Case-study: A Satellite-based Internet Learning System for the Hospitality Industry

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Introduction

The hospitality industry is diverse and global and has two specific segments: lodging properties and food-service operations. It is one of the nations' top industries and employers (Travel Industry Association, 1998). In the hospitality industry, much of what employees know is self-taught or obtained from on-the-job training (OJT), is typically inconsistent and incomplete (Woods, 1997). Generally, in the hospitality domain, information is handed down from one employee to another in an ad hoc manner. As a consequence of high employee turnover, which ranges from 60% to triple-digit figures, most training happens on the job (Hinkin & Tracey, 2000; Casado & Jurowski, 2001). A formal in-house training program is too labor- intensive and time-consuming to develop and to implement (Collins & Malik, 1999). Further complicating the delivery of hospitality-training programs is the size and geographical dispersion of the hospitality workforce. Hospitality operations are implemented worldwide, thereby making delivery of comprehensive training and continuing education to remote areas extremely difficult. The globalization and rapid growth of the hospitality industry combined with a shrinking labor pool, underscores the need for trained personnel (Turkel, 2000). Furthermore, competitive pressures and rising customers' expectations mandate that employees excel at their jobs, which drives the need for hospitality operators to provide real-time training programs and innovative training solutions (Grindy, 1998).

This article describes and evaluates the Northern Arizona University (NAU) pilot program for delivering training and continuing education programs to students at homes and hospitality establishments using a combination of satellite and Internet technologies. This investigation involved the delivery of three different hospitality courses to four different Arizona sites using the Web and Internet for course materials, learning exercises, and asynchronous communications through e-mail and bulletin boards. A Dish Network satellite dish and receiver were located at the business establishment and at each home for receiving delayed broadcasts of live class sessions. The principal question addressed in this investigation is the following: What is the viability of Northern Arizona University in providing a satellite-based Internet learning system for hospitality employees? The following research questions guided this investigation:

- 1. Is the satellite-based Internet learning system technically and financially feasible? Why?
- 2. Is the satellite-based Internet learning system appropriate for the target audience? Why?
- 3. Is Web-based instruction enhanced when it is augmented with delayed satellite broadcasts of instructor-led class sessions? Why?
- 4. Is the level of institutional support for the satellite-based Internet learning system, including administrative sponsorship and commitment, faculty involvement and support, and infrastructure availability, adequate? Why?

The satellite solution implemented in this investigation did not have Internet access capability. Therefore, the students had to use a terrestrial Internet Service Provider (ISP) for online communications and accessing Web courses and resources. The only aspect of the satellite solution that was directly evaluated involved the delivery of video over the UniversityHouse channel. In 1999, NAU, a leader in distance learning in the southwestern United States, launched the UniversityHouse channel, a nationwide satellite delivery channel for coursework and training classes for businesses and educators. The satellite channel was leased from EchoStar Communications, Inc., a provider of Direct Broadcast Satellite (DBS) services.

Recent technological advancements enable satellite networks to provide high-speed Internet access to homes and small businesses. Consequently, developments in satellite-based Internet technologies and services are also presented and discussed.

Related Literature

A distance learning (DL) instructional delivery system does not require the student to be physically present in the same location as the instructor. Effectiveness studies consistently indicate that DL programs produce learning outcomes equal to those of traditional instruction (Russell, 1999).

Increasing numbers of colleges and universities offer online programs and courses to students at home and in the workplace to make education more accessible and affordable (National Education Association, 2000;Whalen & Wright, 2000). Distance learning also changes the way corporate America delivers training to employees. The popularity of DL is driven by the reduced costs and convenience associated with DL opportunities and by students seeking just-in-time education to meet immediate needs for skill enhancement (Ramus, 2000).

Historically, DL meant correspondence study. Today, audio, video, computer, and networking technologies are often combined to create a multifaceted instructional delivery system. The fundamental method to unite the DL instructor with the DL student is the network. Networks suitable for DL implementations include satellite, cable modem, digital subscriber lines (DSL), and wireless cable.

