THE IMPACT OF TELEPHONE NETWORKS ON RURAL AND EDUCATIONAL DEVELOPMENT:
EXPERIENCES OF THE AID RURAL SATELLITE PROGRAM

by

Karen Tietjen, Willard Shaw
Academy for Educational Development

and

Clifford H. Block
Agency for International Development
Bureau for Science and Technology
Office of Education

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Telecommunications has had a powerful impact on development in rural areas of Peru and Indonesia. The AID Rural Satellite Program demonstrated new ways of providing telephone service and transformed the telephone into an educational tool through the addition of simple audioconferencing equipment.

INTRODUCTION

The tremendous growth in worldwide telecommunications services in the last few decades has caused revolutionairy changes in the conduct of business, banking, trade, and politics in both the domestic and international arenas. The economies of industrial nations increasingly depend on telecommunications networks for a multitude of services. The dozens of satellites orbiting the earth have created a worldwide communications system that truly makes the world a "global village" for those people with access to this system. The vast majority of the world's real villages, however, are generally cut off from domestic and international systems, not by choice but by circumstance.

Telecommunications services have been slow to reach into most rural areas of the world for several reasons: high costs, technical problems, and lack of a guaranteed return on investment. It is both cheaper and more profitable to develop telecommunications infrastructures for urban rather than rural areas. There is also the feeling among some planners that rural areas do not need or cannot really use telecommunications facilities and that the positive effects of providing such facilities does not justify the expense and effort. Some would say that basic telephone service cannot be provided until the users are able to pay for the costs. However, there is now a growing realization among expterts that telecommunications is an essential ingredient that hastens development and is not merely a result of it. A reliable telecommunications infrastructure can facilitate economic growth and promote national development aims. Telephone services to rural and remote areas can stimulate economic development and bring the rural resident closer to the mainstream of national life. There is also a growing feeling that access to communications facilities should be viewed as a social service to be provided by governments as they provide schools and not merely looked at in terms of the bottom line of a balance sheet. The Rural Satellite Program (RSP) of the United States Agency for International Development (US:AID) experimented with a variety of ways to provide basic telephone service to rural areas and has repeatedly demonstrated how the ordinary telephone can be transformed into a powerful educational tool at a marginal cost through the addition of simple audioconferencing equipment.

For the last six years, the RSP has explored the potential of satellite-based telecommunications systems as a means of providing relatively inexpensive rural telephone service, sharing scarce expert resources, and expanding educational opportunities to
remote and rural areas. In the Pacific region, RSP undertook two major field projects in Peru and Indonesia. The Rural Communications Services Project in Peru linked six towns in a remote Amazonian river basin with the domestic telecommunications system and provided basic telephone services for the general public and audioconferencing facilities for agriculture, health, and education programs. The Indonesian Distance Education Satellite System connected ten universities in a program of resource-sharing for course delivery, staff development activities, and administration. This report describes both of these projects and their different approaches to utilizing telecommunications services for the development of rural and remote areas.

PERU RURAL COMMUNICATION SERVICES PROJECT

BACKGROUND

Like many developing countries, Peru has experienced a steady decline in economic conditions over the past decade. In fact, the last 20 years have seen virtually no growth in the per capita gross domestic product. Faced with economic and social crises, the Peruvian government has emphasized the development of its vast rural areas in an attempt to increase lagging agricultural productivity. By opening up new production areas in the promising "high jungle" areas, the government hopes to redress existing food shortages and unfavorable agricultural export balance.

The Department of San Martin, in the isolated upper Huallaga Valley, has been the focus of agricultural expansion efforts. Very much a frontier area, San Martin is geographically separated from the commercial, political, and scientific centers of coastal Peru by the Andes. The absence of essential infrastructure and communication services—such as roads, transportation, postal and telephone systems—has conspired to compound the isolation and retard the social and economic development of the region. In short, San Martin has had little access to information essential to the development process—agricultural workers remained ignorant of new cultivation techniques, farmers had little means of acquiring market information and purchasing needed farm inputs, commercial transactions were limited to regional marketing centers, medical care relied solely on existing professional resources and educational and training opportunities were non-existent.

In keeping with Peru's rural sector initiative, the Peruvian telecommunications company—Empresa Nacional de Telecomunicaciones (ENTEL)—has explored ways to extend basic telecommunications services to rural areas. Under a cooperative agreement between USAID and ENTEL, the Peru Rural Communication Services Project (RCSP) was developed to integrate satellite communications into the process of rural development.

RCSP

The RCSP is based on the premise that basic telephone service is an effective means of overcoming infrastructure and resource limitations and constitutes an essential component in the development process. Under the RCSP, telephone service was provided to seven strategic rural communities ranging in size from 800 to 15,000 inhabitants, thus linking them with each other and with the rest of the country through the national telephone network. Building on the basic telephone system, audioconferencing facilities were developed to serve the health, education, and agriculture ministries. By linking field and extension personnel with regional and central ministry headquarters, audio-
conferencing improves the operations and outreach of these centralized institutions. The geographically isolated agricultural extension agents, health care workers, and teachers of the San Martín region benefit from improved access to Lima-based specialists for in-service training and consultation; the ministries now have a means of expediting administrative procedures, coordinating programs, and supervising staff. Overall, enhanced communications supported by the audioconferencing network make both the field personnel and Lima-based bureaucrats more responsive to each other's needs and consequently more effective in their work.

