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THE IMPACTS OF INTERNATIONAL MEDIA DATABASE PROGRAM
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THE IMPACTS OF INTERNATIONAL MEDIA DATABASE PROGRAM (INTELSTACKS) IN EDUCATION

By

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ABSTRACT

THE IMPACTS OF INTERNATIONAL MEDIA DATABASE PROGRAM (INTELSTACKS) IN EDUCATION

By

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INTELSTACKS program, in a form of multimedia database, was developed to fulfill some of the requirements for the teaching of and research on modern international telecommunication issues. The students beliefs about the medium's difficulty level, its entertainment potentials, the type of information presented, and typical instructional demands can exert as much influence over learning as the medium itself. The database was used to support traditional classroom instruction and was assigned to students as one of the major sources of reference to support their term paper. A qualitative study was conducted to assess all the major attributes of INTELSTACKS in relation to student learning gains.

The survey results did indicate that the legibility and comprehensibility of information, the fun to use quality of the program, and sounds showed a statistically significant effect on students' learning gain. The students found the program a good starting point and a foundation for research. Majority of them expressed their willingness to use the program again for their future research on media.

DEDICATION

to Agathe Akoua Nimako, my wife

to Agnes Aka, my step daughter

to Nana Serwaa-Amanpene Nimako and Nana Agyeiwaa Nimako,

my daughters.

ACKNOWLEDGMENTS

It is a pleasure to express my unqualified gratitude to the co-authors of INTELSTACKS program for giving me the privilege of being a member of INTELSTACKS production team. Working with those two experts not only gave me a sound preparation towards my professional activities in technology in education, but also gave me the ideal understanding of the importance of "Joint Intellectual Venture".

I am indebted to Dr. Joseph Straubhaar who, as chairman of my thesis committee, academic advisor, and content expert of INTELSTACKS program, accepted my request for studying the educational potentials of INTELSTACKS program for my master of arts thesis. Again, I thank him for giving the production team an access to his personal library of sources and recommending valuable references that helped the team for the collection of data to build the program.

My sincere thanks also go to Dr. Carrie Heeter who, as Director of Communication Technology Laboratory of Michigan State University, INTELSTACKS technical advisor, designer, and programmer, as well as a member of my thesis committee gave me the benefits of her expertise in "hypermedia and multimedia in education". Learning about hypercard program at that short period of time in order to be able to fully participate in INTELSTACKS development was very challenging. But due to her motivations and "savoir-faire", it is a pride today to count myself as one of the hypercard application fanatics especially in multimedia environments.

I am glad to reveal my deep appreciation to the Office of the Dean of College of Arts and Sciences as well as Communication Technology Laboratory of Michigan State University, for the equipment made available for the development and testing of INTELSTACKS prototype.

Finally, I am very grateful to the individual graduate students who contributed in diverse ways towards the development of INTELSTACKS program. In particular, thanks are due to Mr. Pericles Gomez for his technical support.

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CHAPTER 1

INTRODUCTION

The traditional instruction and research on international telecommunications have principally depended on textbook-based courses, stand-alone database systems, and formal lectures supported by a variety of audio visual materials. Projection of overhead transparencies remains the dominant medium.

The modern integrated electronic learning systems have made it possible to combine text materials, sounds, graphics, colors, animation, and etc. in a form of multimedia that can be stored on a stand-alone floppy disks or computer hard disks. In the case of international telecommunications, there are no clearly defined or designed integrated instructional and research database systems, especially combining electronic and print media information into one educational program.

A hypercard media database, called INTELSTACKS, developed at the Department of Telecommunication, Michigan State University, was specially designed to fulfill some of the requirements for the teaching of and research on modern international telecommunication issues. The purpose of INTELSTACKS is to provide students with some basic demographic and media information and geographic location of each country on the globe. The program provides also users with a tool for sorting and analyzing the data. Such opportunity would help the telecommunication students or any user of the program to better understand and give a meaningful account of media impacts on economic, political, social, and cultural developments within and across nations. The main sections of the study consist of the background and purpose of the study, review of literature related to INTELSTACKS program, sample, methodology for INTELSTACKS development, field test, data collection, data analysis, summary,

conclusions, recommendations, and bibliography.

BACKGROUND OF THE STUDY

Educational media programs are perceived as external devices which, along with other factors, set the stage for cognitive activities, precisely because they are part of a learner's a priori anticipations. What a student thinks or believes to be the case about a particular mediated presentation can come to exert at least as much influence over learning as the medium itself. This may include beliefs about the medium's difficulty level, its entertainment potential, the type of information usually presented, and typical instructional demands.

Presumably, differences in the qualities attributed to different media may influence learning related behaviors of students. According to Salomon (1981), the amount of mental effort invested in nonautomatic elaboration of material (i.e., mindful processing) depends primarily on two factors: (1) the learner's perception of the learning-relevant characteristics of the medium and task, and (2) the learners own perceived self-efficacy in elaborating the information they will receive.

As each new medium is put into educational use, researchers and educators need to consider the impact of the medium's introduction in the curriculum (e.g., interactions between the instructor and the students) and the changes the teaching and learning undergo. Newer media also afford convenient and often novel ways to shape instructional presentations. Evidence from past symbolic system and general cognitive science research (Clark, 1983) indicate that many different symbolic presentations, such as words, pictures, and figures sometimes serve the same or similar functions in cognitive processing. This recommends that instructional designers and curriculum planners could choose the less expensive or more convenient medium for instruction, provided that its

symbolic modes were sufficient to yield the necessary cognitive transformations required by the learning task and learner. If new media programs, such as hypercard, allow for flexible and local construction, then the attributes of newer media may serve as powerful causal variables that influence learning and performance. The allowance for students' manipulation of input data, according to Lesgold and Reif (1983), may activate specific mental operations that facilitate the acquisition of knowledge as well as their improved mastery.

PURPOSE OF THE STUDY

The primary purpose in conducting this study is to assess the extent to which INTELSTACKS program attributes and the instructional presentation it affords can facilitate students' understanding of complex international telecommunication issues so that they will be able to analyze and give a meaningful account of media impacts on economic, political, social, and cultural developments within and across countries. Essentially, the field test will seek to test the main attributes of the program such as the legibility and comprehensibility of information, whether it is hard or fun to use the program, the impacts of graphics and sounds, and organization of information in the program.

