positive public relations. Amateur radio communications require that operators of the radio transmitting equipment hold an FCC license. If the computer literacy teacher does not have a license, then it will be necessary to enlist the help of a licensed ham operator in the community. Packet radio only requires that the supervising operator be licensed; the students will be able to participate in all activities. There are several local amateur radio clubs, and the members are always anxious to sponsor projects that involve youth groups.

Equipment Requirements

1. Computer/terminal: Apple IIe or Mac can be used.
2. Radio: 2 meter FM radio.
3. TNC (Terminal Node Controller): the device that permits the computer to communicate over the airwaves via a radio.
4. Antenna: 2 meter vertical antenna is best.
5. Software: any software package that enables your computer to act as an ASCII terminal with an ordinary telephone modem, such as Microsoft Works.

Costs

1.	Computer	(can use the existing computers in lab)		
2.	Radio	$100	-	$300
3.	Power Supply	$100	-	$250
4.	TNC	$130	-	$150
5.	Antenna	$40	-	$180
6.	Software	free	-	$150

Course Objectives

1. Student will be able to define terminology related to telecommunications and packet radio.
2. Student will use the packet radio system to transmit and receive messages with another station.
3. Student will use the packet radio system to transfer data to and from another station.
4. Student will use a variety of application tools to complete a class project.

Methods

1. Students will read and discuss text and special handouts over telecommunications and packet radio. New terms will be emphasized in discussions.
2. Using a packet radio system, the students will leave a message for another station through the Packet Bulletin Board System (PBBS). Students will also be able to read any messages left for their station plus general bulletins.
3. Using a packet radio system and a packet network, the students will transmit questions to and receive answers from another computer literacy class station.
4. Students will use a word processing package to write questions to be transmitted. They will use a database package to create a file that contains information about the different contact stations. They will use a spreadsheet package to organize the data collected from questions. They will use a communication package to operate the packet radio station.

Evaluation

Evaluation of the course involves some formal and informal methods. Formal methods include a written exam over terminology and completion of projects. Informal methods include teacher observations, student's responses to oral questions, student's time on tasks, student's attitude toward projects, and student's motivation to complete projects.

Summary

This paper is a proposal to use packet radio as an alternative method to the telephone/modem system for teaching telecommunications. Packet radio provides the same services — electronic mail, bulletin board services, data/software transfers — as the traditional telephone/modem system. The major difference between the two systems is cost. Both systems have initial setup costs. On the other hand, operational costs are less for packet radio because all services that can be accessed via packet radio is free. In addition, packet radio gives the students the opportunity to interact with experts in the amateur radio field. For these reasons, the better method for teaching telecommunications is packet radio.

References

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Jones, G. (WD5IVD), & Maner, M. (WI5H). (1991). A General overview of packet radio from the user's standpoint. Packet Radio for Beginners Handout.

Part I: Junior High/High School

A Proposal for Establishing Amateur Radio in Secondary School Curricula

George U. Hubbard

CONTENTS

Introduction

Communication with people in other localities and environments has long been a vital part of the education process. Books and films provide vicarious contacts on a widespread basis, while foreign study programs and exchange

programs provide direct personal contacts on a much more exclusive basis. But with recent advances in technology, telecommunications can be used to provide all students with a form of personal contact on a worldwide scope.

In this proposal we advocate amateur radio as an inexpensive means of telecommunications to provide educational experiences. We also propose that the amateur radio linkage offers several advantages not readily available with more expensive university and industrial telecommunications systems.

Although this proposal is aimed at a high school physics class, we feel that amateur radio has application in many subject areas and at all school levels. It has already been used successfully in non-technical subject areas in secondary and elementary schools as well as in colleges.

The Concept

Amateur radio is an effective way of enabling students to have direct contact with people in various localities throughout the world. The equipment required for an amateur station is now physically small and relatively inexpensive, and is well within space and budget constraints of almost any school. Use of the airwaves, and of satellites for long distance communication, is free.

With an amateur station in the classroom, the students can have direct contact with other students, with subject matter experts, and with people of interest in virtually any part of the world. They can also receive weather satellite transmissions, communicate with astronauts in space, and do many other things not normally available in a classroom setting.

Experience thus far has shown that such direct contact can be very effective in providing instruction and motivation to students at all school levels. The major characteristics of amateur radio in the classroom are the following:

1. It provides a motivating influence.
2. It is inexpensive.
3. It is limitless in geographic scope.
4. Technical support is available when needed.

Expected Benefits

Schools that are currently using amateur radio in portions of their curricula have reported numerous benefits beyond their expectations. The major benefits and expectations of using amateur radio in the school curricula can be summarized and categorized as follows:

- **Stimulation and Motivation:** This is the benefit most frequently cited in the literature. For example, students who had no previous interest in learning geography suddenly wanted to know the locations and conditions after having talked (via amateur radio) with people in those places. Two representative instances will be noted. One group of middle school students got to talk with the chief scientist in Antarctica. It is reported that they asked him every conceivable question; they became keenly motivated to learn more as a result of the conversation.

  On one of the recent space shuttle flights, the entire crew were amateur radio operators. By pre-arrangement, they talked with several groups of students during their passes over the United States. Increased stimulation and motivation were again noted.

- **Direct Instruction:** Subject matter experts and other people of importance can communicate simultaneously with large groups of students in a variety of locations. As an example, Senator John Glenn recently discussed political issues and engaged in a question and answer session with students via amateur radio.

- **Direct Application:** In several reports of amateur radio experiences in schools, many of the students have become directly involved. Activities such as procuring equipment, constructing equipment, connecting and maintaining the equipment, raising money, etc. give the students a vested interest in the operation. But perhaps of equal importance, the students have meaningful application of other aspects of their school experience and have shown added stimulation to learn more in most other subject areas.

- **Civic and Social Responsibility:** Amateur radio operators provide vital communication services during times of disasters and other types of emergencies. They provide warnings before-hand and on-the-spot communication during such events. They are especially successful in getting messages to and from family members when other means of communication become unavailable. By participating in training exercises and in actual situations, students can develop a keen sense of civic and social responsibility.

Application Areas

Amateur radio can provide educational opportunities in all subject matter areas. In fact, it provides many opportunities that are not feasible through any

other means. The possibilities are limited only by one's own imagination. The following examples are but a brief sampling of the potential possibilities.

- **Foreign Language:** By talking with people in Mexico or in other foreign language speaking countries, students can develop language skills and self-confidence in an accelerated manner.

- **Geography:** By actually talking with people from other parts of the country (or world) and asking questions relating to their physical environments, students will be more motivated to learn more about the locations and conditions of those places.

- **History:** By talking with people in other areas and hearing of their ways of life, a study of historical events leading up to their current situations will be more meaningful. For example, talking to students in East and West Berlin about their lives before and after the dismantling of the Wall should produce a very meaningful sense of history.

- **Science:** By taking advantage of the students' interest in the amateur radio medium itself, rich opportunities would exist to teach elements of physics, mathematics, earth and atmospheric sciences, etc.

- **English/Literature:** By listening to and analyzing conversations by airline pilots, police calls, etc., the essential elements of precise communication can be studied and learned.

  By listening to a subject matter expert discourse on a Shakespearean theme and by asking questions in direct conversation, a greater understanding and appreciation can be gained.

- **Current Affairs:** Forums (formal or informal) can be held with students in other parts of the country to exchange differing perspectives on a common theme. For example, amateur radio can bring together students from such places as West Virginia, Detroit, Seattle, and Miami for a meaningful discussion comparing economics and the effects of the recession in areas dominated by coal mining, automobile manufacturing, aircraft industry, and tourism.

Many other topics could be discussed from diverse viewpoints. Such topics could be --

- What should we have done with Saddam Hussein?
- The high cost of health care.

- The example of international cooperation in Antarctica.
- The values derived from our space programs.

These discussions could be even more meaningful if subject matter experts are included for students to query.

Overcoming Possible Objections to Amateur Radio

Because amateur radio in education is a relatively new and revolutionary idea, objections to its use are likely to be raised. Teachers are already busy with lesson plans, reams of administrative paperwork, and outside interests. And there will be a natural resistance on the part of many teachers to becoming involved with something as technical as amateur radio. Some of the objections likely to be raised are the following:

1. *We currently have so many excellent aids to teaching, we don't need another.* The slogan, "We learn to do by doing", applies. We have excellent films and visual aids which the students are expected to absorb passively, and their interest and retention rates are not good. With amateur radio, they become actively involved, and experiences have shown this to be an excellent motivator.

2. *Amateur radio is too technical and forbidding for many teachers.* This may be a valid argument in part, but with one or two teachers who become competent and interested in using it, it can be used in a non-threatening way to benefit the entire school.

3. *Amateur radio will be too expensive for most school districts.* We will show that we can get off to a good start for only a few hundred dollars.