Management responsibility for the RCSP rests with ENTEL. As the national telecommunications authority, ENTEL is in charge of telecommunications and broadcast signal delivery, including telephone, television, telex, etc. The basic telephone service component of the Project naturally falls within ENTEL's domain, as does the operation of the teleconferencing network. However, in a significant departure from its traditional commercial service orientation, ENTEL also has assumed responsibility for the development and coordination of the audioconferencing service, including programming as well as technical system maintenance. To carry out the social service objectives of the Project, ENTEL established an "applications planning" unit charged with promoting, implementing, and evaluating appropriate communications programs which support the activities of the user groups. This includes needs assessment, program presenter identification, scheduling, and materials distribution. Ongoing engineering assistance was provided by ENTEL engineers assigned to the Project. However, as both the public telephone and audioconferencing services were routinized, engineering responsibility has been integrated into standard ENTEL operations with primary technical responsibility becoming that of the local ENTEL public call services staff.

**Telephone System and Audioconferencing Network**

The primary technical goal of the RCSP has been to develop the most efficient, cost-effective means of extending basic telephone service to the San Martín region to provide a blueprint for future expansions of ENTEL's rural communications system. Innovative adaptations of equipment and new network configurations characterize the RCSP technical system. The three larger towns of Juanjui, Tocache, and Saposoa were equipped with modified four SCPC channel earth stations and power generators; the four smaller communities—Pachiza, Huicirigo, Bellavista, and Tingo de Saposoa were connected to the telephone system through VHF radio links bridged at the Juanjui earth station. Simple audioconferencing facilities were installed at ENTEL offices or municipal buildings at the seven sites as well as at ENTEL offices in the commercial centers of Tarapoto and Lima.

As part of the effort to reduce capital costs, the standard earth station design was modified in three ways. First, 6.1 meter earth stations, never before used with INTEL-SAT domestic service, were specified as part of a calculated risk to conserve costs. Second, the earth stations were designed to be non-redundant on the premise that rural telecommunications could forego some reliability if system costs could be significantly reduced. Third, system installation would be conducted by ENTEL under manufacturer supervision, thus forgoing the "security net" of a turnkey contract and the increased costs associated with such an arrangement. Following installation, ENTEL was able to reduce the number of satellite circuits required by the new telephone system from ten to two, by placing the audioconferencing bridge in Lima.
Further cost savings were effected by the use of BUDAVOX radio equipment for the secondary site links, which Peru had acquired in a barter arrangement with Hungary.

Three years following initial installation efforts, the telephone network and audioconferencing system operate with high technical reliability: in 1985 the earth station sites experienced 365 days of uninterrupted service and only four percent of the audioconferences were cancelled because of technical reasons.

However, as with most new and sophisticated communication systems, it has experienced its share of start-up difficulties. During the first 18 months of operation the number of service interruptions was quite high because of modem and transmitter burnout, instability of the INTELSAT IV-A satellite and inadequate tracking indicators, and, of course, technician and operator unfamiliarity with the new system. A major disappointment has been the performance of the radio links. Due to the erratic performance and frequent breakdowns of the unreliable and acknowledgedly poor BUDAVOX equipment, the radio-linked sites were seldom able to participate in the scheduled audioconferences. ENTEL eventually decided to discontinue audioconferencing service at three of these sites and place the equipment in other locations with reliable telephone service.

Finally, many of the telephone system's problems were caused by its popularity. The unexpectedly heavy demand for rural telephone service overburdened the telephone system, resulting in equipment breakdowns, insufficient spare parts to service the system, inadequate power supply, inadequate channel capacity, and long lines at the public call offices. ENTEL has responded by increasing channel capacity, reconfiguring the system to route radio link traffic through the least used earth station, and automatic switching at the regional ENTEL office.

Development Applications

The key objective of the RCSP was to demonstrate the potential of rural telecommunications to serve as a catalyst for development and support sector-specific activities. The RCSP focused on both the role and uses of basic telephone and audioconferencing service in the rural sector.

1. Basic Telephone Service: In late 1983 telephone service was inaugurated at the three primary sites; a few months later the radio links were established at the secondary sites. At each of the seven sites, ENTEL established public call offices equipped with call boxes, which operated from early morning until late evening. Public call service is provided in two ways--telephone calls sent/received and telephone messages sent/received. Public calls are initiated at the ENTEL offices by placing a request with the operator. These requests are arranged sequentially, awaiting an open channel. The individual must wait at the office until his call is successfully placed or cancelled. A similar procedure is followed to receive a call.

Because most receivers (and initiators) of calls do not have home telephones, ENTEL developed a telephone message service to prearrange calls between two public booths or between a private phone and a public booth. When a message arrives in a community, ENTEL delivers it to the recipient's home or work place. These messages are quite brief, indicating merely that the recipient should be at the ENTEL office at a specified date and time.
Within months of service installation, the telephone service was used to capacity. In the first six months of service nearly 5,000 calls were completed per month over the system, ranging from 1,890 calls at the largest community to 39 calls at the smallest. This heavy traffic resulted in congested lines and long waits at the telephone office, with the radio-linked communities often losing precedence to customers at the earth station sites. The following year ENTEL added two additional channels per earth station. By 1985 the average waiting time to complete a call was 50 minutes, 74.3 percent of calls were completed, and traffic had risen to over 11,000 calls per month. In 1985 the telephone system produced over US $134,600 in revenues.