METHODOLOGY OF INTELSTACKS DEVELOPMENT AND THE FIELD TEST

INTELSTACKS Development and Instructional Procedures:

During the initial planning stage, the following elements or components that might influence the program's effectiveness, efficiency, appeal, and credibility were carefully studied. In the case of development procedure, the Topic, Subject-matter, Characteristics of the Target Population, Goals, Tasks, Objectives, Applicable Category of Knowledge, Evaluation, and Resources. These were

regrouped under three main domains. First, Problem Definition. Here the content expert identified the problem with traditional methods of teaching, analyzed the TC 498 students' characteristics, resources, and team responsibilities. Second, Product Development. At this level the production team identified objectives, methods, and construct prototypes. These included enabling and terminal performance objectives, specifications of instructional strategies, media forms, description of instructional design specifications, technical review of the prototype, and construct and assemble of the program. Third, Program Evaluation. This consisted of testing the prototype, analyzing the results, and implementation and / or recycling of the program. For instance the content expert (i.e., the TC 498 class instructor) had to use the program to support his traditional methods of teaching TC 498 course. The students were asked to use the database as a resource for their class assignments and research or term paper. The researcher conducted a survey at the end of the term, determined relationships among results, methods, objectives, and goals, and finally indicated the kinds of revisions (if any) or suggested implementation without major revisions.

The early planning also took into account four instructional design issues that might enhance the INTELSTACKS program for educational purposes. The basic questions raised were the following. First, Purpose: What problem would the program attempt to solve? Second, Conditions: What would be taught, who would be taught, and what would be the potential contraints to the program in terms of classroom setting, resources, teaching, and learning? Third, Treatment (methods): What would be the suggestions about how to apply the database during instruction and information searching and usage by the students ? Fourth, Outcomes: What would be the goals of using the program to support traditional instruction including effectiveness, efficiency, and appeal? Who

would be the people observed ?

FIELD TEST

In an effort to test educational potentials and production qualities of INTELSTACKS prototype, a field test was conducted during the Spring Term, 1990. The research methodology and procedures are explained. Thus the study sample is described, equipment used is specified, training, demonstration and practice are described, the construction of survey instrument is discussed, the hypotheses are stated, data collection, and data analysis procedures are delineated.

THE STUDY SAMPLE

The sample group used for the study included all the 38 students in the TC 498 class, Spring Term, 1990 of the Department of Telecommunications, College of Arts and Sciences, Michigan State University.

DEFINITION OF TERMS

INTELSTACKS: International Media Database Stacks. It is a hypercard-based media database developed to provide students with some basic demographic and media information and geographic location of each country on the globe.

Hypercard: It is a computer (Macintosh) software that helps you to write your own programs. It is like a pencil, ruler, and piece of paper you use to create a blank of paper form that could be reproduced in quantity. The form then becomes a tool to make information gathering and display easier.

Multimedia: It is characterized as a presentation that incorporates many media forms. For example, a presentation that uses computer-generated charts, audio effects such as music and voice, slides, and videodisc images.

Hypermedia: It is characterized as multimedia only it carries it one step further by allowing the learner or user to interact with the presentation. We create a hypermedia environment, for example, by programming a computer to control CD-ROM drives, Videodisc players, Videotaped and animations.

Hypertext: The electronic presentation of text that takes advantage of the random access capabilities of the computer that allow user controlled random access of information.

Branching: The technique for moving from one place to another in the program. A computer program such as INTELSTACKS containing multiple paths which are either chosen by the learner or prescribed by the program.

Peripheral: Electronic equipment connected to a computer. Peripherals include printers, overhead projectors, modems, videodisc players, and disk drives.

LCD: Liquid Crystal Display. A digital display mechanism made up of character-forming segments of a liquid crytal material sandwiched between polarizing and reflecting pieces of glass.

CAI: computer-assisted instruction. It is also known as computer-aided instruction, computer-based instruction (CBI), computer-assisted learning (CAL), or computer-based training (CBT).

MINITAB: It is a general purpose statistical software developed for students, engineers, social and physical scientists, managers, and others who have to organize and analyze data.

Interactivity: In CAI, it refers to the activities performed by both the learner and the computer. Thus, two-way communication between the user and the computer program.

Reactive design: It is the lowest level of interactivity. There is little learner control of content or program operation. Thus, program-controlled content and feedback.

Coactive design: It is the second level of interactivity, the learner has control of the program structure.

Proactive design: It is the highest level of interactivity, the learner controls both the content and structure of the program.

Flowchart: This is a graphic representation of the flow of the program showing

all segments, tracks, and options.

Tutorial: The mode of CAI in which the computer serves as a private teacher.

Formative evaluation: A type of evaluation that takes place during the development of an instructional program so that changes can be made before the product is complete.

Summative evaluation: A type of instructional evaluation that takes place after a program has been completely developed and implemented.

CHAPTER 2

REVIEW OF LITERATURE

The history of our experience with media in teaching has been characterized by expectations. On one hand, each new medium has raised our hopes for benefits to instruction and learning. On the other hand, there has been a historical concern on the part of parents and educators over the impact of increased exposure to newer media. This concern carries with it a fear that children might be harmed or misdirected if they spend too much time with newer media.

Earlier studies emphasized gross, undifferentiated comparisons of the learning impact of newer media, such as television, with more "traditional" media such as classroom instruction. Recent studies have exchanged the behaviorally based comparison between media with more cognitively oriented questions. These cognitive researchers have moved from asking which medium was a better teacher to the concern with which "attributes" of media might combine with learner traits under different task conditions and performance demands to produce different kinds of learning.

Introduction of technologies and techniques should be accompanied by the development of relevant cognitive skills (Olson & Bruner,1974). Olson argued that any accomplishment of human activity must begin with an understanding of the activities whereby information is picked up from the environment, mentally transformed, and stored.

Salomon (1979) offered a theory based on the assumption that (a) both the media and the human mind employ symbols to represent, store, and manipulate information, and (b) that some of the symbol systems employed in cognition are acquired from the symbol systems employed by the media. The Olson theory (1976) attempts to show how in instruction the content of the medium is related

to the knowledge acquired, while the means employed are related to the skills, strategies, and heuristics that are called upon and developed. This implies that perhaps the function of media that presents new symbol systems is not so much to convey old knowledge in new forms but rather to cultivate new skills for exploration and internal representation.

The more distinctive or contrived the symbol system used to represent information, the more distinctive the mental skills that are required and called upon. For example, Salomon (1974) distinguished between televised instruction that only employed the technology of television without much emphasis on the medium's unique symbolic potentialities and televised instruction that does utilize these features fully such as zooming of camera lens. The results showed that only the latter was found to make a difference in the kinds of knowledge acquired and the meanings derived from instruction as it calls upon different sets of mental skills.