4. *Amateur radio in the schools is another fad that will pass.* If it proves ineffective, it will (and should) pass. But initial experiences indicate that it has tremendous potential for positive results. The majority of students who have experienced it have become enthusiastic participants.

Testimonials

A number of schools have already adopted amateur radio in one form or another into their curricula. Many reports have been given and papers written proclaiming its virtues. The following is a very brief sampling of some of the testimonials that have been given.

"I've seen youngsters, who have been 'written off' by other subject teachers, blossom and become 'stars' in Carole Perry's Ham Radio Class."

Stanley Katzman, Principal
The Rocco Laurie School
Staten Island, New York

"The question is, 'Has it helped teach geography?' Beyond my greatest expectations."

Bart Lawson
Geography Teacher
Mooreland, Oklahoma

"In whatever form it will take, amateur radio will continue to be a valuable academic course enhancement entity at ETSU. Amateur radio will probably be taught here for years to come."

Robert M. May, II
Department of Technology
East Tennessee State Univ.

Equipment Configurations and Costs

While a great variety of configurations and uses are available, we propose to start modestly and inexpensively. As the benefits of using amateur radio become established, we can then evaluate possible growth and expansion.

We therefore propose to establish what is called a packet radio station. Packet radio provides inexpensive remote linkage for computer-to-computer communication, and it derives its name from its transmission of digital data in bursts (packets).

Assuming that computers are already available (most microcomputers in schools have the required RS-232 serial port), the following additional equipment is required:

Radio (2-meter transceiver)	$250	-	$ 550
Terminal Node Controller	$100	-	$ 300
Antenna	$30	-	$ 150
Cables and Connectors	50	-	$ 100
Power Supply	$100	-	$ 150
Software			Free
TOTAL PHASE II COST	$530	-	$1,250

Networks are currently available to provide long distance remote communication. The TexNet network links major portions of Texas and portions of Oklahoma and Arkansas. There is no charge for using the network. Operators should have at least the FCC Codeless Technician Class license (well within the capabilities of teachers and motivated students). Packet radio provides direct, real-time communications, such as weather bulletins, exchange of computer programs, keyboard conversations, and many other uses. It also provides non-direct, delayed communication such as bulletin board services and message broadcasting.

- **Two comments:** (1) These costs to the school may be reduced by seeking used equipment (with high expectation of success), seeking private donations, and involving the students in work projects to earn some of the necessary funds. (2) This is a minimum equipment list, but enough to get started and to prove the feasibility of the venture. If successful in this phase, we will seek additional and more powerful equipment for more ambitious projects and uses. A quite sophisticated station can be established for $2,500-$3,000. Again, used equipment and student involvement can reduce this cost.

Implementation Plan

We propose an implementation plan in four phases: (1) Demonstration, (2) Installation, (3) Dissemination, and (4) Adoption. Mr. Clabberhorn, our physics teacher, has expressed a strong interest in using amateur radio in the classroom, and we recommend him as project coordinator. He has already begun studying for the necessary FCC operator's license.

- **Phase 1 -- Demonstration:** Several members of our city's local amateur radio club have expressed an interest in the project. They are willing to bring some equipment to the school and demonstrate some of the things that can be done. They are also willing to install a station in the classroom on a temporary demonstration basis for a one to two week period. Thus, we can have a trial period at no cost and at no risk.

  PROJECT: We will attempt two projects during this trial period. (1) We will establish contact with the astronauts on board the Challenger that will be orbiting the earth at that time. (2) We will attempt to communicate with some of the military personnel who participated in the Iraqi conflict and query them about their experiences. All students in the class will have the opportunity to ask questions. We will also try some random exploratory communications with various parts of the country.

EVALUATION: For Phase 1, the evaluation will be the subjective observation of the students' interest and participation. We will also determine to what extent they are willing to help in establishing Phase 2.

- **Phase 2 -- Install a Packet Radio Station:** The station will be installed in and used (initially) by Mr. Clabberhorn's physics class. Mr. Clabberhorn is currently studying to obtain his license on the Technician level. As noted above, we will need a transceiver, an antenna, a packet controller, connecting cables, a few tools, and storage space. We will conduct money-making projects, and search out sources of used equipment. The local amateur radio club has agreed to help, and they will provide technical guidance.

  PROJECT: We propose a four-week period for earning money and searching for equipment, followed by two weeks to assemble and install the equipment. We will then engage in a series of pilot projects for a six-week period. With Mr. Clabberhorn's guidance, the students will record and plot weather data, perform remote searches for information pertaining to a physics project, and will attempt to communicate with people in far away areas where significant current affairs activities are occurring.

  EVALUATION: To have some form of objective evaluation, Mr. Clabberhorn will prepare a pre-test to be given at the beginning of the six-week period, and a post-test to be given at the end of the period. The test scores will enter into the evaluation, but a subjective appraisal of the students' interest and participation will be the major means of evaluation.

- **Phase 3 -- Dissemination:** In Phase 3 we will demonstrate the use of the radio station to other teachers in the school. We will prepare demonstrations to show the value of this communication medium in teaching various subjects, especially in the non-technical subject areas, and we will prepare a short course of instruction for those teachers who would like to participate. We will work with willing teachers to carry out projects in their curriculum areas. Detailed plans will be developed as Phase 2 nears completion.

- **Phase 4 -- Officially Adopt into the Curricula:** At this point, the feasibility of using amateur radio should be established. We would then hope to work with school administration in making amateur radio an official part of curriculum resource, to determine to what extent the initial

installation should be enhanced, and to develop a long range development and curriculum plan.

Summary

Amateur radio is an effective and inexpensive way of motivating students and of providing educational opportunities not easily available through other means. Its effectiveness has been demonstrated in schools on all age levels. With the phased approach herein recommended, we can introduce and evaluate amateur radio as an effective educational resource with minimum risk and minimum expense.

Part I: Special Education

Implementation of Radio Technology in Classrooms for the Hearing Impaired

Matilda Reeder

CONTENTS

Introduction

- **PROBLEM:** The hearing impaired community, because of difficulties in communicating with a total communication environment, are more apt to withdraw into an isolated community. This creates an overall community loss of intellect, talent, and potential.

- **GOAL:** To educate hearing impaired students to the capability and importance of interacting with the total community by developing an understanding of and interaction with the community through current event information via a typical total communication method, the radio.

Proposal

For all those who work with the Hearing Impaired (HI), the concerns and conflicts of interacting with a Total Communication (TC) society are already known. For those who do not work with the HI community, large amounts of ignorance exists. This ignorance is promoted by the fact that HI individuals, with rare exception, look perfectly normal. They are not green or apparently malformed. They just cannot hear. Most cannot speak well. And the general population does not know their language, *signing*.

Because of these problems, the HI population is inclined to become prejudiced and insist upon sticking with "their own kind." That is, the group isolates itself. The problem with this isolation is the loss both the HI and TC communities suffer from the loss of intellect, talent, and potential held within each group.

The HI community can be main-streamed into the TC group, but they cannot be forced to interact. However, it is believed that the HI group can be brought to interact with the TC population in a manner that is comfortable and safe for both groups - **through radio interaction**.

The radio is probably one of the last communication areas considered for the HI group specifically because it is thought to be restrictive to auditory transmissions. Not true. There are two avenues of communication through radio that can be used successfully with the HI groups. The first method is as old as Edison; that is, Morse code. The second method is a new, rapidly growing method requiring the use of information exchange via a computer. This is called **packet radio**.

Morse Code Uses

Morse code is still used a great deal with radio buffs. This allows anyone looking for someone to communicate with in Morse code to do so with little effort. How can the HI community hear Morse code? The same way the hear television, *visually*. Rather than requiring a speaker to receive the sound of the code, a light can be rigged in place of the speaker. Morse code is sent in combinations of dots and dashes; that is, short and long tones. Light can be allowed to turn on in short and long intervals. Thus, the effect of "hearing" Morse code is accomplished for the HI student through sight. The change from the speaker to the light would be the only requirement for change in the standard radio set-up for HI students.

- **Who:** Radio communications should begin with students in the fourth grade. There is no firm setting on the grade. The course could be started sooner or later. However, the fourth grade is thought to provide a group that has conquered the labor of reading and should be writing well. Addi-

tionally, it is a group with whom the excitement and romance of "secret messages" will provide easy motivation.

- **When:** Training for the amateur radio license should begin at the beginning of the school year. The goal should be to have the class obtain its Novice license before the Christmas break. This would allow the spring semester to be used in combining the radio usage with all existing curricula.

- **Curriculum Uses:** The children can use the radio to identify information on the following topics:
  Geography: Where are their callers from? What is the weather like there?
  Social Studies: How is that person different from them? What is their town government like?
  Language Arts: Write introduction stories about themselves and their contacts.
  Current Events: What is going on in the contacts town/state? Can the student find this information in the newspaper?