Contrary to expectations, the addition of the channels did not serve to reduce waiting time or improve completion rates. These two problems, in fact, worsened. Although more traffic was accommodated with increased channel capacity, the system was still overburdened by the ever-growing demand for telephone service.

Over the past three years of service, certain usage and user patterns have emerged. Initiated telephone calls have dominated the RCSP traffic. More than 93 percent of the calls are made from the network sites to locations outside the network (48 percent were directed to Lima); however, approximately 20 percent of the calls from the remote radio-linked villages are to the larger earth station communities. In general, there is little receiving activity. The average call lasts about six minutes and costs about $.75 US. This amount represents 0.5 percent of monthly family income ($153 US), a relatively high sum.

The "penetration" of telephone usage is high. Nearly two-thirds of the area's families have used the telephone system. The system's utilization rate equaled about 2,561 calls attempted per 1,000 residents. The average number of calls per user is 4.6 per month. Telephone is the preferred means of communication: users indicated that on the average they sent 1.8 letters and 0.6 telegrams per month, and made 1.4 trips to Lima and 4.4 trips to the regional commercial center of Tarapoto per year.

Furthermore, in the years following the initiation of telephone service in San Martin, users have indicated heavy reliance on telephone and telegram service and preference of other communications means, particularly mail, declined dramatically.

Seventy percent of the telephone users used the system for personal reasons, 27 percent for business, and 2.5 percent for both. However, the "commercial" users were by far the heaviest users: 45 percent of the commercial users placed over five or more calls a month, compared with 23 percent of the "personal" users. In fact, commercial users exceeded average use by 24 percent. Clearly, the telephone system is used to facilitate business and commercial activities in the region.

Although it was originally envisaged that telephone service would be limited to public call boxes and possibly made available to local sector offices, not long after system initiation ENTEL made available private subscriber service to homes and businesses, as well as government agencies, at the primary sites. The private subscriber service tended to alleviate pressure on the public call facilities, and, not surprisingly, the completion rate for "private" calls was less than that for "public" calls. Although private users did not wield the same influence on harried operators as the public call customer, the long wait for completing a telephone call was not as onerous. Telephones were installed about equally in private residences and businesses. The original plan to install telephones in sector offices was not implemented because of the high cost of running lines to community clinics, schools, and extension facilities and ENTEL's reluctance to
provide free telephone service to the individual ministries. However, several health administrators, quick to realize the value of telephone communications in their work, allocated funds from their own budgets to pay for telephone installations in zonal hospitals and clinics. The agriculture and education sectors, lacking discretionary funds, relied on the audioconferencing network.

2. Audioconferencing Service: The operations and development efforts of the social service sector in San Martin were severely handicapped by:

- inadequate access to information required to develop and provide effective services,
- lengthy delays in handling routine administrative matters,
- lack of staff supervision, and
- absence of in-service training programs for field workers.

The audioconferencing component was developed to support and strengthen these rural institutions. Audioconferencing facilities, consisting of a convener and push-to-talk microphones, were established at each site, either in the ENTEL office itself or a central municipal building. Targeted users were the field staff of the health, agriculture, and education ministries, including administrators and service personnel such as teachers, doctors, nurses, other health care workers, extension agents, etc. At each site a representative from each sector was designated "local coordinator" to work with ENTEL in identifying sector needs and organizing appropriate programs. A monthly schedule was developed detailing sector programs, participating groups, dates and time, and coordination responsibilities. The schedule was distributed at the beginning of each month to enable field workers to prepare for audioconferences.

Over a two-year period (1984-1985), 658 audioconferences were conducted--266 in 1984 and 392 in 1985. Over 80 percent of the approximately 900 sector personnel in San Martin participated in the audioconferences.

Initial reaction to the audioconferences was enthusiastic. However, technical problems with the new telephone system, as well as the audioconference management system, resulted in a 37 percent program cancellation rate. The radio-linked sites were rarely able to participate in audioconferences because of technical difficulties. Failure of coordinators or presenters to appear on time or at all discouraged those who had taken time to attend the conferences. Participant and presenter unfamiliarity with the interactive technology resulted in lengthy (78 minutes) and tedious conferences.

However, in 1985 improvements in all aspects of the audioconferencing system, programmatic as well as technical, rekindled user interest and confidence, and network use and management settled into a routine pattern. The cancellation rate fell to 29 percent, a dramatic 41 percent decrease from the previous year. Better network coordination and understanding of user needs lowered last-minute cancellations substantially, although general strikes periodically disrupted all sector activity and the erratic services provided by the radio links virtually excluded the secondary sites from participation. Improved network management also responded to user schedules. Previously scheduled between 9:00 a.m. and noon to free the telephone channel for commercial use, the 1985 audioconferences were shifted to lunchtime to accommodate health sector personnel, late afternoon for teachers, and Fridays for agricultural workers (the day set aside for office tasks). The management system relied less on rigidly planned monthly schedules to allow for "unscheduled" (less than six weeks in advance) conferences, which grew to 31 percent of total conferences.
Growing familiarity with the medium improved the quality and content of the audioconferences. Start-up delays were reduced to 15 minutes, and the average conference session lasted 54 minutes. Support materials were prepared and distributed more regularly, although postal and distribution services continued to cause problems.