Greenfield (1984) and Salomon (1979) reviews have shown that symbolic features of mediated experiences and instruction seem to affect differentially the skills activated in the service of knowledge acquisition and on the mastery of these skills. This supports the Vygotskian view that a particular coding or structural elements of the media (e.g., filmic causal sequences) or particular afforded activities (e.g., programing) may have specific effects on related mental skills. Thus, the employment of a coding element such as a close-up, or the allowance for students' manipulation of input data (e.g., Lesgold & Reif, 1983), may activate specific mental operations that facilitate the acquisition of knowledge as well as their improved mastery.

The possibility of skill activation and cultivation from specific media attributes also raises new conceptual and empirical questions. If media's symbolic modes of information presentation can activate, even cultivate mental

operations and skills, are these skills unique? What is their utility? And how far do they transfer? These questions are of particular interest with respect to the use of computers in instruction (Papert, 1980; Pea & Kurland, 1985; Tikomirov, 1974;), for many computer-afforded activities are rationalized in terms of their unique effects on transferability skills. For instance, one may pause to ask whether one's knowledge in LOGO programing would help the one to solve some logically related complex problems in the real world? Writes Papert (1980): "By providing a very concrete, down-to-earth model of a particular style of thinking, work with the computer can foster...a 'style of thinking'...that is to say learning to think articulately about thinking." In all, it appears that media's symbolic forms and computer afforded activities may have skill-cultivation effects, but that these are not necessarily unique nor easily transferable. It is, therefore, necessary for future educational media research to ask not only how best we can develop the understanding and mental representation of media information but also how best we can relate that acquired knowledge to a real contexts or apply it to solve real world problems.

Studies on student choice of instructional conditions by Saracho (1982), Machula (1978-79), and Clark (1982) indicated that student enjoyment of instructional media and their subsequent learning achievement were negatively correlated. The study suggested that allowing students to choose the medium or method they prefer may not always result in maximum learning outcomes. A year long study by Saracho (1982) found that students assigned to Computer Assisted Instruction (CAI) in basic skills liked the computer less but learned more than from other media. Similarly, Machula (1978-79) gave instruction to over 100 undergraduates via television, voice recording, and printed text. Students liked the television less but learned more from it than from the voice recording which they liked more.

A review by Clark (1982) has indicated that students incorrectly assess the extent to which the instructional methods associated with the medium allow them the most efficient use of their effort. It was found that higher ability students seem to like methods and media that they perceive as better structured and more directive because they think these demand less effort to achieve success. Lower ability students, on the other hand, seem to like less structured and more discovery-oriented methods and media. They seem to avoid investing the effort required by the more structured approaches which they may expect to result in failure.

It seems that as each new medium comes along, researchers select questions previously addressed to the older media (Clark, in press, Gardiner, 1982; Wartella & Reeves, 1983). Two important lessons and questions are summarized as follows:

1. Past research on media has shown quite clearly that no medium enhances learning more than any other medium regardless of learning task, learner traits, symbolic elements, curriculum content, or setting.

Gross comparisons of computers or video disc technologies versus more conventional media for instruction are not likely to prove to be more useful in the future than they have been in the past. All such research was subject to compelling hypotheses concerning uncontrolled effects of instructional content, method, and novelty. We do not expect that any known or to-be-developed media will alter this expectation. However, evaluations of developed and developing media-based programs might usefully compare alternative forms of delivering and shaping instruction on the basis of cost efficiency and appeal to students without necessarily making inferences about "learning" or "performance" (effectiveness) advantages due to the medium selected. According

to Reiser and Gagne (1982), the future media selection schemes should be based on appeal and efficiency rather than presumed learning benefits. This is similar to the views of instructional theorists (Reigeluth, 1983), that instructional outcomes (effectiveness, efficiency, and appeal) should focus on the instruction rather than on the learner; learning achievement (effectiveness) is but one aspect of instructional outcomes.

2. Any new technology is likely to teach better than its predecessors because it generally provides better prepared instructional materials and its novelty engages learners.

As each new medium is developed and gradually introduced to educational settings, it provides the opportunity for trying out novel and often engaging instructional design strategies. So, as each new medium is put into educational use, researchers might consider a number of different questions. For example, we might ask about the impact of a medium's introduction on the setting (e.g., organizational climate, interactions between provider and user groups, allocation of resources), and the changes the setting undergoes (e.g., Sheingolg et al., 1983).

Office of Technology Assessment (OTA,1988) research on educational uses of computers in a wide range of applications has also found that the varied capabilities of the technologies are key to their power. Educators use interactive technologies for many purposes; there is no single "best use" of technology in schools and colleges to improve learning. Among others, the OTA findings showed that students using databases outperform other students in tests of information processing skills. In addition, databases help students to understand underlying concepts and relationships better, work more cooperatively, and become more enthusiastic about gathering and analyzing data. The studies also revealed that "hypertext" systems allow students to effectively manipulate text,

graphics, and different levels of information. This supports the view that some cognitive strategies such as frames, chunking and maping are best for certain category of knowledge such as verbal information, concrete concept, and rule (Gagne & Wager, 1988) .

MULTIMEDIA

"The ability to transfer information is what education is all about", and multimedia systems allow you that by using the sensory functions of the body. Multimedia is the combination of visual, graphics, audio, and textual materials using simple or sophisticated technology. "The best things that come from multimedia tools", according to Roberts (1991), "are the motivation to really learn and the students increased self-esteem when they see and show off the results." Interactive multimedia allows students to prospel themselves forward by their own curiosity (i.e., learning by digression) and build, connection by connection, their very personal understanding of the world (T.H.E., Special Issue, IBM Multimedia, Sept., 1991). Multimedia allows teachers to transform teaching and learning. Teachers create exciting and effective learning environments where students are given the opportunity to have hands-on "content-performance" practice with those learning tools. Consequently, they become active participants rather than passive recipients of information, says Knight (1991). Putting tools in the hands of students in turn forces them to think about relationships. According to Soloway of University of Michigan (T.H.E., February 1991, vol 18), in the classrooms, using multimedia learning becomes an active process where student uses the technology to communicate his or her understanding of a subject to those around him or her.

Based on interviews with dozens of educators and industry people as to why they use multimedia technology instead of more traditional classroom

tools, here are some of the responses regarding benefits, to both students and educators, for using multiple integrated technologies in the classroom (T.H.E., Feb 1991): Multimedia

- Reaches all the senses which enhances learning. It is tailored to the learning styles of individuals whether they are visual, verbal, auditory, or physical learners.
- Encourages and validates self-expression, helps students to have more control and more of a voice in their own learning process.
- Fosters communication between students and teachers. It allows ideas to flow in ways that may not always be possible through words alone.
- It is a lot of fun.
- Makes sense: technology is already built into the lives of today's students, so it is something with which they feel comfortable.
- Creates an active rather than passive atmosphere because it forces the students to participate and think about what they are learning. "Engages the disengaged", said one educator.
- Gives sense of ownership to the user. Students actually create what they learn and there is often physical evidence of that learning.