Other curricular areas and topics are also available (math and science) but they were not determined to be as relevant to this first year group.

After the first year, the students, upon entering the fifth grade should be encouraged to continue practicing their Morse code. They should be tested often and encouraged to try for the more advanced classes of amateur radio license. The radio can be used in class on the same types of topic areas and expanded to math and science. During the sixth grade the students should be introduced to packet radio.

Packet Radio

Our society is leaning more and more heavily on the use of computers. Even the world of radio has developed uses for the computer. This allows radio operators to communicate using their computers instead of actually talking. Thus, packet radio fits well into the constraints of the HI community. Additionally, it provides the HI with experience using computers, certainly developing career skills for all students, regardless of hearing capabilities.

- **Who:** Packet radio communications should begin with students in the sixth grade. It was mentioned above that the efforts with Morse code should continue throughout the fifth grade. Thus, the sixth grade is a natural graduation from Morse to the computers. Additionally, by this

time the group should have had some experience with computers within the existing school curriculum.

- **When:** Training for the packet radio license should begin at the beginning of the school year. For all students who may have entered the school and do not hold an appropriate license, an opportunity should be provided them to obtain their license. For those waiting to obtain a license, they should be teamed with someone already possessing a license. All aspects of communicating with packet radio should be addressed within the first grading period (e.g., six weeks). After this has been accomplished, the students should be able to begin using packet radio with course assignments.

- **Curriculum Uses:** The children can use the radio to identify information on the following topics:

  Geography: The students should go international now.
  Social Studies: The students should discover different international governments.
  Language Arts: Any writing assignments regarding contacts would be appropriate.
  Current Events: Look up newspaper stories and attempt to speak/write with someone in that country. The students should try to validate newspaper stories.
  Math: Students should determine antenna requirements, understand band width restrictions and advantages, customize equipment if donations are provided, etc.
  Science: Studies with other schools or individuals can be generated. Interface with the educational efforts of the space program.

At this point the curricular uses of packet radio are restricted only by the instructor and the students. Even language could be studied, if the contact answers in his or her native language. After all, the HI community can learn to read and write other languages as well as its own.

- **Equipment and Costs:** The initial setup for the packet radio station is inexpensive and easy. The following equipment and costs are identified:

Antenna	$100
Coaxial Cable and Connectors	$100
Coaxial Relay	$50
Transmit Amplifier (40 Watt in, 150 out)	$250
Receive Pre-Amplifier (GaAsFet 144-148 MHz)	$90
Radio Transceiver	$750

Terminal Node Controller	$200
Computer (CPU, Color Monitor, Keyboard)	$1,500
TOTAL	$3,040

The costs here represent a top of the line setup for the school. Lower costs can be realized by purchasing less expensive equipment and through community donations. When obtaining this equipment, it should be considered that the equipment can be purchased as capital equipment and amortized over the life of the equipment. Additionally, if this initial cost of equipment is accepted, and less expensive, quality equipment can be purchased, then the savings can be used to further develop the program at the years completion.

- **Future Developments:** To maintain the interest of the HI students in the community, it should be considered reasonable to use the packet radio as a long term student development and motivational concept. After the first year, the students, upon entering the seventh grade should be encouraged to continue practicing their Morse code and the use of the computer. As the students progress through their middle and senior grades, the math and science uses of the radio increase. These can include the use of NASA's efforts to support education and provide students with the opportunities to venture into the harder sciences. These can be addressed by further teaching of communications methods and satellite technology.

Conclusion

This program is considered viable for both the HI and TC communities. It can be used with the students throughout their public education. Radio can provide hands on experience for students. These experiences will eventually weigh heavily with the students when they begin to consider their careers. Finally, it will provide an avenue of learning beneficial to the entire community.

Part I: Gifted and Talented

Integration of Packet Radio into K-12 Gifted and Talented Programs

Gayle Tuma

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Texas public schools must provide special educational opportunities for students classified as gifted and talented. One opportunity which would certainly be considered unique is use of packet radio for telecommunications. The purpose of choosing the gifted and talented group to begin using amateur packet radio is to develop a method of introducing it into the schools. We hope, during the process of using the equipment for the gifted and talented classes, all students will receive a benefit from the technology.

Each teacher of gifted and talented students in the Red Oak ISD is required to attend special inservice training sessions that focus on teaching strategies and teaching suggestions for this group. One such training program could be developed to study for the FCC amateur radio Codeless Technician Class License examination. Before they acquire the license, numerous activities could be

initiated simply by monitoring amateur radio activity. Once the they receive their license, the teachers would then be able to supervise various activities which used amateur radio for communications.

There are presently three elementary schools in the Red Oak ISD and a fourth to be opened 1994. These schools house grades K-4. This would be an excellent opportunity for connecting the grade levels among the schools. This could be accomplished via amateur radio (using both voice and packet modes).

Technology funds at this time are being used primarily to equip and update computer labs in all the schools in the district. With limited resources, it may be difficult to acquire any of these funds for packet radio projects. However, special funds are set aside for gifted and talented programs. The necessary equipment could be purchased by each school and used by all grade level gifted and talented students. Each school will need to determine the most appropriate placement of the equipment. The equipment will certainly not be restricted to use by gifted and talented students and students who are not in the gifted and talented program should be introduced to the equipment and technology.

Kindergarten

Kindergarten may need to concentrate on voice communication because writing skills at this level are very limited. The gifted and talented students are not separated from the other students during their school day as they are in the higher grade levels. They are usually given individual directions or added dimensions to regular assignments. These students could be the moderators of classmate dialogue. They could keep a record of the frequencies on which communications are made, and listen to other broadcasts during free-choice activity sessions.

First Grade

First grade gifted and talented classes can continue to advance with the activities presented in kindergarten and expand those to include an introductory discussion of radio waves and satellites. Toward the end of the year, when their writing skills have begun to develop, some short E-mail messages to the other first grade gifted and talented students could be sent under the supervision of a licensed operator. Greater cooperation with scheduling may be necessary with voice communication since separate class times are scheduled for gifted and talented classes beginning in first grade.

Second Grade

By second grade, the students can write E-mail messages, listen to NOAA broadcasts and discuss weather patterns, and monitor other frequencies for various information. A system of pen pals could be initiated with the other second grade gifted and talented students.

Third and Fourth Grades

Third and fourth grade gifted and talented students can continue with the suggestions for first and second grade and, if equipment is available, begin getting satellite images and discussing geographic forms and weather patterns from visual images. Third and fourth grade students may also want to begin statewide correspondence with other third and fourth grade students through ROSE, TexNet, or NETROM packet radio networks.

Some students might show an interest in obtaining their own amateur radio license by this age. Assistance in studying for the exams could be found through radio contacts during their gifted and talented classes. There is an Ellis County Amateur Radio Club which could offer assistance to the schools.

A Final Note

There are no essential elements for gifted and talented students. These students are to be challenged by enhancing the standard curriculum. The teachers of gifted and talented students may want to meet regularly to explore how packet radio applications can assist them in enriching the curriculum. These activities can expand the depth of language arts, science, social studies, geography, and math. The possibilities seem endless and the opportunities worthwhile.

PART II:
Lesson Plans for Use of Radio Communications to Expand the Walls of the Classroom

Part II: Elementary

ATS-3 Satellite: Linking 6th Graders and Pacific Islanders

Dorothy Embry

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NOTE: A special experimental Federal Communications Commission license is required to transmit using an ATS-3 station.

Aim

To use radio communication between our students and those in the Pacific Islands as a motivation to learning geography and history of the area.

Materials Needed

1. A radio receiver and transmitter (transceiver) with an appropriate antenna and a microphone
2. World, Pacific, and detail Island maps
3. Notebook for keeping data
4. Walkie-talkies for class practice

Preparation Note

Contact Pacific Island teacher through ATS-3 at University of Hawaii to have students available to talk with our students. Schedule a date and time. (If our equipment is not set up, arrange with another ATS-3 site to use their facilities.)

Motivation

Ask students:

- What do you know about Hawaii?
- Where is Raratonga?
- Have you ever talked to someone who has been there?
- Discuss the possibility of talking to students your age who live in the Pacific.

First Day

Turn on radio station to receive communication. Listen to transmissions to get accustomed to understanding radio voices. The teacher or other designated operator will demonstrate equipment operation.