The number of audioconferences increased in 1985 in all sectors except health, which was most adversely affected by the elimination of three radio-linked sites from the network. Average attendance per audioconference grew in every sector except agriculture; total enrollment, including repeat users, was 10,000 person sessions. In 1985 ENTEL itself discovered the utility of the audioconferencing network for training and management and consequently added its regional headquarters in Iquitos to the network. In fact, ENTEL use accounts for 33 percent of network use. Based on sector demands and requests of its own staff, ENTEL intends to move the decommissioned audioconferencing equipment to other regional communities.

Network use in 1985 was predominately for in-service training, which accounted for 64 percent of all sector and ENTEL programs. Administrative use fell from 30 percent in 1984 to 12 percent in 1985. This shift reflects user preference and need for in-service training, as well as frustration with administrative conferences which consisted mainly of directives communicated from ministry headquarters in Lima. With the emphasis on in-service training, Lima gained increased precedence as the originator of audioconferences. Indicating that regional experts were inferior to Lima-based authorities, sector participants expressed a strong preference for more centralized training programs. RCSP staff in Lima responded by recruiting the best qualified presenters--both within the central ministries and from other institutions and universities--to meet the growing demand for distance training. Although some programs continued to originate from regional headquarters of Tarapoto, there was little reliance on and interaction among local resources.

The health sector was the most competent and innovative in its use of the audioconferencing network, reflecting perhaps greater congruence of its communication and information needs with the service provided by the RCSP. Unfortunately, because of persistent non-performance of the radio links, the medical consultations to the most remote communities had to be cancelled. Clearly one of the most service-oriented activities, these distance diagnosis and treatment programs enjoyed great popularity during their short tenure.

However, other health programs flourished. To gain access to Lima-based specialists, an ongoing training program was developed with the Colegio Medico in four areas: internal medicine, pediatrics, gynecology and obstetrics, and primary health care. These conferences were well received by the participating doctors, nurses, nurses aides, and community health workers. Over a ten-month period, total attendance reached over 1,100. The RCSP network was also used to support the National Vaccination Campaign--for coordinating logistics, training workers, monitoring progress, and evaluating results.

The education sector conducted the greatest number of audioconferences. The network became the means of delivery for 32 workshops conducted by PROMULCAD, an innovative teacher training program. Special education was also a sector focus. A series of audioconferences were developed on learning disabilities. So successful were the programs that local parents asked to attend, and eventually, in an innovative mixed media event, audioconferences were broadcast live over the local radio station and
questions entertained through a "call-in" arrangement. Using new diagnostic tools gained through the audioconferences, the teachers were able to document local needs and successfully petition for the establishment of a regional treatment center.

The agricultural sector was least able to establish a viable audioconference program in San Martin. Plagued by strikes, poor leadership and management structure, only 88 audioconferences were completed in 1984 and 1985. Furthermore, the farm-visit strategy promoted by the ministry prevented extension workers from regularly attending audioconferences. However, in 1985 the new training orientation and revised schedule helped to increase the number of successful audioconferences by 57 percent.

What has telephone and audioconferencing service meant to rural San Martin? Rural telecommunications networks have had a powerful impact. The telephone service has been expanded twice; it has sustained a strong and growing demand, used by many people with relatively low incomes; it generates sufficient revenues to be partially self-financing.

At a marginal cost, the audio conferencing system supports many innovative applications and enjoys high public sector demand, as well as promising viable commercial use for the private sector. Over 92 percent of the audioconference participants indicated the programs improved their skills and job performance, and 55 percent responded that without the audioconferencing service they would be unable to obtain essential information and training. The network's popularity with rural workers is attested to by official letters to ENTEL requesting it to continue service after formal RCSP conclusion, even if they must pay for the service.

Based on the RCSP experience, Peruvian development agencies have for the first time made telecommunications a priority investment for rural areas. CORDES, the rural development agency, has agreed to contribute US $45 million to extend telecommunications service to 700 rural communities over the next five years. ENTEL itself has developed a plan to expand service to the Andean Trapezoid area and provide audioconferencing service. Rural communications in Peru has achieved recognition and credibility as a catalyst for development.

SISDIKSAT: THE INDONESIAN DISTANCE EDUCATION SATELLITE SYSTEM

BACKGROUND

Higher education in Indonesia is now facing a number of challenges that require innovative responses. Years of heavy investment in primary and secondary education have greatly increased the number of high school graduates. Each year nearly one-half million graduates compete for fewer than 100,000 openings at the 43 government-supported institutions of higher learning. The 400,000 "losers" must look for places at inferior private universities, wait for next year's exam to try again, or give up their goal of a college degree.