This investigation assesses the viability of Web-based courses augmented with one-way video and audio delivered over a DBS network. The National Education Association (NEA) (2000) conducted a comprehensive study of DL that offers descriptive information about DL courses using a combination of delivery technologies. The NEA study found that most Web-based courses did not make extensive use of video. However, according to Lacy and Supra (1997), digital video and Web access have the potential to provide a meaningful balance between the desire to have another person explain the material and the benefits of having the learning material available at any time.

According to Smith, Ruocco, and Jansen (1998), current technologies make the use of digital video in education practical. Historically, video has not been widely used in Web pages because of production and workstation requirements, the considerable size of the video files, and the download times due to slow modem network connections. According to Dimitrova et al. (1999), high-quality video over the Web will not become widespread until homes and offices are connected to the Internet via affordable broadband-access technologies, such as DSL and cable modem.

At the end of 2000, eight states reported no DSL or cable modem service (FCC, 2001). By 2004, about 26 million homes in the United States still will not be able to access broadband applications and Internet services (Sullivan, 2000). A Satellite-based solution is a possible alternative that can address residential and business customers equally well (Gedney, Schertler, & Gargione, 2000).

The decade of the 1990s saw the introduction of economically viable direct broadcast satellite DBS services, building on the foundation of geostationary earth orbit (GEO) satellites and digital-compressing technologies (Elbert, 1999; Mead, 2000; Elbert 2001). Ku band DBS systems, permitting smaller antennas on the ground and the ability to deliver over 200 television channels, have provided an attractive alternative to Cable TV programming (Elbert, 1999).

Satellite links can operate in different frequency bands. According to Elbert (1999), the frequency allocations at C, Ku, and Ka bands offer effective bandwidths of one gigahertz (GHz) or more per satellite, facilitating a range of broadband services not constrained by local infrastructure considerations. The C band, commonly used in first-generation satellites, is crowded because terrestrial microwave links also use these frequencies. The current band usage trend is toward the higher frequencies of Ka and Ku bands, which allow use of small earth-station antennas (Gedney, Schertler, & Gargione, 2000).

With DBS, video is delivered through a satellite channel and viewed by a student at the scheduled broadcast time or tape-recorded for viewing at a later time. DBS enables the transmission of a course to a large geographical area. Consequently, the logistics of delivering programming is greatly simplified that otherwise would have to go by way of a local cable or ultra high frequency (UHF) TV system, both of which may be unavailable due to limited channel capacity (Elbert, 1999). Delivering DL applications directly to the home or workplace via satellite, however, specifically depends on whether a user can afford the monthly fees and installation and equipment costs, the strength of the signal at the receiving site, and the ease of installing and operating the equipment (Elbert, 1997).

A DBS platform also can be used for gaining access to Internet resources and video streaming, a sequence of moving images that are sent in compressed form over the Internet and displayed by the viewer as they arrive. A separate terrestrial-based ISP for the outbound portion of the request and receive process is required. Data requests are uploaded via the terrestrial link. Data is then downloaded from the Internet to a receive-only dish over a high-speed DBS link. Special routing schemes are required to handle the unidirectional links, which are not yet optimized for DBS Internet architectures (Hu & Li, 2001). According to Mousti (2001), a hybrid satellite-based Internet system is an interim solution until the more reliable and convenient two-way satellite-based Internet systems are widely implemented. Two-way satellite-based Internet systems are based on Very Small Aperture Terminal (VSAT) technology and provide both data transmission and reception without depending on a terrestrial network.

If satellites are to play a key role in national or global infrastructures, they must provide seamless interoperability with both existing and evolving terrestrial networks (Gedney, Schertler, & Gargione, 2000). The long-latency and error-prone characteristics of satellite links, however, complicate the interoperation of satellite systems and the existing Internet infrastructure (Elbert, 2001; Hu & Li, 2001). Consequently, further development and adaptation of protocols and standards are required to resolve these technical challenges (Elbert, 2001; Hu & Li, 2001; Gedney, Schertler, & Gargione, 2000).