Have the class note the voice codes that are used:

1. over — after call to a specific station
2. wait — stand by; please stand by
3. received — all received correctly (This is not a promise to take any specific action)
4. go — go ahead; any station transmit
5. clear — end of contact
6. closing station going off the air
7. break or back to you — the receiving station's turn to transmit

These international phonetics are used to help clarify station identification:

A - Alfa	G - Golf	N - November	U - Uniform
B - Bravo	H - Hotel	O - Oscar	V - Victor
C - Charlie	I - India	P - Papa	W - Whiskey
D - Delta	J - Juliett	Q - Quebec	X - X-ray
E - Echo	K - Kilo	R - Romeo	Y - Yankee
F - Foxtrot	L - Lima	S - Sierra	Z - Zulu
	M - Mike	T - Tango	

- **Follow Up:** Note problems in understanding voices on the radio. Discuss ways communication could have been improved. Ask students to plan topics for conversation for practice lesson tomorrow.

Second Day

Demonstrate how to use the microphone to transmit and receive. Place the mic a few inches from the mouth. Press and hold the button to send, release to receive.

Remember to use these guidelines:

1. Always be courteous.
2. Speak clearly and not too quickly (you'll have fewer requests to repeat).
3. Speak in normal tone, no need to shout just because you are sending your message a long way.
4. Use plain language and keep jargon to a minimum.
5. Press and hold the mic button while talking; release to listen.
6. Remember to be a good listener.
7. Do not do all the talking.

Divide the class into two groups. One group remains in the classroom while the other goes to an adjacent room. Give students the opportunity to listen and to talk using walkie-talkies. Students take turns as operator, sending and receiving calls. Listen for clarity. Remember 100% communication is the goal. Help students overcome shyness in using the mic and to talk about subjects students in the Pacific might like to know about.

- **Follow Up:**
  1. Discuss any problems in handling the equipment.
  2. What types of voices seemed to transmit well?
  3. Read information in the text about the Pacific.
  4. Use maps to identify distances and time zones.
  5. Locate Hawaii and other main island groups.
  6. Make a list of things you would talk about and questions you might want to ask someone who lives there.

Third Day

One group from yesterday represents Hawaii, the other Texas. Practice sending communications back and forth. Continue to use the guidelines from yesterday. Use questions the group has generated. These might include questions about family, housing, food, weather, entertainment, school. Answer any questions briefly and clearly.

Talk about NASA's ATS-3 satellite and Pan Pacific Education and Communications Experiments by Satellite(PEACESAT). Identify the location of ATS-3 at 105 degrees west longitude and area serviced by this satellite. Discuss

time zones to understand when we may communicate with the Hawaii and the Pacific islands. Explain that even though we have scheduled to talk to one elementary school, the air waves are open and other groups may be listening and will have an opportunity to respond.

- **Follow Up:** Have the group select two students who will represent the class to talk in the first exchange with Hawaii. Let group have input into what topics should be discussed. Talk about the need for other students to remain silent, so all may hear.

Fourth Day

Get radio equipment set up well ahead of time. All students are assembled quietly and the two students who will talk in place.

The radio operator will make the initial contact and then allow students to talk. The rest of the class will listen carefully to the conversation and take notes about new information given and any questions that come to mind as a result of what they have heard.

Schedule a second "meeting" with the contact school and decide on the subject for discussion.

The radio operator will sign off.

The quality of this experience will be determined by the preparedness of the students and the clarity of transmission.

- **Follow Up:** Discuss information received. Locate sites mentioned and note questions for research before next contact.

Fifth Day

Individual outline maps will be used to locate specific places of the people who responded yesterday. Use the outline maps for island groups. See the maps attached to this plan. Note scale of miles and longitude, latitude markings. Students work in log books, noting important facts about school, family, housing, city life, etc. Add illustrations from the pictures in their minds of life in the Pacific.

- **Evaluation:** The teacher might make these observations:
  1. Have students demonstrated greater interest in geography and people of the Pacific islands because of the radio contact?

2. Did using radio help them have a better understanding of life in the Pacific rather than using traditional means of presentation?
3. Did students seem eager to know more about that part of the world?
4. Were other resources sought for information needed?
5. Do students seem excited about using radio communication to reach other parts of the world?

Amateur Radio Pen Pals

Dorothy Embry

CONTENTS

Aim

To introduce students to other students across the country. To learn about other communities and their activities and lifestyles.

Materials Needed

Radio receiver and transmitter, an antenna, and microphone. Also information about other schools in this country having amateur radio facilities.

Preparation Note

Previous contact with teachers of other schools in the country with whom you can make contact by amateur radio.

Motivation

Explain to students how being a pen pal is making a friend with someone you have never met in person. Have students brainstorm some questions they

would like to ask. Also have students come up with information about themselves and their community they think is interesting to share with their pen pals.

First Day

Open a discussion about our community. What do we have here in Denton; what are we close to; what kinds of fun things do we do; how big are we, etc. Then narrow the scope to individuals—how old are you; how many brothers and sisters do you have; do you like to swim; etc.

Next make a list of information about our community and then an individual list of information of students. Use this information to make a list of information that will be interesting to find out from the pen pals. Collect the list to be used in the next lesson.

Second Day

Assign students each a particular pen pal from the participating school. Using the list from the day before, have each student compose a letter to his/her pen pal. Require that the letter include information about our community and the individual student as well as asking questions of interest about the pen pal and his/her community.

Third Day

With a prearranged schedule with the other school, make radio contact. Allow students in turn to talk to their pen pals using their letters as a guide for their conversations.

Fourth Day

Have students write a follow-up letter to the pen pal they spoke to the day before. Discuss impressions—did they have accents in their speech; was their voice what you expected; did you think it was strange that they all lived on farms; etc.

Fifth Day

Address envelopes and send letters giving pen pals addresses and pictures.

Follow-Up

Arrange for another pen pal radio contact on a monthly basis to further communications.

Uses of Packet Radio in Teaching 3rd Grade Social Studies

Julie Tubbs

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Introduction

Communication of material and knowledge is a way in which learning can become meaningful for many students. Packet radio is a tool which students may use to convey knowledge to others and a vehicle through which they may acquire information in return. They say the world keeps getting smaller and smaller. Through the use of packet radio, students can reach out to other parts of their community, state, nation and world. Therefore the following is a discussion of ways in which to incorporate the use of packet radio into the social studies curriculum at the third grade level.

History of the Community

Students need to know about and appreciate their own community. This is the focus of the curriculum at the third grade level. It is difficult to motivate students when they only hear about different facts related to their community. Through the use of packet radio, students will be motivated to research and learn more about their community if they will be sharing this information with others.

Therefore, I would like to first focus on the essential elements which deal with the history of a community.

Essential Elements

1. Describe community change over time.
2. Identify significant community landmarks.
3. Know facts of the community's founding.
4. Identify multiple causes of past and present events in the community.
5. Describe changes in family lifestyles.

At the NECC Conference a teacher, Susan Gordan, presented her utilization of telecommunications, via phone lines, to facilitate her students' learning about their community by sharing what they learned with students who were also learning about their own community. Before the classes communicated, each did initial research on their respective communities. They used research materials and community guest speakers. Then the teachers picked an era, such as the 20's, and the students created a fictitious character with a fictitious family from that era.

Each student did a character sketch of their fictitious character, their families, recreation of that time period, day to day events, etc. Then the students "became this character and corresponded via E-mail with their partners in the other school who had also created fictional characters from the same time period. Throughout the year the characters changed and progressed through the 50's up through to the present.

This project can easily be carried out using packet radio.

Culture/Human Behavior

Know importance of:

1. Cinco de Mayo
2. Martin Luther King's Birthday
3. Memorial Day
4. Other historical celebrations

Students could research the reason why each holiday is celebrated. Students could then plan ways to celebrate each holiday, and share these plans with a sister school. Not only would this meet social studies objectives, but also math skills, as well as many language arts objectives, could be incorporated into this unit.

Essential Elements

1. Identify and compare custom and folkways.
2. Compare a foreign country and the United States.

The packet radio station would be useful in meeting these two essential elements. It could be used to compare customs and folkways of a foreign country; we could work with a sister school. It would be interesting to compare different holidays each country celebrates and the customs associated with each in a pen pal type manner.

Conclusion

There are many ways in which telecommunications can be used to enhance the social studies curriculum. One of the added advantages of this communication process is the utilization of language arts skills, and math skills in some cases. Also, once you become involved in these projects, other utilizations of the technology will be realized.

The communication and application of the skills that a student learns in the classroom cause learning to be more meaningful and require active involvement by the student. Packet radio is an inexpensive technology that will enhance this process.

Using Weather Satellites with 3rd Grade Students

Julie Tubbs

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Geography

Part of the social studies course description at the third grade level in Grapevine-Colleyville Independent School District is that students expand their geographic knowledge and skills by studying the physical features of their community and its location in comparison to other communities. Also students learn map and globe skills in which they utilize these tools to locate the continents and major bodies of water. At the third grade level some students have a difficult time relating visuals seen on maps to real concepts such as the physical features, continents, and oceans. Through the use of weather satellites students can actually compare real pictures of actual physical features and land forms to maps that they use in class. This lesson plan utilizes pictures taken with weather satellites to help achieve the objectives stated below.