Indonesia's rapid economic growth and expanding need for trained manpower add increased urgency to the demographic imperatives. The existing colleges and universities are unable to meet the demand and fulfill the nation's needs because of several limitations including manpower and financing, low productivity rates, and the extremely
uneven development of these institutions. Widely scattered across Indonesia's many islands, they also face the limitations of growth based on self-reliance.

In 1976 Indonesia became the first country in the developing world to launch its own satellite—the Palapa A-1—and to develop a satellite-based communications network which has been crucial in linking the thousands of islands comprising the 3,000 mile-long Indonesia archipelago. A decade later Indonesia is again in the vanguard as it pioneers an innovative project utilizing its telecommunications capacity to meet its development objectives.

Under an agreement between USAID and the Directorate General of Higher Education of the Ministry of Education and Culture, the SISDIKSAT Distance Education Project was created to meet the challenges of increasing the opportunities for and quality of university education.

SISDIKSAT

The SISDIKSAT Distance Education Project was designed to maximize the scarce professional and teaching resources of the Eastern Islands Universities Association, a group of fairly new universities and teacher training colleges on the islands of Kalimantan, Sulawesi, Maluku, and Irian Jaya. Linking ten distant and remote universities with a telephone-based "electronic classroom," SISDIKSAT is used to provide rarely available academic courses to university students, upgrade faculty knowledge and teaching skills through in-service training programs and seminars, and facilitate administrative and institutional communication. Its effect is to make the expert resources of one university available to the other participating universities, thus multiplying each professional's outreach and effectiveness. Also included in the SISDIKSAT system are the Java-based Bogor Agricultural Institute—Indonesia's premier agricultural university—which serves as a center of excellence, and the Directorate General of Higher Education, which is the bureaucratic headquarters. SISDIKSAT's main activities are course sharing, seminars, audio-conferences, training programs, message service, information exchange, and demonstrations which often include other user groups outside the university community.

(One example of this is the "electronic classroom" installed in 1985 in conjunction with a small solar-powered earth station located in the remote area of Wawatobi which will serve the agricultural research station and local extension workers.)

SISDIKSAT is managed by a core staff at the central project office in Ujung Pandang with locally appointed staff at each site. At project headquarters, the staff consists of a Project Administrator, a Program Coordinator and a Chief Technician with a few support staff. It is important to note that all of these positions are part-time, filled by local university personnel in addition to their regular teaching and professional duties who receive little in way of recompense. These personnel are responsible for the planning, administration and management, and technical operation of a 13-site system which spans 2,500 miles of ocean and offers more than 15 courses a semester.

Technical System and Electronic Classroom

SISDIKSAT is a fully interactive (i.e., two-way) communication network, utilizing two dedicated voice channels on the Palapa satellite and a four-wire ground telephone
system. It consists of an audioconferencing channel with loud-speakers and 12 microphones in classrooms seating from 40-80 persons. A second channel is used for a number of purposes: facsimile transfer, private phone conversations, telewriting via a graphics system developed by the British Open University, and as a back-up channel. Each site is also equipped with auxiliary power supply units to meet frequent power outages.

System design, procurement, installation and burn-in took place over a two-year period (far longer than anticipated) and resulted in several technical innovations designed to limit costs and enhance reliability. Unlike other conferencing systems using a terrestrial bridge to link multiple sites, SISDIKSAT uses the satellite itself as a bridge in a "loopback" (half-duplex) design. Although only one site can talk at a time, it reduces the number of channels that need be leased. At a range of $125,000-$190,000 per channel per year, the cost-savings is significant. However, one disadvantage is that line noise originating from one site can automatically be passed to all other sites. To prevent this, a "gating" system was placed between the classrooms and central telephone exchanges at each site. A signal from the transmitting classroom closes the transmit circuits at the other end of the local telephone line thus preventing the transmission of line noise and other localized disturbances to the entire network. In areas where electrical storms are frequent and local lines are normally poor, this device greatly improves the audio quality throughout the system.

The issue of maintenance and repair of the equipment has also been tackled. Although technical training and extensive spare parts have been provided, logistics and manpower continue to be a problem. Getting a failed piece of equipment to SISDIKSAT headquarters takes coordination and money, and once at Project headquarters, repair takes time and skills that are at a premium. More than sophisticated technical skill and knowledge, the technical system requires vigilant management and a small, but full-time, cadre of technicians to ensure all equipment at each of the 13 sites is in good operating order.

Despite these problems, the technical system has performed very well throughout the past year. Only 2.5 percent of SISDIKSAT program activities have been cancelled because of technical problems between August 1985 and the present. (This excludes the one percent down-time resulting from the Palapa satellite's unprecedented move out of orbit in September 1985.) However, this 98 percent reliability record of the audio capacity does not extend to the graphics transmission. Although the facsimile component works well, the telewriting equipment has proved disappointing. Its poor performance record results from several factors: overly complex design, susceptibility to climatic conditions, demanding technical oversight, and extreme sensitivity to line noise--a virtual given of the Indonesian phone system. Its function has therefore not been incorporated into regular SISDIKSAT activities, with apparently no ill-effect on the system's pedagogical effectiveness--contrary to the earlier claims of teachers that visual capabilities were essential.