While video streaming is an attractive tool for higher education, required bandwidth, quality of service (QoS,) Internet congestion, and interoperability standards represent major obstacles in enterprise-wide Internet protocol (IP) network implementations (Cheng, 1999; Cunningham & Francis, 2001; Nguyen et al., 2001). The Internet2, a high-speed QoS-enabled network, and IP multicasting, the scheduling of video streaming at a particular time to a group of users, should facilitate the widespread use of video and make full-screen video the standard (Schatt, 2000; Tynan, 2001). Satellite-based Internet systems could play an important role. The broadcast capabilities of satellite networks make them inherently multicast-enabled (Ray, 2001). Satellite technology also could be used to distribute content directly to the end user or closer to the edge of a network to reduce the number of terrestrial router hops, each of which can lose packets or cause additional delay and poor video quality (Cunningham & Francis, 2001; Ray, 2001).

Satellites have been, and continue to be, used for DL implementations (Gedney, Schertler, & Gargione, 2000). Satellite broadcast courses include live or videotaped class meetings or lectures. A satellite broadcast format relies on one-way audio and video and may use terrestrial-based technologies, such as the telephone, fax, and Internet applications, to allow remote students to communicate with the instructor during class broadcasts. Two-way communication over the satellite link also is possible through an electronic keypad that enables a student to respond to questions posed by the instructor (Chute, Thompson, & Hancock, 1999; Sullivan, 2000).

The receiving site may be a home or classroom located in corporate workplaces, local community colleges, regional academic sites, or K-12 schools. DL satellite implementations are common in organizations that have too few students or trainees to justify onsite instruction (Schwitzer, Ancis, & Brown, 2001).

A satellite-based implementation also may provide an interactive audio and video classroom, the most technically advanced form of DL. An interactive audio and video format, however, provides less flexibility in time and location for students (Schwitzer, Ancis, & Brown, 2001).

Many courses broadcast via satellite are now complemented and enriched by a Web-based component (Gifford, 2001). However, DL satellite implementations may be used strictly for accessing online courses and resources, especially in remote areas lacking broadband access.

Many DL satellite providers also are delivering video courses to desktop computers over terrestrial-based networks. The delivery of video-based learning programs to desktop computers, instead of classroom and conference facilities, appears to be a growing trend (Hancock, 1999). However, DL providers advise students that high- bandwidth connectivity and appropriate computer equipment are necessary to take courses via video streaming.

To be effective, the design of a DL instructional delivery system addresses both technological and human issues. The delivery technology must be reliable, available, and easy to use. DL equipment also must be installed in a convenient and inviting location to ensure maximum utilization of the DL system (Chute, Thompson, & Hancock, 1999).

DL implementations require educational institutions to adapt programs and course offerings for online learning environments. According to Stenerson (1998), a university must carefully analyze learner needs and characteristics, the institutional culture, and support services to develop a systems design for a successful DL program implementation.

According to Berge and Schrum (1998), a DL program implementation that is linked to a strategic-planning process has a greater chance of success. The strategic-planning process identifies the budget, infrastructure, staffing, and policies required for program implementation.

Satellite-based DL Implementations

University of Alaska. As a result of successes in satellite communications that began in 1965, increasing levels of experimentation with transmitting educational programs via satellite by colleges and universities occurred (Gedney, Schertler, & Gargione, 2000). The University of Alaska was among the first educational institutions to use satellite technology for delivering educational programs. In 2001 the Alaska Distance Education Technology Consortium joined with the University of Alaska and StarBand to embark upon a three-year distance education project to test StarBand's satellite-based Internet solution for rural Alaska. Consortium members selected 25 sites throughout the state (http://www.alaska.edu/swadetc/ak_sat). In the city of Sitka, for example, the system was installed at Sheldon Jackson College, a small institution of 300 students established to provide higher-education opportunities for Alaska Native students (http://www.starband.com/whoweare/pr/051401.htm).