Objectives

A. Recognize that the earth is a sphere that can be represented by a globe.
B. Know that a map is a model of things and places.
C. Use a map key or legend to determine the meaning of map symbols.

D. Name and locate seven continents and four oceans.
E. Identify physical features: a. peninsula, b. island, c. mountain, d. plain, e. ocean, f. lake, g. river, h. gulf.

Essential Elements

1. Name and locate 7 continents and 4 oceans
2. Identify physical features

a. peninsula	b. island
c. mountain	d. plain
e. ocean	f. lake
g. river	h. gulf

Teaching Strategies

1. Identify the term "model". Discuss how models are like the larger objects they represent. Lead students to identify why models need to be smaller than the objects they represent.
2. Look at the globe. Identify it as a model of the earth.
3. Compare the globe to maps in the book. Compare and contrast the globe and maps.
4. Define and identify the following physical features: a. peninsula, b. island, c. mountain, d. plain, e. ocean, f. lake, g. river, h. gulf.
5. Make a book defining each term. Draw a picture that illustrates each term.
6. Locate your community on a map. Identify legend, map symbols, compass. Identify symbols that represent each physical feature.
7. Using a United States map, locate an example of each. Write a list of each feature physical feature listed above and where it is located in the United States.
8. Using pictures from satellites, locate examples of each physical feature listed above.
9. Compare and contrast the weather satellite images to the United States map.
10. Using a globe identify the seven continents and four oceans. Identify the physical features of each continent.
11. Using images from satellites, compare and contrast the physical features to the representation on the globe. Write a list of these on the board.
12. Using a balloon and paper mache, create a model of the earth incorporating as many physical features as possible. Include the seven continents in the correct locations.

Evaluation

1. teacher made tests.
2. student made model of the globe.
3. checklist of students demonstration of map skills.
4. checklist of students identifying an example of each physical feature on maps and on satellite images.

Introducing Students to the Packet Radio Communications Tool

Larry W. Lucas

CONTENTS

Note: Teachers must be FCC licensed amateur radio operators.

Daily Instructional Time Period

Forty-five minutes

Materials Needed for Each Lesson

1. Computer for each participating classroom.
2. A radio receiver and transmitter with an appropriate antenna.

3. Notebooks for student journals/logs.
4. Teaching transparencies and other appropriate audio-visual materials

Goals

1. To motivate students to improve their writing and reading communication skills by involving them in a packet radio telecommunication project.
2. To instruct students in the use of packet radio as a telecommunication tool.

Objectives

1. Students will be introduced to "telecommunications".
2. Students will be instructed in the basic fundamentals of radio transmissions.
3. Students will be introduced to radio-based telecommunications, i.e. packet radio.
4. Students will engage in "hands-on" activities of sending and receiving text files.

Lesson 1, Objective 1:

- **Activities**
  1. Discuss and define the term "telecommunications".
  2. Have students copy definition of telecommunications into their writing journals/logs.
  3. Discuss and give examples of how telecommunications are used.
  4. Direct students to list, in their journals, five or more examples of how telecommunications are used in society today.

- **Evaluation**

  Students' journals and class participation.

Lesson 2, Objective 2:

- **Materials Needed**

  Transparencies of radio parts and concepts with radio parts visible.

- **Activities**
  1. Review definition and examples of telecommunications by having several children read the definition and examples that they wrote into their journals.
  2. Ask students to raise their hand if they listen to a radio and then have them share what they listen to on the radio.

3. Discuss the uses of radio-entertainment and information dissemination. Ask students for examples of each.
4. Explain some of the basic principles of radio - electromagnetic waves and propagation, transmitter/receiver, antenna - using not only verbal explanation but also by showing the actual radio components or using visual diagrams.
5. Have students add these terms and a simple definition of each to their journals.

- **Evaluation**
  Student journals and their ability to point out or verbally explain terms.

Lesson 3, Objective 2:

- **Materials Needed**
  Crossword puzzles, transparencies

- **Activities**
  1. Review fundamentals of radio transmissions by calling on several students to read the definitions of the terms previously copied and by having various students point out the radio components that are concerned with each of the fundamentals being discussed.
  2. Discuss and identify, on actual radio or visuals, the following terms: frequency and wavelength, audio, packet radio.
  3. Instruct students to add these terms and definitions to their journals.
  4. Have students complete a crossword puzzle consisting of all the terms introduced thus far-they may use their journals.

- **Evaluation**
  Completed puzzles

Lesson 4, Objective 3:

- **Materials Needed**
  1. Instruction sheets
  2. Communications software package

- **Activities**
  1. Briefly review terms already discussed by grading puzzles together.
  2. Discuss and demonstrate radio-based telecommunications by demonstrating how to create a “text file,” how to load/run the communications software, how to connect with the other class, exchange files, and “chat”.

3. Pass out printed instructions on how to do the above procedures for students to put in their journals for reference and study.

- **Evaluation**

  Teacher observation of student comprehension through their verbal responses.

Lesson 5, Objective 4:

- **Activities**
  1. Review procedures from last session by having various students demonstrate procedures (use of instruction sheet allowed and encouraged).
  2. Divide class into teams of 2-3 students and have each team compose and send a short file. (Stress to students that the text sent must be grammatically correct with proper spelling and that they are to edit one another's work.)

- **Evaluation**

  Students' ability to send a short, correctly written, text file to the other participating class.

  Note: Continuing lessons (time interval would vary depending on the abilities of the children) would consist of guided practice with writing, editing, sending and receiving text files and the review of terms and concepts presented.

4th Grade Language Arts, Writing, & Packet Radio

Gayle Tuma

CONTENTS

The purpose of this lesson is to help fourth grade students improve their writing skills and to learn about other students. The students will be writing to electronic pen pals within the district or throughout the state using packet radio E-mail. The students should be acquainted with other E-mail network systems before introducing this plan. Each student will be paired with a student in another fourth grade class in Texas. It will also be necessary to find other students with appropriate equipment.

Objectives

1. Students will develop guidelines for writing to pen pals.
2. Students will do research about the area in which their pen pal lives.

3. Students will use proper punctuation and capitalization.
4. Students will edit their own writing and that of classmates.

Essential Elements

4Ai Use ideas and information from sources other than personal experience for writing
4Aii Expand topics by collecting information from a variety of sources
4Bii Delete superfluous information to address the purpose and audience more effectively
4Ci Participate in rewriting activities
4Cii Apply convention of punctuation and capitalization
4Cv Join related sentences into paragraphs

Materials Needed

1. Packet radio equipment (See TCET publication: Packet Radio: An Educator's Alternative to Costly Telecommunications)
2. Information about remote sites
3. Maps showing areas of contact sites
4. Lists of possible subjects to discuss with pen pal

Activities

These activities can last from a minimum of one week to a maximum of an entire school year. The teacher will have great flexibility depending on the interest of the students.

Lesson 1

Begin by discussing the sites that will be participating. As a group, students should make a list of questions they might want to ask children from each area. Students might be divided into smaller groups to determine initial contact information, then bring the whole group together to share ideas.

Lesson 2

Discuss questions that the students in the other sites might ask. Think of resources that might be helpful in answering questions about their region or school. Record possible questions and answers.

Lesson 3

Write preliminary messages and share them with classmates. Students will evaluate letters of their classmates and make suggestions for a rewriting process.

Lesson 4

Cooperating teachers will have determined pen pal partners in preconferences before beginning this project. Students will send E-mail messages to their selected partner. At least five questions will be asked in each message. Some may be questions concerning person aspects (i.e. When is your birthday?, Where were you born?, What is your favorite color?, etc.). Other questions will deal with subjects that will require some research by the receiver of the E-mail.

Lesson 5

Students will answer the letters from their pen pal. Students may want to work in groups to do the research required to answer some questions, and to proofread partners' responses.

Evaluation

The unit will be successful if the students are able to send and receive legible correspondence. The students should improve writing skills, and develop an understanding of telecommunications and word processing software.

The writing process will be complete after the initial contact and response, however, it can continue longer. The longer the project continues, the content of the correspondence will need direction and structure by the teacher. Specific topics should be introduced for research.

Packet Radio and 6th Grade Science: Land Biomes

Kathy Hootman

CONTENTS

Background

A biome is a large geographic region, found in many locations, with similar climate and similar plant and animal populations. The six major land biomes are grassland, taiga, temperate deciduous forest, desert, tropical rain forest, and tundra.

Objectives

For each land biome, the student will be able to:

1. describe characteristics and features.
2. describe the climate, considering the temperature and the rainfall.
3. describe common plant and animal types.