Studies suggest that students studying in pairs or small groups learn faster, retain more, and feel more positive about the learning process and about themselves. Individualized multimedia instruction also allows students of varying skill levels to learn productively within a single classroom environment.

Despite all those teaching and learning benefits from multimedia, there is still a need for indepth research on these new educational tools since many questions still persist regarding the full potentials of multimedia. For instance, have educators or the companies that produce multimedia products really stopped to think about the variety of purposes of putting multimedia into

educational uses? Or is there simply a growing trend to gather together all available technologies, repackage or repurpose, and use them without true consideration for pedagogical value? What is not so readily understood is the extent of multimedia's ability to help better educate students. There is a mounting concern that not enough users of multimedia have paused to consider the consequences of using or adopting those technologies in our educational systems. "At this stage we do not know whether multimedia helps the learning process" said White (T.H.E., Feb., 1991).

According to Fred D'Ignazio of East Lansing High School, Michigan (T.H.E., Feb., 1991), multimedia has to go through the cycle of experimentation, discovery, and reinvention since multimedia is still young to have been tested and conclusively proven effective in research laboratories. In response to the question whether multimedia is an effective tool, Jon Young (T.H.E., Feb., 1991) believes that multimedia is at least as effective today as other methods of teaching and learning, but there is no proof.

Lessons for Study about INTELSTACKS

The literature reveals that media do not affect learning in and of themselves. Rather, some particular qualities of media may affect particular cognitions that are relevant for the learning of the knowledge required by students with specific aptitude levels when learning some tasks. The study and development of media in education are aimed at the improvement of the education, not the glorification of the media. If that is the case, then there is a need to conduct a formal study, not mere summative evaluation, to assess and improve (if judged necessary) the educational potentials of a teaching and learning tool like Intelstacks. This suggests some interesting questions that the researcher may address. For example, to what extent may the students' understanding of the

subject-matter (Intelstacks Information) facilitate students' understanding of complex international issues? In what ways may the cognitive strategies such as "chunking" or organization of the information (e.g., networks, electonic media, print media, programs, etc) help students to better acquire the concrete concepts of international media systems? To what extent may Intelstacks attributes such as sounds, graphics, and "hot buttons" enhance students' learning of the subject-matter?

In response (partial or full) to the above questions, INTELSTACKS program was primarily developed in an attempt to solve the complex teaching and learning of facts and concepts about international media systems within and across nations. The design strategies were to breakdown the generalities (e.g., networks) and examples (e.g., radio and television) of media concepts and facts into logical units, present those concepts and facts to students in a form of class presentations by the content expert (instructor), and then ask students to use the "hot buttons" built into the program to navigate easily through the stacks for an indept knowledge. Again, the Find and Sorting tools were purposely provided so that students could connect those facts and concepts together, see, analyze, and understand the kinds of relationships that exist among the INTELSTACKS information (especially the electronic media, print media, and general information). Such learner control or manipulation of information would not only motivate the student to learn more in an efficient way but also help him or her to perceive the kinds of impacts that different media systems have on national and international economic, social, and cultural developments. Apart from the amount of information that the student could gain from the database, the special attributes of INTELSTACKS such as sounds, maps, content organization, screen design (especially the legibility of the text formats), and other graphics were designed to promote instructional outcomes (i.e., teaching

and learning efficiency and appeal). Another interesting factor that needed to be considered here was "comprehensibility". Anderson and Lorch (1983) found that children attend to televised material that is comprehensible to them. This implies that comprehensibility determines attention rather than the other way round. This suggests that instructional production techniques should be oriented to conveying comprehensible information rather than attracting attention. The study of INTELSTACKS attempted to identify all the critical attributes of the program which not only distinguish between other media in meaningful ways but which also affect learning relevant cognitions.

CHAPTER 3

METHODOLOGY OF INTELSTACKS DEVELOPMENT AND FIELD TEST

RATIONALE FOR INTELSTACKS PROCEDURE

Computer Assisted Instruction (CAI) continues to incorporate more and more multimedia elements. The use of color, sounds, graphics, and animation makes software or courseware entertaining and educational. Melding of audio, visual, and text materials into one program is a better way to excite students about the prospects and processes of learning (T.H.E., Multimedia Source Guide, 1992-1993). Unlike most of other educational software or courseware, the basic tenets that make INTELSTACKS program more a strategic tool for instruction and research are the importance that the authors attached to the academic content (Substance), Instructional Design Process (Style or Method), and communication technologies (Tools)

DEVELOPMENT PROCEDURE

During the initial planning stage, the following elements or components that might influence the program's effectiveness and credibility were carefully studied: the Topic, Subject-matter, Characteristics of the Target Population, Goals, Tasks, Objectives, Applicable Category of Knowledge, Evaluation, and Resources. Some series of events of instruction were considered as well, such as gaining attention.

TOPIC: A general topic (General Information on International Media and Programs) was selected from the broad telecommunication subject area. The general topic was further divided into subtopics forming the four major stacks of the program. Thus, General Information,

Electronic Media, Print Media, and Telephony were selected. Due the to interdependence or interrelated nature of the stacks, a branching system using a hypercard program was best thought of as the appropriate mode for content presentation. The hypercard program was chosen because of itscapabilities of combining sounds, text, graphics, color, etc in a form of one multimedia program. The instructional strategies chosen were stand-alone tutorials and classroom presentations.

SUBJECT-MATTER ANALYSIS. The knowledge base or relevant information about facts and concepts of each country and its media was carefully analyzed and selected to build the database.

TARGET POPULATION. Factors such as the age, expected academic skills, and interests of the users or students were the author's concern. As the program was originally planned for TC 498 students or users with the same academic standard or above, the target population was considered as mature students or users who could handle complex issues. Also, the students in TC 498 were assumed to have taken some basic courses such as TC 220 and TC 230 and that they had acquired the necessary entry prerequisites such as the invention of telegraphs and telephones, to use the INTELSTACKS program. For those users who have not mastered the prerequisite skills, the reference guide built in the program sufficiently served as a facilator or sources for introductory studies on telecommunication issues. Of course, to arouse each student's interest during class instruction is a difficult task. So the use of sounds, maps, moderate graphics, and different text styles was a way of getting users or students attention.