Gilat Satellite Networks, an Israeli technology company, developed a two-way satellite-based Internet service in partnership with Microsoft and EchoStar Communications. Gilat introduced the first two-way consumer satellite Internet service during the fall of 2000 in the United States. This delivery system, called StarBand, is based on VSAT technology. Data is received and sent via a 24-inch by 36-inch oblong dish at the customer premise. The StarBand dish antennas also enable the reception of EchoStar's Dish Network satellite TV broadcasts. The service currently offers download speeds of about 500 Kbps, with upload speeds ranging from 60 Kbps to 400 Kbps. This is comparable with many residential DSL connections (Grice, 2000). StarBand charges $69 per month for service. Equipment and installation costs are $600.

University of Hawaii. The Pan-Pacific Education and Communications Experiments by Satellite (PEACE) at the University of Hawaii began operation in 1971. PEACE is a public-service satellite telecommunications network linking educational bodies in the Pacific Islands with regional organizations and governments for purposes of research, education, environmental management, economic development, and health. PEACE, for example, enables the University of Hawaii to provide training and technical assistance to increase the region's capacity to serve children and families with disabilities. PEACE services include voice, data, facsimile, and video applications. Internet access is available at speeds ranging from 64 to 128 kilobits per second (Kbps) (http://www.peacesat.hawaii.edu).

PEACE presently relies on two GEO satellites for coverage of the Pacific Islands. The University of Hawaii maintains that satellites will remain the principal means for telecommunications in the foreseeable future. A few islands will have access to fiber optic networks. The distances among the islands are too great for a terrestrial-based microwave network (http://www.peacesat.hawaii.edu/tech/2-sats.htm.

Old Dominion University. Satellite-based DL networks, such as Teletechnet, enable students to earn degrees at local community colleges. Old Dominion University (ODU) in Norfolk, Virginia, operates Teletechnet in partnership with community college systems. Students attend the community college for a two-year associate degree. In another two years, they can earn a bachelor's degree (http://web.odu.edu/webroot/orgs/AO/DL/teletechnet.nsf).

Teletechnet uses Ku band broadcast satellite technology with terrestrial audio feedback from students. ODU classes are broadcast live to students at one of 50 classroom sites within Virginia, Indiana, Washington, North Carolina, Arizona, and Georgia. Teletechnet students maintain contact with other students and their instructors through traditional mail, voice mail, e-mail, and Internet conferencing systems (http://web.odu.edu/webroot/orgs/AO/DL/teletechnet.nsf).

Two degree programs in nursing, for example, are available through Teletechnet at Yavapai College in Prescott, Arizona. One program is designed for registered nurses with diplomas or associate degrees in nursing seeking a Bachelor of Science. The second program is the Master of Science in Nursing. ODU maintains that nursing education, like hospitality education, typically occurs in urban settings, often requiring student relocation impossible for place-bound students. Consequently, in an effort to reduce nursing shortages and enhance professional nursing services in local as well as rural communities, the School of Nursing at ODU is making nursing education available to students in the communities in which they live (http://web.odu.edu/webroot/orgs/hs/nurs/nursing.nsf/pages/dist_lrn).

Video streaming is offered to students who are physically located at home or work and cannot come to one of ODU's Teletechnet sites. Video streaming takes place at the same time as the course on ODU's main campus. A student is able to ask the instructor questions via an Internet chat application. The answers are viewed over the video stream. However, ODU advises students taking classes via video streaming to connect to an ISP providing high-bandwidth connectivity. ODU also advises students to use computers with at least a Pentium II 300-megahertz (MHz) processor and 128 Megabytes of Random Access Memory (RAM) (http://www.odu.edu/AO/vstream/index.html).

Lehigh University. DL began at Lehigh University in Bethlehem, Pennsylvania, in 1992 with 27 students taking courses toward a Master's Degree in Chemistry. Since that time, over 700 DL students have been admitted to eight Lehigh graduate degree programs through the Lehigh Educational Satellite Network (LESN). LESN carries delayed and live broadcasts of on-campus classes to students at multiple corporate sites. During live broadcasts, corporate students interact with the instructor and other students through a telephone conferencing system and by interactive computer and fax (http://www.distance.lehigh.edu/Overview2.htm).

LESN programs are broadcast over two Ku band communications satellites. Satellite coverage includes the continental United States, northern Mexico, southern Canada, and Puerto Rico. Downlink equipment options are either a 4-foot or 6-foot VSAT dish or a 10-foot or 12-foot steerable satellite dish.