Length

Two Weeks

Essential Elements

Texas, 6th Grade Science 1A, 1B, 1C, 1D, 2B, 2C, 2D, 2E, 3A, 3B, 4A, 4B, 4D, 4E, 4F, 4G, 5A, 6B, 6C, 6D, 6E, 7A, 7B, 7C, 8B, 8C, 9D

Materials

1. Radio transceiver,
2. Packet controller,
3. Control operator,
4. Maps coded with the biomes of the world,
5. Charts with average precipitation of each biome, and
6. Charts with yearly temperatures of each biome.

Preparation Notes

For each biome the teacher needs to arrange a "net" of stations located in different areas of the world or North America. One contact for each biome would also work. Using packet radio to communicate with contacts in the various biomes, gather temperature and rainfall data for the biomes.

Motivations

1. Take the students on a walk outside. Ask them how they would describe our type of climate and our types of plants and animals.
2. Study information in the text about each biome.
3. Chart rainfall and temperatures in different biomes using packet radio to obtain the data.
4. While studying each biome ask questions like: Which biome would you like to visit? Why? What type clothes would you need to take? What type of animals could you pet?
5. While studying each biome make statements like:
   - Similar biomes are found at equal latitudes north and south.
   - Mountains have different biomes at different altitudes. Millions of species of animals live in the tropical rain forest biome. Few people live there and much of it has never been explored.
   - Animal populations may vary due to migration and hibernation.
   - Deserts cover about one fifth of the land on the earth.

Procedure

1. Divide the class into six groups. Assign each group a land biome.
2. Have each group prepare pertinent questions to ask contacts who live in their assigned biome.
3. Provide the groups with library research time or a list of possible question topics. (see attached list)
4. All students should also be prepared to answer questions about the biome in which they live.
5. On designated day of their assigned biome contact, students will give a brief introduction and present the questions they plan to ask.
6. Turn on the radio and log into a "net" or contact a station. Ask questions and record the contact for future processing of the information.

Follow-up Activities

Have each group compare the information gathered to the information in the textbook and write paragraphs to add to the textbook about the information they collected. Have them draw pictures to illustrate their paragraphs and make charts and graphs if possible.

Summary and Review

Have each group present their paragraphs, illustrations, and charts to the class.

Biome Question Topics

Common Plants, Gardens, Crops/Farming, Foods Eaten, Lumbering, Herbicides, Pollution Laws, Seasons, Adaptation Features, Housing Types, Jobs, Diseases Present, Outside Activities, Temperature.

Common Animals, Animal Population, Eating Habits/food Chains, Undomesticated Pets, Endangered or Extinct Animals, Pesticides, Visible Pollution Effects, Hibernation and Migration, People Population, Goods Produced, Clothing Worn, Construction, Sports, Rainfall.

Part II: Middle School/Junior High

Weather Patterns Using Satellite Images

Debra Bennett

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Time

2 weeks

Unit Objective

The students will be able to identify weather patterns, how they move, and what effect they have on our daily weather.

First Day

- **Objective**

  Students will be able to name the three types of weather systems - pressure systems, fronts, and air masses.

- **Materials**
  1. overhead projector
  2. radio and computer capable of receiving satellite images
  3. VCR
  4. current weather map
  5. teacher prepared notes over weather patterns

- **Method**
  1. Students take notes from overhead over weather patterns.
  2. Examine satellite images and compare them to a current weather map to identify where the systems are located.
  3. Have students begin to recognize cloud patterns as compared to weather systems.

- **Evaluation**

  Question students orally throughout the discussion to monitor understanding.

Second Day

- **Objective**

  Students will be able to describe how temperature is related to weather patterns.

- **Materials**
  1. radio and computer capable of packet radio
  2. access to a weather bulletin board system
  3. blank U.S. or Texas map
  4. current weather map

- **Methods**
  1. Obtain current weather data for U.S. or Texas using packet radio.
  2. Have students plot temperatures obtained on the blank map.
  3. Examine current weather map and compare the weather patterns to the temperatures plotted. Ask students to find similarities and differences.

- **Evaluation**
  1. Grade map.
  2. Monitor students for understanding during discussion of findings.

Third Day

- **Objective**

  Students will be able to identify the symbols used by the National Weather Service to plot information on a map.

- **Materials**
  1. handout with weather symbols on it.
  2. several weather maps with various symbols on them
  3. worksheet covering weather maps

- **Methods**
  1. Hand out sheet with weather symbols on it and go over it with the students.
  2. Hand out weather maps and worksheets and have students complete them.
  3. When students are finished worksheet, go over it with them.

- **Evaluation**

  Grade worksheet

Fourth and Fifth Day (a two day project)

- **Objective**

  Students will be able to plot current weather data on a map using the National Weather Service symbols.

- **Materials**
  1. radio and computer capable of packet radio and receiving satellite images
  2. access to weather bulletin board service
  3. blank U.S. maps
  4. atlases and/or maps of the U.S.

- **Method**
  1. Obtain current weather information from packet radio for the U.S.
  2. Have students plot temperature and pressure for a number of locations.
  3. Using pressure data plotted, students draw isobars.
  4. Now students can examine the satellite images and compare them to the pressure systems on their maps. Ask them to try and determine what type of cloud cover is associated with the different pressure systems.
  5. In groups, students draw conclusions about how pressure systems are related to temperature and cloud cover.

- **Evaluations**
  1. Grade map.
  2. Have groups present their conclusions to the class. Monitor for understanding during the discussion.

Sixth Day

- **Objective**

  Students will be able to describe how weather patterns move across the U.S..

- **Materials**
  1. radio and computer capable of remote sensing
  2. print out or video tape of images collected on days 1 and 4
  3. VCR

- **Method**
  1. Students examine the satellite images collected on days 1 and 4 and a current image.
  2. In groups, have students determine the location of high and low pressure systems for each of the images based on cloud cover.
  3. Groups then compare their answers and try to come up with an overall decision on the location of the pressure systems.
  4. Individually, students describe in paragraph form how the patterns have moved.

Evaluation

1. Monitor groups progress and the decision made by the class.
2. Grade paragraph.

Seventh Day

- **Objective**

  Students will be able to describe the type of weather associated with each of the weather patterns.

- **Materials**
  1. radio transceiver
  2. list of schools that participate in radio conferences - it should be prearranged which schools are going to be contacted.
  3. current weather maps for the world

- **Method**
  1. Using the radio, students exchange weather information with students from several locations in the U.S. and the world. Conference should be prearranged with the schools that will participate.
  2. In groups, have students try to determine, from the information received by radio, what type of weather system is present at each of the locations contacted.
  3. Have students consult weather maps to check and see if their hypothesis was correct about the location of the weather patterns.

- **Evaluation**
  Monitor students oral response throughout the lesson.

Eight Day

- **Objective**
  Students will be able to describe what information is needed to make a weather forecast.

- **Materials**
  1. weather maps for two consecutive days in the past
  2. today's weather map

- **Method**
  1. In groups, students list what types of information they know about the weather and how it changes.
  2. Class gets back together and each group contributes its list to come up with a master list for the entire class. Then discuss how this information is used to forecast the weather.
  3. Groups examine the first day of the weather maps from the past. Students come up with a forecast for the next day based on the information discussed earlier.
  4. Groups come back together and compare their predictions. Then compare their prediction to the weather map for the second day. They check to see how accurate their prediction was and evaluate the method they used.
  5. Groups look at today's weather map and try to forecast the weather for tomorrow.

- **Evaluation**
  1. Check students understanding orally throughout lesson.
  2. Circulate and monitor the progress of the groups.

Ninth Day

- **Objective**

  Students will be able to recall important facts and concepts having to do with weather patterns, their movement, and their effect on daily weather.

- **Materials**

  1. Today's weather map

- **Method**

  1. First compare forecasts with current weather map to see which group came closest.
  2. Have students individually come up with 5 potential test questions.
  3. Break students into groups and have them quiz each other using the questions they devised.

- **Evaluation**

  1. Circulate and check students' questions for accuracy.
  2. Grade students' questions.

Tenth Day

- **Objective**

  Students will be able to answer questions about weather patterns without the aid of a book or other resources.

- **Materials**

  1. written test
  2. radio and computer capable of receiving satellite images
  3. VCR

- **Method**

  Students take written test. As a part of the test, have students examine and describe weather patterns on the satellite images.

- **Evaluation**

  Grade test

Texas Essential Elements Covered in this Unit

1. Manipulative laboratory skills. The student shall be provided opportunities to demonstrate the safe use of earth science equipment.

2. The use of skills in acquiring data through the senses. The student shall be provided opportunities to:
   A. observe earth materials and structures, changes in the weather, astronomical objects, and
   B. examine geological, star, and weather maps.

3. The use of classification skills in ordering and sequencing data. The student shall be provided opportunities to classify objects or events according to their similarities and differences.

4. Experience in concepts and skills of measurement using relationships to standards. The student shall be provided opportunities to :
   A. measure earth science properties; and
   B. plot data on graphs, maps, and charts.