GOALS. The main goals that the author expected to accomplish as a result of

the program were:

- Providing students and teachers a maximum of information that could be useful for classroom applications.
- Integrating body sensory attributes of media such as sound, text, maps, and graphics into a single computerized source that will enhance users' cognitive skills.
- Providing an international media database system that can be accessed from on campus locations such as computer laboratories, the main library as well as personal stand-alone floppy and hard disks.

INSTRUCTIONAL TASKS. The nature of the program design provides the users with the guidelines to use or efficiently learn from the database. For instance the data were organized into logical units and navigating through the stacks was done using the "hot buttons".

OBJECTIVE. After careful study of the content for a particular country or countries within the INTELSTACKS program, students should be able to build connections between the amount of media penetration and services on one hand and demographic information on the other hand. Thus, the student could understand and give a meaningful account of media influence on economic, political, social, and cultural developments within and across nations.

APPLICABLE CATEGORY OF KNOWLEDGE. The type of learning outcomes for this program could be described as:

a. Textual Information; recalling figures, percentages, names, and organized bodies of factual information.

b. Concrete Concepts; identification of properties or components of a

country's telecommunications system, such as development of radio, television, satellite, computers, cable, programs, radio and television stations and networks, etc.

c. Rule; the ability to relate media to national and international development issues.

d. Problem solving; the ability to apply the appropriate media rules or systems of a specific country (e.g., the United States or United Kingdom) to another (e.g., Ghana) especially when dealing with media related issues.

EVALUATION. Two types of evaluation process, formative and summative, were used to assess the educational potentials of the program. The authors were highly interested in finding out whether the database system would be effective for instruction and research, interesting and motivating, had high standards of technical and aesthetic quality, and also what revisions were needed to improve the INTELSTACKS program.

The formative evaluation was an ongoing process throughout the entire development process. After the first design by the researcher, the production team met to examine, discuss, criticize, and then made changes where necessary. The graphic designer finally designed the INTELSTACKS format. The researcher and the content expert met from time to time to examine the input data and updated some of the information.

After the first version of the program was developed the author deemed it necessary to test it on a sample of the target population. This summative evaluation, in a form of Field Test, forms the basis of this thesis (study). The methodology, findings, and conclusions are discussed in the remaining chapters.

RESOURCES. At this stage of the process, three important issues were

considered: equipment and software; human resources; and financial matters.

Equipment and Software: As INTELSTACKS demand a standardized program (i.e., hypercard), a Macintosh microcomputer was predetermined. A LED crystal projector, simple overhead projector, and normal classroom white screen were needed as a peripherals.

Human Resources: The topic and the program goals helped the author to determine the skills needed to develop the program and how much time in terms of human effort. The people needed were content expert (TC 498 course instructor), graphic designer and programmer (hypermedia expert in the Department of Telecommunication, and instructional designers (two graduate students in the Department of Educational Systems Development, College of Education).

Financial Matters: Depreciation of equipment to be used at the Department of Telecommunications and individuals to be paid for their time were considered.

Due to the limited resources, the co-authors (the content expert and the hypermedia expert) made some important decisions so as to save time, money, and human effort. For example, time for trial and evaluation was built into the content expert's course schedule. Two interested graduate students, both majoring in Instructional Design and Technology, agreed to work on the project development. The hypermedia expert from the same Department of Telecommunication served as the programmer as well the overall technical advisor.

EVENTS OF INSTRUCTION

The co-authors also carefully considered the use of some series of events that might promote internal learning processes, as suggested by Gagne's learning

model. These include:

a. Gaining attention. The program title, introduction, and initial instruction were presented using special graphics. Text attributes such as, boldface, and italics were used where necessary.

b. Stimuli. Distinctive features, such as graphics and text attributes were used to present the information in organized, systematic, and small segments.

c. Guiding Learning; The "hot buttons" serve as facilitators for relating ideas within a stack or to those of other stacks. Again, the use of maps helps students to locate countries on the globe and also to make better connections on telecommunication issues such as physical conditions affecting media adoption in a particular region, cross border data flow, tariffs, satellite and frequency allocations.

INTERACTIVITY. As a means of making the program more meaningful to the user, the highest level of interactivity (i.e., Proactive Design) was the level of choice instead of Reactive and Coactive. The proactive design permits the user to control both content and structure of the program whenever there is a need by sorting and manipulating the database.

FLOWCHART. The use of a flowchart initially gave the graduate assistant a broad "map" of the program's structure. This helped to identify branches, input points, graphics, and other program features. Also, it helped to make accurate judgement whether there was a balanced mixture of text attributes and graphics on the cards or screen display.

INTELSTACKS PROTOTYPE

Intelstacks is a hypercard based program. It comprises five stacks; (1) General Information such as population, GNP, Education, etc (2) Print Media such as daily newspapers, weekly and monthly magazines. etc (3) Electronic Media such

as television, radio, computers, satellite, etc (4) Telephony such as telephone manufacturers, devices, ownership, local and long distance services, and (5) World Map representing each country. These stacks are interconnected by the "hot buttons" found on each card in the program. Prior to the field test, country indexing and statistical tools as well as the Telephony stack were not activated.

When the INTELSTACKS prototype was ready for the field test the researcher and the content expert (i.e., TC 498 course instructor) carefully studied the program (content, fields, buttons, stacks, etc). All the activated stacks and buttons worked successfully and the content or information was sufficient enough for class applications. Then we decided to test the program on TC 498 students.

FIELD TEST

It is extremely difficult, in teaching and learning, to give accurate measurement of all media attributes that may have an impact on student learning achievements. The scope of this study was defined to assess all the major attributes of INTELSTACKS in relation to student learning gains.

In an effort to test educational potentials and production qualities of INTELSTACKS prototype, a field test was conducted during the Spring Term, 1990. The research methodology and procedures are explained in the following sections. The study sample are described, equipment used is specified, training, demonstration and practice are described, construction of survey instrument is discussed, the hypotheses are stated, data collection, and data analysis procedures are delineated.

HYPOTHESIS

The students' ease of reading the text formats (legibility) and understanding of the subject-matter (comprehensibility) were expected to have a major infuence

on the accomplishment of their mental processing of information presented in the INTELSTACKS program. Therefore, the design techniques such as the text formats, content organization, and terminology or wording need careful examination.

Second, the sounds, graphics, and special effects built into the program deserve attention. This is true because all that we normally hear (as sounds or noise) and see textually or graphically during instruction tend to activate the body senses, especially in times of learning difficulties, boredom, or fatigue. Thus, sounds and special effects are expected to play a part in getting students' attention and stimulating them to be active learners. Furthermore, the searching tools such as the "Hot Buttons", Find, and Sorting provide learner control or manipulation of information. This control not only motivates students to learn more in an efficient way but also permits them to make sense of what they are learning. Making navigation through the stacks a fun should help motivate students to take control.