VSATs are used in many of the LESN implementations. Lehigh clients find that VSATs are affordable and easy to install and provide high accuracy derived from one-piece molded construction. However, in most LESN implementations, a VSAT is fixed on one satellite and is able to receive signals only from that particular satellite. LESN clients also have reported rain-induced interruption of the broadcast signal (http://www.lesn.lehigh.edu/sat/Technical_Specification_Page.html).

The steerable larger dishes, able to receive signals from other satellites, also receive more programming. A dedicated VSAT dish has proved to be more reliable because it is never left on the wrong satellite (http://www.lesn.lehigh.edu/sat/Technical_Specification_Page.html).

LESN programming requires that a classroom be equipped with a video monitor, integrated receiver decoder (IRD), telephone conferencing system, VCR, fax machine, and a computer system connected to the Internet. To take full advantage of the LESN programming, two fully equipped classrooms are needed (http://www.lesn.lehigh.edu/sat/Technical_Specification_Page.html).

In 1999 Leigh University began offering asynchronous video-streaming courses known as LESN-Online over terrestrial-based networks. The LESN-Online program was created to reach students outside of large corporations. In addition to full-degree programs, LESN-Online also offers noncredit short courses and certificate programs (http://www.distance.lehigh.edu/Overview2.htm).

Primedia Workplace Learning (PWPL). PWPL is a subscription television service that delivers 60 percent of its education, information and training to the workplace by satellite. PWPL provides business-management and professional-development programs for five specific industries: automotive, financial services, government services, healthcare, and industrial and manufacturing (http://www.pwpl.com).

According to Hancock (1999), the PWPL satellite network delivers educational training programs to a national audience cost-effectively. Michael Mooney, formerly Senior Vice President of Technology at PWPL, states that the PWPL satellite network offers the capability of consistently delivering high-quality video to all customer sites simultaneously. Mooney also maintains that receiving sites can be added without increasing the daily operations cost (Hancock, 1999).

PWPL programs are broadcast over Ku band communications satellites. Downlink equipment options are either a 4-foot or 6-foot VSAT dish. PWPL recommends that the IRD be located in a classroom, conference room, or break room. From the IRD, an additional viewing location can be installed. Other equipment required is a TV and VCR for viewing and recording programs (http://www.hstn.pwpl.com/userguide/installation.htm).

PWPL is gradually transitioning the delivery of learning programs to desktop computers instead of classroom and conference facilities. According to Mooney, industry-wide trends point towards delivering video to desktop computers (Hancock, 1999). Consequently, PWLP began offering Web-based courses in 2001 (http://www.pwpl.com/onlinelearning.asp).

PWPL is presently using the Cisco CDN solution for delivering full-motion, TV-quality video to desktop computers at corporate sites. The Cisco CDN solution consists of a Content Distribution Manager (CDM) and one or more Content Engines (CEs). The CDM resides at the administrator's site, while one or more CEs reside at each of the remote sites of the intended audiences. Videos are encoded into a digital format, such as MPEG. Then the video files are imported into the CDM, where a uniform resource locator (URL) is created for each file. Finally, the video files are assigned for delivery to specific CEs out in the field and replicated to CEs. The CDM replicates the video files using the bandwidth parameters set by the company. Students view videos on-demand by clicking the URLs embedded in the course Web page (http://www.cisco.com/warp/public/cc/so/neso/ienesv/cxne/prmda_an.htm).

Satellite Educational Resources Consortium (SERC). SERC is a nonprofit provider of curriculum-based resources. SERC provides high school courses, including German, Latin, humanities and physics, via satellite to schools otherwise not offering those courses. SERC also enables educators to take professional development courses via satellite. Since its inception in 1988, SERC has delivered school-course offerings to students in 24 states (http://www.serc.org/whatis/index.htm).

SERC programs are broadcast over Ku band and C band communications satellites. Downlink equipment options are either a 6-foot VSAT dish or a 12-foot steerable satellite dish (http://support.serc.org/techhelp/specs/satrec.htm).