5. Properties and relationships of objects/events (spatial arrangement, position, etc.) to other objects and events. The student will be provided opportunities to compare and contrast types of weather systems.

6. The use of defined terms based on experience and observation. The student shall be provided opportunities to clarify operational definitions used to explain earth processes.

Computer Literacy and Packet Radio

Deedra Griffin

CONTENTS

Description

This is a three week lesson plan for a packet radio/review unit. Packet radio will be used to communicate with other schools in the state of Texas. Information gathered will relate to the life-styles of the people in that area. Certain other characteristics, such as weather statistics, will also be gathered. All of this information will be put into reports, spreadsheets, and databases which will serve as a review for the final exam. Essential elements which relate to telecommunications will also be met because of the use of packet radio.

Objectives

- Research students' own area in regards to entertainment, weather, activities and hobbies, population of city, and jobs.
- Actively participate in telecommunications by using packet radio to share the information in number one above and to also gather the same information.
- Organize the gathered information into reports, spreadsheets, and databases.
- Share the gathered information with their classmates by giving an oral presentation at the end of the unit.

First Day

Introduce unit. Explain in detail the requirements and timeline. Hand out printed timeline. Assign groups.

Second Day

Each group summarizes its typical Friday night. Half of class communicates with other schools using packet radio and sends and receives Friday night information. The other half of class uses library resources pulled into the classroom for researching weather statistics.

Third Day

Same as Second Day but groups switch and do what they did not do yesterday-packet radio or research on weather.

Fourth Day

Review word processing commands using a very short report that the students key in. Each group will key in a report using word processing software about a typical Friday night in the other cities.

Fifth Day

Half of class uses packet radio to communicate with other schools and share weather statistics about their areas. The other half of class finishes reports from yesterday and then prepares their statistics on activities and hobbies that they are involved in.

Sixth Day

Same as Fifth Day but groups switch and do what they did not do yesterday.

Seventh Day

Spreadsheet review by keying in a simple spreadsheet and performing various commands.

Eighth Day

Half of class uses packet radio to communicate with other schools. Groups will send and receive information about activities and hobbies. The other half of class will prepare spreadsheets using the weather statistics that they previously received.

Ninth Day

Same as Eighth Day but groups switch and do what they did not do yesterday.

Tenth Day

All groups prepare spreadsheets based on the information they received about activities and hobbies.

Eleventh Day

Review database commands by creating a small database.

Twelfth Day

All groups will use packet radio to communicate with other schools and share the following information: students' names, school name, city, number of students in your grade, population of city, dad's job, and mom's job.

Thirteenth Day

All groups will create databases to record information received yesterday.

Fourteenth Day

Summary of project by reviewing word processing, spreadsheet, and database commands. Students and teacher, could use documents already created to do the following: 1) In the report: spell check, italicize the title, search and replace, move a certain paragraph. 2) In the spreadsheet: put activities in alpha-

betical order. 3) In the database: search for all schools who have less than 20 in their class or all the schools that are in a city of more than 1,000,000 people.

Fifteenth Day

Each group gives an oral presentation on its findings. Students are evaluated by noting whether their presentation includes information relating to the unit and lesson plan objectives.

Part II: Middle School/Junior High

Making Texas Geography Come Alive

Dick Greene

CONTENTS

Objectives

Students should demonstrate the ability to:

1. gather and report information accurately
2. to orient a map and note direction
3. recognize the scale of a map and compute distance
4. use specific coordinates to locate places on a map
5. express relative location
6. read map symbols
7. compare distributions and locations of different features on maps and make inferences

Materials Needed

1. A packet radio station consisting of a computer, TNC (Terminal Node Controller), and a transceiver that operates on the two meter band.

2. A list of other stations on the Texas TexNet which have agreed to work with the students in your class.
3. Various types of maps of Texas and the surrounding states.

Preparation Note

The teacher should arrange in advance with teachers in other schools on TexNet for communication between schools. It would be advantageous to use stations in as many of the cities on TexNet as possible.

Activities

The class should be divided into work groups of two or three students. Each group will be assigned several stations they will be responsible to contact. The students are to complete the following:

1. Locate on a map, using longitude and latitude, their assigned contact stations.
2. Determine the relative location from their school of their assigned contact stations in both degrees of heading and direct line distance.
3. Using maps, determine the types of land forms and natural features that they would expect to find in the area surrounding their assigned contact stations.
4. Prepare questions for their assigned contact stations that will establish the accuracy of the information they have prepared.
5. The questions should be entered into the computer for later transmission to the various contact stations.
6. After receiving answers to their questions from the contacted stations, each group should prepare and present to the class an oral report on their assigned contact stations. The report is to contain all the information gathered.

Follow-up Activities

Using a large wall map, the students should locate and mark on the map each of the stations contacted by the class. The same stations may be used in the future for the exchange of information.

Part II: Middle School/Junior High

A Database Application Using Packet Radio to Collect the Data

John B. Willis

CONTENTS

In this teaching unit designed for a 7th/8th grade computer literacy class, the students will do the following:

1. set up a database file for tracking tornadoes
2. use weather data accessed from NWS via packet radio to complete the file
3. use the database file to plot tornado activity

To be most effective, this unit should be conducted during the months of April and/or May when tornado activity usually reaches a peak level.

In this activity it is assumed that the students have already been introduced to the concept of database and are familiar with the terms file, record, field, and data item.

Materials Needed

In addition to personal computers (in this case Apple IIe's) and printer, this unit requires database software, such as Appleworks, a wall map of Texas and Oklahoma, an LCD display unit, and packet radio equipment. The latter consists of a transceiver which can operate in the 144-148 MHz range, a terminal node controller, a 2-meter antenna, and software that allows the computer to act as an ASCII terminal.

First Day - Introducing the Lesson

To introduce the lesson, first review the meaning of database by soliciting responses from the students. Ask for examples of items that one would want to store in a database. Suggest weather data if no student happens to mention it. Ask what kinds of weather data are of most concern to people living in Texas. This should stimulate such responses as severe thunder storms, flash floods, hurricanes and, hopefully tornadoes. Focusing on tornadoes, ask the students what kind of information about these storms would be most helpful to know for people living in Texas.

Load the database software and use the LCD display so the students can follow along as they load the software also. Have them name the file "Tornado Tracker" or any other name that suggests the purpose of the file. Have them create the following fields, many of which should have come out of the previous discussion:

DATE:
TIME:
LOCATION:
LOCAL TEMPERATURE:
DURATION:
PATH:
DAMAGE:
FATALITIES:

While the above fields are displayed on the LCD, check to see that individual students are properly entering the fields on their own computers and assist

anyone having difficulty. After the fields are properly entered, have them save the file.

Second Day - Gathering Data

Distribute a blank record printout of the fields created on day 1 to each student. Discuss the type of data that will be put into each field. For example, will the local temperature be in degrees Celsius or Fahrenheit? Also indicate that the local temperature means the temperature at the location of the tornado, not at their own location. Decide whether it is more practical to measure damage in dollar estimates or by type such as “several homes destroyed”, “the main business section leveled”, “several roofs torn off”, etc. For the location field, decide whether to use latitude and longitude or the mileage from the nearest town (i.e. 5 miles sw of Palestine). Decide what units to use for duration (minutes or hours) and how many compass points to use for the path field. Eight should be sufficient (N, NE, E, SE, S, SW, W, NW).

Once the data types for the fields have been agreed upon, use a newspaper account of a tornado to fill in a record on the blank printout previously handed out. Give groups of 2 or 3 students a copy of the newspaper account and let them search the article to fill in as many fields as possible. When everyone has completed this activity, call on students to read their data entries for each field. Check to see that everyone is entering data items in the correct format.

Third Day - Using Packet Radio

The students should now have a good idea of the kinds of data they need to find for their tornado file. Now divide the class into teams of three for collection of weather data. One student will be designated to use the packet radio system to connect with the TexNet node and weather server. The second student will use the computer to search the weather service bulletins for tornado activity while the third student will record the data on a blank record printout.

Once the class has been split into teams, select one team to do the first weather data search. Use the LCD unit so that the whole class can monitor the activity. Once the search is complete, the team will post its data on a bulletin board so that the rest of the class can enter the data into the tornado database file.

Fourth - Seventh Day - Compiling Data

Each day at a designated time at the beginning or end of the class period one of the teams will use the packet radio system to gather that days tornado data. Each member of the team will rotate assignments each time it is that team’s turn to access the data. In this way each student will have an opportunity to operate

the packet radio system, use the computer and record data. This will be a daily, ongoing activity for as long as the instructor determines that it is worthwhile or until enough data has been gathered for the final phase of the lesson.