These critical elements prompted the researcher to formulate the following four hypotheses to guide the collection and analysis of data for the study.

Hypothsis 1:

The legibility and comprehensibility of INTELSTACKS information, the sounds and graphics built into the program, how fun and easy to use the program is, and the organization of information in the program have statistically significant positive effects on students' understanding of the course material.

Hypothsis 2:

The legibility and comprehensibility of INTELSTACKS information, the sounds and graphics built into the program, how fun and easy to use the program is, and

the organization of information in the program have statistically significant positive effects on students' learning enhancement in class.

Hypothsis 3:

The legibility and comprehensibility of INTELSTACKS information, the sounds and graphics built into the program, how fun and easy to use the program is, and the organization of information in the program have statistically significant positive effects on students' stimulation to think in new ways.

Hypothsis 4:

The legibility and comprehensibility of INTELSTACKS information, the sounds and graphics built into the program, how fun and easy to use the program is, and the organization of information is organized in the program have statistically significant positive effects on students' discovery of something interesting.

THE STUDY SAMPLE

The sample group used for the study included all the 38 students in TC 498 class, Spring Term, 1990. This class consisted of twenty male and eighteen female students, majoring in international telecommunications. The class was considered as homogeneous since all the 38 students were undergraduates (juniors and seniors) except two who were graduate students.

TRAINING

As the program was new to the students the instructor, assisted by one graduate assistant, organized a three - hour training session. The training program focused on how to operate a Macintosh microcomputer, accessing the database from Communication Arts and Science Macintosh Laboratory workstation or stand-

alone floppy disk, techniques of navigating through the stacks, using special commands for the program, and how to get help.

EQUIPMENT

The equipment and software used for the instructor's class demonstration and presentations included one MAC II microcomputer, one liquid crystal overhead projector, one large white screen, the hypercard program and the INTELSTACKS program.

Immediately after the first day demonstration and presentation of the INTELSTACKS to the entire class, the database program was installed on all the workstations at the Communication Macintosh Laboratory workstations. A copy of the program was made available to any student who requested that on his or her own floppy disk. There were enough microcomputers for each student, so this provided an opportunity for the students either to work in groups or individually.

DEMONSTRATION AND PRACTICE

For a period of four weeks the instructor used the international media database to support his traditional classroom teaching. After seeing the database in presentation form, the students were asked to use the database at the Mac Lab or their own copies of the program on floppy disks to support their class assignments after lectures. The researcher and other graduate student were scheduled to assist the students during the laboratory periods. The instructor assigned the INTELSTACKS program to the students as one of the sources of reference to support their term paper.

DEVELOPMENT OF SURVEY INSTRUMENT (CONTENT VALIDITY)

The researcher constructed a survey instrument with which to gather information vital to the study. The content expert, the hypermedia expert, and two graduate assistants reviewed the draft of the survey questionnaire. They previewed the survey instrument for content validity, with appreciable suggestions for changes in some individual questions. Considering the newness of hypercard to many students, the two professors suggested the inclusion of students' prior knowledge of the hypercard program in the questionnaire.

DATA COLLECTION

During the last class of the term, the questionnaire (see appendix A), was administered to all the 38 students in TC 498. The students responded independently and the papers were collected at the end of the class.

CHAPTER 4

DATA ANALYSIS

The principal variables and the INTELSTACKS attributes that were studied included, first the independent variables: legibility and comprehensibility of INTELSTACKS information, the extent to which the sounds enhanced the use of the database, the extent to which the graphics detracted students from using the database, students' fun to use the program, how hard they found it to use the program, and the extent to which the organization of information in the program confused them when using the database. Second, the independent variables were questions whether students thought INTELSTACKS enhanced their learning of and understanding of course material, stimulated them to think in new ways, and resulted in their discovery of something interesting that they did not know before using the program.

Both descriptive (summary) and inferential statistics (simple regression and correlation) were used to analyze the data. Multiple regression was the statistical model used to test the statistical significance of all the four hypotheses. The practical significance of INTELSTACKS program was judged through the quality of the students' term papers and individual remarks. A MINITAB statistical program was used to analyze the data.

1. Independent variables:

The information presented in the database was legible and comprehensible	5	4	3	2	1
The database was hard to use	5	4	3	2	1
The graphics detracted from database information	5	4	3	2	1
The sounds enhanced the database information	5	4	3	2	1
The database was fun to use	5	4	3	2	1
The way information is organized in the database is confusing	5	4	3	2	1

2. Dependent Variables:

The database has enhanced my understanding of course material	5	4	3	2	1
The database has enhanced my learning from class	5	4	3	2	1
The database stimulated me to think in new ways	5	4	3	2	1
I discovered something interesting I did not know before when I used the database myself	5	4	3	2	1

Before testing the hypotheses both visual analysis and summary statistics were made using scatter diagrams and descriptive tables obtained from the MINITAB output of the principal variables.

SUMMARY STATISTICS

Table 1: The statistics describing the percentage and average of the students' ratings of all the 36 variables used for the study are presented in this table. The variables are classified into domains; Factor Efficiency, Learning Gains, Difficulty, Preference, Hardware and Software Usage, and Frequency of Hypercard Usage.

Factor Efficiency

TABLE 1A: Efficiency

VARIABLES:	PERCENTAGE Agree High 5	4	3	2	Disagree Low 1	Average
Legibility & Comprehensibility:	31.6	52.6	15.8	---	---	4.2
Efficient access:	31.6	42.1	23.7	2.6	---	4.0
Sounds enhanced:	7.9	18.4	39.5	21.1	13.2	2.9
Fun to use:	10.8	48.7	40.5	---	---	3.7
Documentation sufficient:	2.6	36.8	44.7	7.9	7.9	3.2
Map not important:	2.6	2.6	10.5	36.8	47.4	1.8

The summary of the above data indicates that, first, students' ratings of the legibility and comprehensibility of INTELSTACKS information and how fun it was to use were very positive. No student perceived low or negative effect of these two aspects of program on their learning enhancement. Second, concerning efficiency in accessing information, only 3% of the students felt INTELSTACKS was not efficient way to access information, while 73% agreed or strongly agreed that it was efficient, and 24% found it average. Third, the program's documentation was found to be average. Fourth, 84% of the students found the maps, built into program to help students locate locations of the countries, very important. Only 5% agreed that they were not important, and 11% found them average. Fifth, all the students rated the program as a fun to use. Finally, on the average, 66% of the students agreed that the sounds enhanced the database information.