A SERC classroom is equipped with a television connected to the satellite dish, Internet-enabled computers, a VCR, and a telephone system. Many SERC classes are broadcast live. During live broadcasts, students talk to one another and listen to one another via telephone. Other classes utilize the Internet as a communications medium and for accessing learning materials (http://www.serc.org/whatis/members).

Public Broadcasting Service (PBS). PBS is a private, nonprofit media enterprise owned and operated by the nation's 349 public television stations (http://www.pbs.org/insidepbs). Courses for college credit are offered through the PBS Adult Learning Service (ALS), established in 1981. ALS became a national broker for the distribution of telecourses, which typically include textbooks, study guides, faculty manuals, test banks, and video lessons. More than 5 million students have enrolled in courses offered by local colleges and universities using telecourse packages distributed by PBS (http://www.pbs.org/als/about_als/index.html).

ALS telecourses are available to DBS subscribers. DBS carriers that currently offer ALS courses are DirecTV and the Dish Network (http://www.pbs.org/als/about_als/index.html). The video components of the telecourses include studio instructors and video documentaries that explore particular themes within a lesson. Some of the ALS courses include a Web-based component. For example, the ALS course, Introduction to Business Communications, includes 30 hours of online courseware. In addition, faculty members can conduct all assignments and testing via the Internet. Students also use Internet-based applications to participate in asynchronous and synchronous class discussions that build upon the video lessons (http://www.pbs.org/als/intro_market/inmkdescrip.htm#telewebcourse). According to Arlene Krebs, Director of Technology Initiatives and Development at California State University, Monterey Bay, many courses broadcast via satellite are now complemented and enriched by a Web-based component (Gifford, 2001).

Virginia Satellite Education Network (VSEN). VSEN was established in 1984 to reduce educational disparity in Virginia. VSEN provides advanced placement and foreign language courses to rural high and middle schools with too few students to justify hiring a full-time teacher. All courses are broadcast live via a C band communications satellite system. Courses feature one-way video and two-way interactive audio classes. (http://www.vsenvirginia.org)

A VSEN classroom is equipped with a television connected to a satellite dish, a VCR, a fax machine, and a telephone. Students also may participate on a tape-delay basis if the time the class meets live is inconvenient. Students also may use tapes to review material or for make-up classes (http://www.vsenvirginia.org/faq.html).

SchoolAccess. General Communication, Incorporated (GCI), an Alaska-based integrated telecommunications provider, provides Internet access to rural schools via its SchoolAccess program. The SchoolAccess program currently provides 22 rural schools in New Mexico and Arizona with high-speed Internet access through a Ku band communications-satellite system using VSAT technology. According to Martin Cary, GCI Vice President of Broadband Services, the SchoolAccess program allows rural students to retain their cultural ties as well as to have access to the educational enhancements made possible by the Internet (http://www.gci.com/about/press/2000launch.htm#top).

Northern Arizona University. In 2000 StarBand joined with NAU to install 120 systems to provide the Navajo Nation and the Hopi and Havasupai tribes with access to the Internet for the first time. Realizing that the StarBand satellite-based Internet solution had implications for DL applications, StarBand expanded the initiative by launching the StarBand 2001 Distance Learning Project (http://www.starband.com/whoweare/pr/051401.htm).

In March 2001, StarBand and NAU worked together to provide hospitality training for students living on the both the Fort Mojave and the Colorado River Reservations. Many of the popular resorts and gaming facilities in Arizona are located on Native American reservations. Although the NAU School of Hotel and Restaurant Management (SHRM) provides hospitality-related studies, many Native Americans find the financial requirements and the cultural adjustments of attending classes on campus to be significant barriers. The StarBand satellite-based Internet solution is enabling tribal students to take advantage of the first-ever, online hospitality customer-service training program (http://jan.ucc.nau.edu/%7Ehrm-demo) tailored to the learning styles and cultural needs of Native Americans (http://www.starband.com/whoweare/pr/051401.htm).