Programming

In October 1984 SISDIKSAT initiated a trial semester offering two courses; it is currently completing its fifth semester with a regular schedule of 15 courses. To date it has delivered 60 undergraduate courses such as statistics, research methods, poultry production, and forestry. Use extends beyond normal course delivery to other activities including training, faculty seminars, and administrative conferences and to other user groups. The Open University uses SISDIKSAT for regular in-service training for its local
tutors in the eastern islands and for administrative communication with its provincial offices. The Directorate General of Primary and Secondary Education is now launching in-service training for its teachers. Other groups such as the Summer Institute of Linguistics and the Bogor Graduate Agriculture Program use the system for weekly management meetings. Initial problems of attendance and regularized use have diminished as both the users and SISDIKSAT management staff become more familiar with operational procedures.

Course Delivery and Attendance

SISDIKSAT emphasizes primarily a three-pronged course exchange program among its members. SISDIKSAT develops course materials in the national language, delivers courses for at least two semesters to meet the short-term needs of its members, and works with junior faculty so that they can teach the courses in the future without SISDIKSAT. Courses are selected over the system by participating institutions' representatives--generally the Vice Rektor for Academic Affairs--based on need and resource availability. Both the courses and the course teams are identified at the same time, and the sites indicate which courses they will follow. No site has yet participated in all courses; no course has yet been taken by all sites. The three-person course team prepares the written materials and/or study guides with assistance from SISDIKSAT staff. SISDIKSAT reproduces the materials and distributes them to the participating campuses. The course team shares the instructional responsibilities over the system (generally 100 minutes per week) while local tutors at each receiving site supervise students, lead local discussions, administer and correct tests, and generally serve as the arms and eyes of the distant lead teachers. Course credit and grades are given by the local institution, not the offering site.

Of the 60 courses delivered so far, 29 have been extensively monitored. SISDIKSAT classes have averaged 97 minutes per week with 31 minutes for student questions and teacher answers. This compares very favorably with a survey of regular on-campus classes that lasted only an average of 65 minutes with only 4 minutes for student questions and teacher answers.

Uneven student attendance from week to week and semester to semester has been a problem. Attendance has ranged from 1,500 a week in the February 1985 semester to 2,600 in the September 1985 semester. Attendance varies because of holidays, the courses offered, and the timing of the semester. Many of the SISDIKSAT institutions have slightly different academic calendars, thus making a coordinated semester almost impossible. Most sites have at least one local tutor supervising the satellite class, but in some instances 3-5 faculty members are present for the classes. Many of these faculty members attend classes on their own to learn more of the content of the course and see how it is taught by an expert. In fact, SISDIKSAT specifically reserves one half hour per week following the regular class session for meetings between the faculty and lead teacher as part of its teacher upgrading program.

Both student and faculty figures show substantial attendance during a 12-week core period when all participating universities are functioning full time. Attendance traditionally is low during the initial and final three-week periods of the semester largely because of the different starting and ending dates of the universities. For example, the September 1985 semester began with a disappointing turnout of 200-300 students and 40-50 faculty. However, this number grew until it reached a peak of 3,085 students and 92
faculty in week 11 of the semester. The next semester began with approximately 900 students, reflecting a better match with the schedules of many institutions.

SISDIKSAT was able to deliver 83 percent of its scheduled class sessions in 1985-86. Less than three percent of classes have been cancelled because of technical problems.

In contrast with the low failure rate of the technical system, failures in the "human" system accounted for 88 percent of the class cancellations. The main hindrance to course delivery was teachers failing to come to class at the proper time (51%), followed by the absence of teachers and students at class time (20%) and the absence of students (17%). Although student absence was mainly confined to the first weeks of the semester, teacher absence was a common occurrence throughout the semester. Only 13 of the last 24 courses did not have any cancellations because of teacher "no-shows."

For an explanation of these course delivery patterns we must look to standard Indonesian university practices. First, among the participating BKS universities there is no standardization of the academic calendar, which creates considerable confusion in coordinating a ten-university project. Even at individual institutions the starting times are a bit murky—it often transpires that the first month of a semester is spent on organization and producing a class schedule.

Further, little emphasis is placed on class attendance, as attendance records are neither kept by the teacher nor seem to figure in the final grade. Finally, tremendous latitude is exercised by the teachers over what, when, and how they are going to teach. They are free to cancel classes at will and re-schedule them. The students seem to have little say in the matter nor do interviews reveal that they are unduly disturbed by these capricious scheduling practices.

Use and Participation

The SISDIKSAT schedule is almost fully booked from 8 am to 5:00 pm for courses and training. In actuality, network use starts two hours earlier with administrative conferencing between the three universities in the eastern time zone, and continues into the evening with specially requested courses and Open University use. However, nearly every week sees some discrepancies between what was planned and what actually happens.