Learning Gain

TABLE 1B: Learning Gain

	PERCENTAGE					
	Agree High 5	4	3	2	Disagree Low 1	Average
VARIABLES:						
Enhanced learning:	10.8	40.5	35.1	8.1	5.4	3.4
Stimulated to think:	5.3	13.2	47.4	29.0	5.3	2.8
Understand course material:	5.3	34.2	42.1	15.8	2.6	3.2
Discover something:	18.4	39.5	29.0	5.3	7.9	3.6

Regarding learning effectiveness, 52% of the respondents strongly agreed that the program enhanced their learning in class, while 35% neither agreed nor disagreed, and 13% said it contributed little to their learning process in class. Concerning the students' attitude about understanding of the course material with the help of the program and whether the program stimulated them to think in new ways, they found the program to be average. However, 58% said the program helped them to discover something interesting that they did not know before.

Difficulty

TABLE 1C: Difficulty

	PERCENTAGE					
	Agree High 5	4	3	2	Disagree Low 1	Average
VARIABLES:						
Hard to use:	---	2.6	23.7	39.5	34.2	1.9
Graphics detract:	2.6	2.6	18.4	34.2	42.1	1.9
Not good to learn about media:	---	10.5	13.2	44.7	31.6	2.0
Organization of information confusing:	---	2.6	18.4	50.0	29.0	1.9
Insufficient training:	2.6	7.9	36.8	42.1	10.5	2.5
Rather not have used the database:	2.6	10.5	21.1	39.5	26.3	2.2

On the design related items, the percentage of the students who had difficulty using the program was very minimal. Table 1c shows that 74% disagreed that the program was hard to use, 79% also disagreed that the way the information was organized in the program was confusing, and only 5% agreed that the graphics detracted them from effectively using the database. Again, 50% found the training sufficient, 66% liked to use the database, and only 34% agreed that databases are not a very good way to learn about media from other countries.

Preference

TABLE 1D: Preference

	PERCENTAGE					
	Agree High 5	4	3	2	Disagree Low 1	Average
VARIABLES:						
Do not like computers:	5.3	2.6	31.6	21.1	39.5	2.1
Program is different:	7.9	29.0	39.5	18.4	5.3	3.1
Liked program less:	5.3	2.6	31.6	52.6	7.9	2.4
Liked program better:	5.3	21.1	60.5	7.9	5.3	3.1
Program better for in-class presentation:	---	13.2	18.4	42.1	26.3	2.2
Program close to final version:	10.5	23.7	47.4	15.8	2.6	3.2

Regarding the researcher's concern about the quality of the program, in relation to other software or courseware that the students have used for instruction and research, he found that, on the average, the students liked INTELSTACKS better than other software they have used, 60% liked the program just like any other programs they have used, and 66% found it different from other software. However, 68% of the students did not like it for in-class presentation. About 50% expressed the need to update the program. Concerning the students' attitude towards the use of computers in education, 8% expressed dissatisfaction.

Hardware and Software Usage

TABLE 1E: Hardware & Software Usage

	PERCENTAGE	
	1=use (YES)	0=Do Not Use (No)
VARIABLES:		
IBM	63.9	36.1
MACINTOSH	47.2	52.8
OTHER COMPUTERS	16.7	83.3
Word Processor	88.9	11.1
Spread Sheet	50.0	50.0
Database	41.7	58.3
Hypercard	27.8	72.2
Other Software	11.1	88.9

Table 1E indicates that about half of the class are non Macintosh users and 64% are IBM (compatible) users. As for software, only 28% of the students knew how to use hypercard, and only 42% had ever used a database. Word Processing is the most commonly used software, followed by Spread Sheet.

Frequency Of Hypercard Usage (Months)

TABLE 1F: Frequency of Hypercard Usage (Months)

	MONTHS WITH HYPERCARD	
Months	Count	Percent
0	13	56.5
1	1	4.4
2	1	4.4
4	2	8.7
8	1	4.4
12	4	17.4
24	1	4.4

Concerning the question on students' familiarity with Hypercard program, 23 out of 38 students responded to this question. The data as described by the MINITAB show that only one student had used hypercard program for more than one year before the study, four students for almost a year, three students between four to eight months, four students barely a month, and 13 students had never used Hypercard prior to the study.

Frequency of Hypercard Usage (Hours)

TABLE 1G: Frequency of Hypercard Usage (Hours)

HOURS PER WEEK WITH HYPERCARD

Hours	Count	Percent
0	7	33.3
1	6	28.6
2	4	19.5
3	3	14.3
15	1	4.8

Twenty one students responded to the question on the number of hours spent on hypercard per week. The table shows that only one student spent almost 15 hours a week on hypercard application, seven spent less than an hour, six spent an hour, and the rest two hours on the average.

Hypercard Again

TABLE 1H: Hypercard Again

	Count	Percent
1= Will use Again	23	95.8
0= Will Not Use Again	1	4.2

The question as to whether a student will use the program again or not, 24 students responded. All the respondents, except one, expressed their willingness to use the program again.

VISUAL AND SUMMARY ANALYSES

As a means of checking for multicolinearity, all the six independent variables were first, plotted against each other. Second, correlations were run for all the independent variables. The scatter diagrams and the correlations output obtained helped the researcher to determine the nature of relationships among the independent variables (see Table 1).

Relationships Among Independent Variables

TABLE 2: Correlation Matrix For Independent Variables

	LEGCOM	HARD	GRAPDR	SONDENH	FUNUSE	ORGCONF
LEGCOM	–	–.223	–.421	.099	.530	–.449
HARD	–	–	.257	–.181	–.318	.626
GRAPDR	–	–	–	–.210	–.380	.566
SONDENH	–	–	–	–	.434	–.008
FUNUSE	–	–	–	–	–	–.347

Significance at .05

The correlation matrix table above indicates that there were slight associations between (1) the legibility and conprehensibiity of INTELSTACKS information and how students found it fun to use the program, (2) Hard to use the program and the organization of information confusing, (3) Graphics detracting from database information and the organization of information confusing. As the multicolinearity was not severe, the researcher decided to use all these media

attributes to test the hypotheses formulated for this study, at 95% level of confidence.

Relationships Among Dependent Variables

TABLE 3: Correlation Matrix For Dependent Variables

	UNDSMAT	ENHLRN	STIMU
ENHLRN	0.727		
STIMU	0.515	0.526	
DISCOV	0.028	0.325	0.168

Significance at .05

The correlation matrix for the dependent variables above indicates that there are moderate positive associations between all the variables, students' understanding of the course material, learning enhancement, stimulation to think in new ways, and discovery of something interesting. Only discovery of something new that showed weak positive associations between students' understanding of the course material and students' discovery of something interesting. On the other hand, there was a strong positive relationship between students' understanding of the course material and their learning enhancement. These correlations were tested at 95% level of confidence.