Final Day - Plotting the Data

The final activity for this lesson can be done as a class or by each team. Since each team has compiled all the data in the tornado database, it might be more interesting to have each team plot the data and make comparisons as a class.

To plot the data, have each team post a large road map of Texas and Oklahoma. Have them glue small funnel cloud cut outs to the map to represent the starting location of each tornado. Have them use a bright colored marker to indicate the path of the tornado from its initial location to its last sighting. If that data is not available for a particular tornado then have them draw an arrow to indicate the general direction of movement (See figure 1). Funnel clouds of varying sizes could be used to indicate either the relative size of the storm or its destructive capacity in terms of dollar damage.

Once the maps are complete, bring the class together to discuss the results. Have the students analyze the maps for any patterns, similarities or differences. Elicit responses to explain their observations. Since all students used the same database, have them try to explain any differences in the maps made by each team. Ask for conclusions about the nature of tornadic activity based on their results. Finally, have each team submit a written summary of its findings.

Extension Activities

There are many variations and further investigations that could grow out of this lesson. For example, the students could pool their data with another school or schools via packet radio or even expand their database into a total weather report. Each cooperating school could set up its own weather station and communicate daily or weekly weather reports over the packet radio system. This information could be entered into a weather database and, after a specified time, analyzed for various trends.

When one considers the opportunities for sharing information with other schools via packet radio and the number and variety of possible databases, it is easy to see that the number and variety of learning activities is almost endless.

A Collaborative Physical Science Project Using Packet Radio Telecommunications

Barbara Wade

CONTENTS

Studying Heat and Temperature

Packet radio adds to the study of this topic by allowing students access to real data concerning air pressures. Since it is not convenient to create an environment in which students can monitor temperature and control the air pressure, students are told that air pressure affects the boiling and freezing points of a substance. Demonstrations can be done using a bell jar, vacuum pump and water. However, the temperature is not easily monitored.

With packet radio, students can obtain data from several different sites to determine how air pressure affects the freezing and boiling points of water.

Packet radio also is applicable to almost any laboratory experiment that students might do. Students often do not realize the importance of writing accurately and clearly in their reports. The reason is probably that the student is writing for the teacher who they realize already knows what is being done. If the students must communicate procedures, data and results to other students at different sites, they are encouraged to realize the importance of clear and accurate communication.

Advance Preparation

The use of packet radio will require some advance teacher preparation. All teachers involved will need to communicate and agree on several items. These items may include

1) If all students will use similar or different methods.
2) If procedures used will be assigned by teacher or be determined by student groups.
3) If student groups will discuss procedures before or after initial contact is made. (If student groups are to agree on a procedure before experiment is done, another contact will need to be added before module 2.)
4) If there will be a follow-up to allow students at different sites to discuss results. (Follow-up could be done by videotaping the presentations and exchanging those with other sites.)
5) Times for contact to be made.

Teachers will also need to secure necessary materials for the experiment.

Lesson - Heating curve for water

- **Objectives:** The student will be able to:
  1. Predict the effects of adding heat to water.
  2. Predict the effect of pressure on the freezing and boiling points of water.

- **Module 1: Introduce/review concepts:** heat, temperature, boiling point, freezing point. This introduction or review may include a reading assignment, demonstration, or other traditional materials. Discuss methods of investigating the effects of
  1. adding heat to a substance and
  2. pressure changes on freezing and boiling points.

  If the class is strong, the student lab groups could be allowed to design and submit their own method of investigation. If the class is weak, after

prompting students for ideas, the teacher may wish to have all students use a specific method. A typical procedure might include the following steps:

1. Obtain ring stand, Bunsen burner, thermometer, and beaker of ice.
2. Measure temperature of ice.
3. Light and adjust burner.
4. Slowly heat beaker of ice until water has boiled for 3-5 minutes, recording temperature periodically (Ex: every minute, every 30 seconds). The time periods may vary depending on equipment used.
5. Turn off burner.
6. Put equipment away after it cools.

- **Module 2:** Students perform lab exercise, collect data and graph results. The collection of data may be done in a variety of ways including use of computer and peripherals. The graphs may be done by hand or by using a spreadsheet.

- **Module 3:** Students contact other lab sites via amateur radio to discuss procedures and exchange data.

- **Module 4:** Students write report (report includes data from all sites). Lab reports include title, hypothesis, materials, procedure, data, calculations when appropriate, and conclusions.

- **Module 5:** Student groups present their findings to classmates. The presentation of their report should include:
  1. procedure(s) used by their group and contact groups
  2. data collected by their group and contact groups
  3. conclusions of their group on the effects of heat on water and the effects of pressure on the freezing and boiling points of water. (Conclusions are not limited to the ones listed.)

- **Module 6: (optional)** Discussion of findings between contact groups.

- **Module 7:** Relate findings to substances other than water. (Remind students that from 0 degrees C to 4 degrees C, water behaves differently than other substances.)

- **Module 8:** Test for understanding of concepts.

Part II: Gifted and Talented

Using Amateur Radio Technology with Gifted Students

Douglas Rowe

CONTENTS

LESSON #1

- **Objectives**
  1. To generate the student's interest and enthusiasm about radio communications
  2. Demonstration of an actual DX amateur radio communication (Note: transmission should be planned in advance)
  3. Demonstration of an actual Packet Radio transmission
  4. To explain the organization of call signs for amateur radio
  5. Comparison of the prefix of amateur radio call signs to that of commercial radio and television prefixes.

- **Activities**
  1. Demonstration of DX communication
  2. Discussion of call signs used in amateur radio
  3. Have students locate on map where transmission in activity #1 originated.
  4. Demonstration of Packet Radio communication.

- **Homework**
  1. Have students learn the numbered regions of the amateur radio map.
  2. Students are to find and draw (maps provided below) the Boundaries and Prefixes of the call signs for commercial radio and television stations

LESSON #2

- **Objectives**
  1. To generate the student's interest and enthusiasm about radio communications.
  2. Explanation and background behind the usage of UTC (Universal Continental Time) and GMT (Greenwich Mean Time).
  3. Explanation of the basic vocabulary used in Amateur Radio (handout of key words included with lesson plan).
  4. To provide an understanding of present use of radio communications via field trip to National Guard.

- **Activities**
  1. Field Trip to the Communications Unit of the National Guard.
  2. Discussion of observations made during the trip.
  3. Develop and explain the concepts behind the usage of UTC and GMT.

- **Homework**
  1. Students are to learn at least half of the vocabulary words provided.

LESSON #3

- **Objectives**
  1. To generate the student's interest and enthusiasm about radio communications.
  2. Using an actual demonstration of an amateur radio transmission, the students should be able to:
     a. Understand the basic format of establishing radio contact.
     b. Know how to use a grid locator to determine both your location and location of contact.
     c. Be able to identify segments of the vocabulary or abbreviations that were used in this transmission.
  3. To further expand the vocabulary used in amateur radio.

- **Activities**
  1. Prior to actual radio transmission, the proper way of establishing contact will be developed (format that will expanded in group discussion is given below).

2. Grid location of our station will be determined.
3. Once contact has been established, the student must plot his location on the grid.
4. During transmission, the student is to circle any abbreviations made during the communication.
5. At least one more repetition of the above activities #2 through #4.
6. Show film focusing on amateur radio & its operation.

LESSON #4

- **Objectives**
  1. To generate the student's interest and enthusiasm about radio communications.
  2. To be able to give the correct pronunciation of alphabetical letters used in call signs, etc.
  3. To understand the function and operation of Civil Defense.

- **Activities**
  1. Present my name via this format, thus Doug Rowe would be given as: Delta Oscar Uniform Golf (Doug) Romeo Oscar Whiskey Echo (Rowe).
  2. Students will be able to say each letter of their first and last name according to the International Telecommunications Union Phonetics.
  3. When another student is pointed to, the student could give their name in this format.
  4. Field Trip to the Civil Defense Unit of Rapid City.

- **Homework**
  1. Each student would write a two to three page paper on observations made during this field trip.

LESSON #5

- **Objectives**
  1. To generate the student's interest and enthusiasm about radio communications.
  2. To develop the student' s understanding the ways amateur radio could be used at West Junior High.
  3. To introduce the students to the concept involved in understanding wavelengths.
  4. To introduce the students to the type of operation that takes place at a commercial radio station.
  5. To introduce the students to the type of operation that takes place at a commercial Television Station.

- **Activities**
  1. Group discussion of the ways that amateur radio could be used by:
     a. their activities (gifted and talented students);
     b. the computer literacy curriculum;
     c. other subject area's curriculum.
  2. Introduction of the concept of wavelengths.
  3. Field trip to KOTA (commercial radio station located in Rapid City).
  4. Field trip to KEVN (commercial television station located in Rapid City).

- **Homework**
  1. Each student would write a two to four page paper listing the similarities and differences between a radio and television station in regards to their mode of operation.

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