Primary use is for "course delivery": 35.8 percent of use was devoted to this activity during the last two semesters. Optimum use, based on the scheduled 100 minutes per class, calls for 44.8 percent of SISDIKSAT prime time (8:00 am to 5:00 pm). Cancellation of classes and failure of teachers to fully utilize the allotted time accounts for this lower figure. There was also a great shortfall in the utilization of a half hour per course designated for tutor meetings. The tutor-teaching meetings are important to SISDIKSAT's teacher upgrading program, and omission lessens the anticipated "multiplier" effect. However, 100 percent of 40 tutors surveyed said that their SISDIKSAT experience improved their ability to teach similar courses. Eighty-six percent said they increased their knowledge of the subject area even without regular tutor meetings. "Silence" accounted for 17 percent of SISDIKSAT time which corresponds to the discrepancy between scheduled and actual course delivery. This includes silent periods during and between programs as well as the time that it is not being used at all. SISDIKSAT administration and technical management used 19 percent of system time, while
official university business, meetings and messages constituted 27 percent. Most of these conferences, however, occur informally. With the exception of the three afore-mentioned universities no group within the Directorate General of Higher Education other than the Graduate Agriculture Program uses SISDIKSAT for regular administrative meetings. Finally, seven percent of system time is used for private message transfer. University personnel were quick to realize its economy in communicating with distant areas.

Although these activities do not figure in the usage statistics as they engage after-hours or semester break time, SISDIKSAT provides service to the Open University of Indonesia and presents a seminar series. The Open University meets up to ten hours per week for tutorial and course development purposes. The SISDIKSAT seminar series is designed primarily for faculty members with the goal of promoting information, research, and intellectual exchange. Although aimed at university personnel, other local institutions such as the health and agriculture departments have participated in the monthly seminar series. In January 1986 the semester break time was used to present a series of 24 two to three-hour seminars which attracted over 1,200 participants. As attendance was voluntary, the implication is that a need and demand exist for this service. Of the 604 participants surveyed, 99.8 percent requested that SISDIKSAT continue to deliver seminars. Over 97 percent found the programs useful and interesting.

Is there a demand for SISDIKSAT? A review of site participation indicates that there is. Most universities sent a substantial number of students to SISDIKSAT courses, but highest attendance is credited to the most isolated, distant, and youngest institutions. The two eastern-most campuses account for nearly a third of the SISDIKSAT students. These two campuses also regularly use off-hour system time for administration and "purchase" special courses for evening presentation, basically using SISDIKSAT over a 12-13 hour period per day. Two other universities have "outgrown" their SISDIKSAT classroom facilities and have expanded or added classrooms. Three sites have been added to the 12 originally installed: one university, one teacher training institute, and the central office of the Open University.

In general, the lowest and weakest attendance accrues to the largest and best-staffed institutions in the SISDIKSAT network. Not surprisingly, they view themselves as sources of expertise and course presenters, rather than needful recipients. Indeed, the other universities are eager to receive courses originating from these sources and they are always well attended. Evidence indicates, therefore, that SISDIKSAT is useful and convenient for the larger universities; it is essential to the smaller and remote campuses.

The response of undergraduates to SISDIKSAT has been somewhat ambivalent. Although the vast majority of those surveyed thought that SISDIKSAT teachers and materials were as good or better than local resources, that audio quality was good, and that classes were well-run with sufficient time for participation, a majority also expressed their continued preference for locally taught courses. Only 20 percent said that they preferred taking a course via satellite, and 31 percent believed that they learned less in a SISDIKSAT course than in a regular course. (Ninety-five percent of their local tutors felt that they learned as much or more via satellite.)

This ambiguity results from several factors. First, there is the natural human preference for face-to-face interaction--particularly strong among Indonesians. Also, occasional technical problems and poor soundproofing in some classrooms may have alienated some students. There are probably also some students who are not very interested in high quality instructors and materials. They may prefer a locally produced
50-page text to a SISDIKSAT-produced 300-page text. Objectively, the students are saying that the satellite courses are very good; emotionally, they are saying that they still feel more comfortable with their regular system.

This response is one indication that audioconferencing programs may be more suitable for more mature learners who have clearly identified learning needs and recognize the value of outside expertise. Such people are more likely to look beyond the delivery system and base their opinions on the value of the information they receive. Upperclassmen, graduate students, and, especially, professional people may be a more responsive audience for this type of system.

The overwhelmingly positive evaluation results from data collected from 846 of the seminar participants seem to support this idea. Ninety-nine percent of those participants found the seminars "very useful" and requested more. Over 92 percent found them "very interesting." Similar high percentages were positive about the supporting materials, degree of interaction, and format of the programs. These seminars seem to have struck an area of great need among professionals in remote areas. Participants included personnel from off-campus groups such as the health, family planning, and agriculture sector. Additional positive feedback has come from the Open University tutors getting in-service training over the system and from local SISDIKSAT tutors. Many professionals have suggested that SISDIKSAT give graduate courses for working professionals. The area of in-service training is potentially one of the most powerful uses of such audioconferencing systems. The need exists in all countries. The potential audience is very receptive. SISDIKSAT and the RCSP have shown that it can be done.

LESSONS LEARNED

The Rural Satellite Program promotes an innovative idea; its pilot projects were the first efforts in testing the technology/methodology developed under the Program. Establishing a rural telecommunications network requires tremendous effort; establishing a distance instruction program in the developing world, where the vicissitudes and vagaries of the climate, environment, and infrastructure make daily life a challenge, at times approaches the overwhelming. Over the past five years, a tremendous amount has been learned about the planning and implementation of satellite-based projects, from the minutia of equipment procurement and technical design to the grander theories of distance education and development. The basic tenets about the need for strong institutional support, sound management, and dynamic leadership still stand. The following are just a few of the lessons from the AID Rural Satellite Program.