Initially, T-1 lines, dedicated phone connections supporting data rates up to 1.544 Mbps, were proposed for the two remote Native American sites in northwestern Arizona. The T-1 solution, however, was unavailable at one of the sites. Consequently, SHRM needed to identify a cost-effective wireless solution. The StarBand satellite-based Internet solution was selected because it provided adequate bandwidth and eliminated the need for T-1 lines and reduced the telecommunications cost by $100,000. Since this satellite-based Internet service is limited to consumers, NAU negotiated a contract with StarBand to allow educationally related entities working with NAU to utilize this service.

The NAU DL project was funded by a U.S. Department of Labor grant to develop the necessary telecommunications infrastructure to deliver hospitality training to the Colorado River and Fort Mojave Indian tribes (U. S. Department of Labor, Employee & Training Administration: Pilot Demonstration Grant, 1999). In 2001 several satellite dishes were installed at each tribal location to provide Internet access for three to six workstations. In addition to two-way Internet services, this hybrid satellite system provides satellite television programming via EchoStar's Dish network. The StarBand satellite-based Internet service also enables the tribes to receive delayed DBS broadcasts of instructor-led class sessions offered on NAU's UniversityHouse channel.

SHRM developed a Web site for the customer-service training program using audio, interactive graphics, questions, and quizzes to facilitate learning (http://www.nexc.com/nexchange/campus/index.cfm?action=article1). Initially, this Web-based training program used video clips. The video clips were later removed due to video-streaming difficulties. The StarBand Web site presently states that StarBand is currently not suitable for video-streaming applications (http://www.starband.com/faq/starbandfacts.htm).

Methodology

This investigation used the case study research approach to evaluate the viability of a satellite-based Internet learning system for hospitality employees. The case study research method is considered appropriate for an investigation involving an in-depth evaluation of a novel instructional solution within a real-life context.

The literature, while not extensive, contains specific guidelines for researchers to follow in carrying out case study research. The research methodology for this investigation is primarily based on guidelines developed by Yin (1994).

Data and methodological triangulation provided a comprehensive picture of what was being investigated. The primary data collection method was questionnaires administered personally by the researcher in an interview and survey format. Secondary data collection methods were observation and document analysis. Information was collected from six different data sources or units of analysis.

Eighteen individuals were selected to complete questionnaires based upon the potential insights that they might contribute to this investigation. Profiles of the selected individuals are denoted in Table 1.

A multiple-case design with embedded units of analysis was selected for the investigation. Evidence from multiple cases is considered more compelling and robust than evidence from a single case. This investigation involved five cases: three homes, a work site, and NAU. Each case was treated as a comprehensive case in and of itself. The data were analyzed and triangulated within the integrity of that case. The patterns for each single case were then compared across cases following replication logic. The results of the analysis are used to answer the research questions. Answers to the research questions are used as the key criteria for assessing the viability of NAU in providing a satellite-based Internet learning system for hospitality employees.

Table 1: Profiles of Respondents

Case/Unit of Analysis	Contribution to Investigation
Case A: **Student**	• Knowledge of instructional delivery system • Used instruction delivery system from home in Flagstaff AZ to successfully complete a course for college credit
Case B: **Student**	• Knowledge of instructional delivery system • Used instruction delivery system from home in Phoenix AZ to successfully complete a course for college credit
Case C: **Student**	• Knowledge of instructional delivery system • Used instructional delivery system from home in Winslow AZ to successfully complete three courses for college credit
Case D: **1. Student**	• Knowledge of instructional delivery system • Used instructional delivery system from the Flagstaff Marriott Residence Inn to successfully audit a college course
2. Hotel Chief Engineer	• Knowledge of the installation of the instructional delivery system at the Flagstaff Marriott Residence Inn
3. Hotel General Manager	• Perspective on the use of the instructional delivery system by Marriott and lodging employee
Case E: **1. Administrators A and B**	• Knowledge and perspective of SHRM's DL history from two high-ranking SHRM administrators
2. Administrators C and D	• Knowledge and perspective of NAU's DL history from two high-ranking NAU administrators in the Offices of Distributed Learning Services and Strategic Initiatives
3. Faculty A, B, C, D, and E	• Knowledge and perspective of SHRM's DL history from four SHRM associate professors (tenured) and one SHRM assistant professor (tenure-track)
4. Faculty A and F	• Has DL, Web, and IITV course experience.
5. Faculty B, C, and D	• Has used the instructional delivery system
6. Staff A	• Has DL and Web course experience • Knowledge of DL student-support services from an employee in SHRM

7. Staff B	• Knowledge of DL faculty-support services from an employee in the Office of Distributed Learning Services
8. Staff C	• Knowledge of DL program implementation from an employee in the Office of Distributed Learning Services
9. Staff D	• Knowledge of NAU's DL information technology infrastructure and services from an employee in the Office of Information Technology Services
10. Staff E	• Knowledge of DL course design and development from an employee in the Office of Distributed Learning Services

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Conclusions

Based on the results of the investigation, the SHRM pilot program is capable of providing remote hospitality employees with accessible, flexible, affordable, and appropriate educational opportunities for reaching personal and professional goals. In general, the students, whether at home or work, were satisfied with both the technology and the quality of the learning. However, the accessibility and flexibility of the instructional delivery system in a hospitality environment could be constrained by labor policies, work schedules, and a lack of training space, which might require hospitality employees to view videos and to complete coursework at home.

As a result of successes in satellite communications that began in 1965, increasing levels of experimentation with transmitting educational programs via satellite occurred. Today, satellite-based DL programs are prevalent throughout the world. Developments in satellite communications offer new possibilities for streamlining and improving the SHRM instructional delivery system. Technological advances are enabling satellite systems to combine broadband data rates with small terminals, thereby providing affordable Internet access to homes and small businesses. Satellite-based Internet solutions permit pictures, sound, and text to be digitized, combined, and transmitted in a single stream of data for reception on PCs, TVs, and other devices. However, the quality and reliability of IP video over terrestrial and satellite networks is presently not comparable to DBS video. Satellite IP video and multicasting applications are in early developmental stages. The technological barriers to offering satellite IP services, while challenging, are being addressed rapidly.

Hospitality organizations will increasingly rely on DL technologies for delivering educational and training opportunities primarily due to the cost-effectiveness and convenience of a DL format. The hotel general manager noted, however, that widespread adoption of SHRM's instructional delivery system within a hospitality organization, like Marriott, would require management support and confirmation that employee recruitment and retention are enhanced.

The results of this investigation indicate that Web-based instruction was appreciably enhanced when it was augmented with delayed satellite broadcasts of instructor-led classes. Viewing full-screen, broadcast-quality videos of traditional class sessions appears to have various psychological and pedagogical benefits for DL hospitality students. The DBS videos also seem to have a positive effect on student attitudes concerning the institution and the learning experience.

The SHRM pilot program has the potential of generating significant interest in a sizeable and growing marketplace. The NAU respondents felt that the SHRM pilot program fit within the mission of NAU and appears capable of generating sufficient revenue to cover the associated costs if fully implemented and marketed properly. However, the long-term viability of the SHRM pilot program is tenuous at NAU until several key issues are resolved. These issues span six general areas: administrative issues, organizational structure, the financial model for DL, educational quality, student support services, and faculty support.

There is a growing need for innovative training solutions in the hospitality industry. The current training techniques are ineffective in accommodating an industry with a diverse and global workforce and high turnover rate. Technology holds many answers to the improvement of human capital in the hospitality industry. The novel instructional delivery system examined in the present investigation could be one of them.

The instructional delivery system will evolve with advancements in telecommunications technologies, enabling distance learners to access higher quality multimedia learning materials and experiences more easily. Satellite-based Internet solutions offer the opportunity to transfer multimedia content from the Internet backbone directly to the desktop computers of DL students or closer to the edge of networks accessed by DL students. The potential result is accelerated delivery of content, high- quality transmission, and an enhanced viewing and listening experience for students. Furthermore, the point-to-multipoint transmission capabilities of satellite-based Internet solutions simplify the distribution of educational programming and materials to geographically dispersed and remote student populations. Consequently, satellite-based Internet solutions are likely to play a significant role in equalizing access to educational programs and resources within the United States and globally.

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