Technical

1. Everything takes more time than anticipated. The planning of a rural system, purchase of equipment, shipping, testing, installation, and initial shake-down period can take several years. The basis of a sound technical plan is an accurate initial baseline survey of the existing resources and, in the case of an audioconferencing network, the telecommunications system itself. Pay particular attention to the quality and stability of your local lines. The 44,600 miles up to the satellite and back probably will be less of a problem than the last mile of cable that links your classroom to the satellite network.

2. In choosing equipment, start simple and make it more complex only if the staff, time, money, and skill are available to support it. The capabilities of the equipment, of
course, should correspond to the needs of the activities and staff who will be using it. One of the program's main technical problems has been with the highly complex and delicate graphics system that has been subject to hardware problems, interference from poor quality lines, and lack of proper maintenance and operation procedures. Problems with a secondary but glamorous piece of equipment can create a negative attitude toward the entire system, even if the basic audio system is functioning well. The idea of teaching with a solely audio system worries instructors; initial planning surveys find most teachers stressing the absolute need for graphics equipment. These statements should not be taken at face value. Close observation of regular face-to-face teaching methods should be made. It could reveal that visual and printed materials are not a fixture of regular teaching practices—as in Indonesia—and the need for graphics is not as immediate as perceived.

3. Technology-based projects generally start off with the good intentions of avoiding concentration on the hardware at the expense of the software. When the inevitable problems occur during testing and installation, all attention becomes riveted on "getting the thing to work" and less priority is given to the actual activities that will be undertaken when the system does work. It is also a unfortunate that funding is often more easily found for the purchase of new equipment than for the operation, maintenance, and repair of existing equipment. However, this "actuality" does not lessen the very real need for ongoing support of the technical system. As the foundation of the programming activities, its reliable performance is essential. "Economizing" in this area can cause fundamental problems. The program's technical systems require more manpower than spare parts, a requirement more easily met in the developing world.

Planning

4. Accurately assess the stages of growth and maturity of the user institutions before creating an implementation plan. A major challenge of the Indonesia Project has been to reconcile the actual educational practices of the universities with the requirements of distance education. Do not assume that the basic pedagogical methods of higher education in the developed world are in place in the developing world. In Indonesia, particularly, SISDIKSAT found itself grappling with such basics as getting the instructors to come to class regularly, determining if they had ever developed a curriculum for their face-to-face classes, ascertaining whether textbooks actually existed and if they were in a language the students could understand, before focusing on more "esoteric" needs of distance education such as course adaptation, study guide development, and interactive teaching techniques.

5. Do not assume that an existing institution or association of institutions implies common needs among its members. Nor should need be confused with demand. In the Peru Project, it was originally anticipated that the Lima-based ministries were eager to communicate with field personnel in facilitating administration and management. Although field workers were enthusiastic, central ministries were reluctant to avail themselves of a two-way network whereby field personnel could respond to and question central policy.

6. Do not assume standard administration practices or structure are present at all participating institutions. A continuing management problem for SISDIKSAT has been the lack of standardization among the universities which causes conflicts in essentials such as semester start-up, testing, etc. Further, the management needs of the distance teaching program may be incongruent with management practices of the institutions.
For example, remuneration for course development in Indonesia is predicated on the production of textbooks or modules; SISDIKSAT requires study guides. It has been difficult to convince the course teams to produce study guides when compensation depends on textbook development.

Implementation

7. Although telecommunications can provide a reliable link between members of a group, it does not solve any existing problems of the coordination and organization of that group. It is a major task for SISDIKSAT to get 10 institutions to agree upon programming. The RCSP could not overcome the shortcomings of sector organization, as evidenced by the agricultural sector. A strong organization is needed at the center of the network to coordinate, mediate, and implement the proper policies and procedures that will ensure a smooth-working, highly efficient telecommunications network. This requires officially mandated authority, strong and competent leadership, and--very important--readily accessible budget.

8. The introduction of an innovative system does not automatically mean that the users will adopt innovative ways of utilizing such a system. A major effort must be made to get users to take advantage of the new capabilities and limitations facing them. You have to work for incremental change. Faculty members who have been lecturing for years will not immediately see that it is more effective if periods of 10-15 minutes of lecture are interspersed with interactive periods that involve the students. Providing users with a telewriting/graphics capability does not automatically ensure that they will use it or use it well. There must be staff members trained in interactive audioconferencing who are available to work with users of the systems and gradually get them to expand and improve the ways in which they use the system's capabilities.

*Karen Tietjen is Director for Applications Management of AID Rural Satellite Program, and Willard Shaw served as the program's Field Advisor in Indonesia. Both are Project Officers at the Academy for Educational Development. Clifford Block is Associate Director for Development Communication, Office of Education, U.S. Agency for International Development.

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Inquiries regarding the AID Rural Satellite Program may be directed to Dr. Clifford Block, United States Agency for International Development, Bureau for Science and Technology, Office of Education, Washington, D.C. 20523; and Ms. Karen Tietjen, Academy for Educational Development, 1255 23rd Street, N.W., Washington, D.C. 20037.

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