Correlating the independent with the dependent variables, the researcher checked to see whether the independent variables were linearly related to the dependent variables or not. Also, correlations were run to see the strength of the bivariate relationships between the independent and dependent variables (see Table 4).

Bivariate Relationships Between Independent And Dependent Variables.

TABLE 4: Correlation Matrix For Dependent(Dv) Versus Independent(Idv) Variables.

	UNDMAT	ENHLRN	STIM	DISCOV
LEGCOM	.387	.468	.128	.204
HARD	-.019	.136	.024	.091
GRAPDR	-.095	-.341	-.169	-.219
SONDENH	.196	.443	.216	.365
FUNUSE	.502	.703	.372	.223
ORGCONF	-.061	-.063	.141	.035

Significance at .05

SUMMARY OF TABLE 4

1. First independent variable, whether students thought the program was fun to use: here we clearly see a very strong positive association (.703) between how students found it fun to use the program and how the program enhanced their learning, positive association (.502) between whether students found the program fun to use the program and their understanding of the course material, and slight positive association (.372) between whether students found it fun to use the program and whether they were stimulated to think in new ways.
2. Second independent variable (Legibility and comprehensibility of INTELSTACKS information): here we observe that there is positive relationship (.468) between how legible and comprehensible the students rated INTELSTACKS and how strongly students thought INTELSTACKS enhanced their learning, and slight positive relationship (.387) between how legible and comprehensible the students rated INTELSTACKS and students' self reported understanding of the course material.

3. Third independent variable, how much students thought the sounds enhanced the database: There are positive relationships between (1) enjoying the sounds and feeling that learning has been enhanced (at. 443, which is moderately related), students' discovery of something interesting (at .365, which is moderately related , stimulations to think in new ways (at .216, which shows weak association) and their perceived understanding of the course material (at .196, this also shows a very weak association).
4. Fourth independent variable, how hard the program is to use: We can see from the table that there are very weak associations between hard to use the program and all the dependent variables.
5. Fifth independent variable, how much graphics detracted from the database): Here we observe that there are weak negative associations between graphics detracting from the database and students' understanding of the course material as well as their stimulation to think in new ways. Again, graphics detraction shows a fairly significant negative associations between learning enhancement and students' discovery of something interesting.
6. Sixth independent variable, how much organization of information confused the students: This shows practically no relationship between any of the dependent variables. These correlations were tested at 95% level of confidence.

The scatter diagrams revealed that there were no linear relationships between these independent variables, Hard to use the program, Graphics detracting from the database, and Organization of information confusing, and all the dependent variables. Again, the correlation matrix of Table 4 indicates that the independent variables, Hard to use the program, Graphics detracting from the database, and Organization of information confusing, have no strong relationships with the

dependent variables.Despite these weak associations, the researcher still found it necessary to include all the attributes (independent variables) in the analysis. The reason was that the intent of the study was primarily to assess all the attributes or factors that might contribute negatively or positively to the educational potentials of INTELSTACKS program.

HYPOTHESES TESTING

The researcher was interested to know if there was any statistically significant evidence of an association between the media attributes and the students' learning achievement or gain. In light of this, four hypotheses were developed to test each of the six predictors used for this inferential analysis. Multiple regression was a statistical model used to test the statistically significance of the four hypotheses.

In the following analyses the researcher used how legible and comprehensible of INTELSTACKS information was, the extent to which sounds enhanced the database, the extent to which graphics detracted students from the database, how fun and easy to use the program was, and the extent to which the organization of information in the program confused the students, to measure (1) students' understanding of the course material, (2) students' learning enhancement in class, (3) students' stimulation to think in new ways, and (4) students' discovery of something interesting that they did not know prior to the use of the program.

Each hypothesis was tested at 95% level of confidence using 30 degrees of freedom, as expected from the MINITAB out put. This gave a critical value of 2.042 for the 36 observations.

Hypothsis 1:
The legibility and comprehensibility of INTELSTACKS information, the sounds and graphics built into the program, how fun and easy to use the program was, and the organization of information in the program have significant positive effects on students' understanding of the course material.

MTB > regr c4 6 c5 c8 c9 c10 c11 c19 c40

The regression equation is:

UNDSMAT = - 1.11 + 0.233 LEGCOMP + 0.161 HARD + 0.118 GRPHDTR - 0.010 SONDENH + 0.700 FUNUSE + 0.115 ORGCONF

37 cases used 1 case contains missing values

Predictor	Coef	Stdev	t-ratio	p
Constant	-1.111	1.244	-0.89	0.379
LEGCOMP	0.2328	0.2380	0.98	0.336
HARD	0.1605	0.2024	0.79	0.434
GRPHDTR	0.1184	0.1655	0.72	0.480
SONDENH	-0.0096	0.1331	-0.07	0.943
FUNUSE	0.7003	0.2642	2.65	0.013
ORGCONF	0.1153	0.2642	0.44	0.666

s = 0.7527 R-sq = 33.8% R-sq (adj) = 20.6%

Analysis of Variance

SOURCE	DF	SS	MS	F	p
Regression	6	8.6786	1.4464	2.55	0.041
Error	30	16.9971	0.5666		
Total	36	25.6757			

SOURCE	DF	SEQ SS
LEGCOMP	1	3.0482
HARD	1	0.3398
GRPHDTR	1	0.1655
SONDENH	1	1.0912
FUNUSE	1	3.9259
ORGCONF	1	0.1079

Unusual Observations

Obs.	LEGCOMP	UNDSMAT	Fit	Stdev.Fit	Residual	St.Resid
14	4.00	5.000	3.688	0.386	1.312	2.03R
25	4.00	1.000	2.425	0.333	-1.425	-2.11R
34	3.00	4.000	2.439	0.335	1.561	2.32R

R denotes an obs. with a large st. resid.

The regression output gave the following coefficients for INTELSTACKS principal attributes used for the study: elegibility and comprehensibility of INTELSTACKS information 0.23, hard to use the program 0.16, graphics detracting from the database 0.12, sounds enhancing the database -0.01, the organization of information confusing 0.12, and fun to use the program 0.70. These results indicate that:

1. Legibility and comprehensibility of INTELSTACKS information increased the understanding of the course material for those students who found it easier to read and understand the information presented in the program.
2. On the other hand, the program decreased the understanding of the course material for those individuals who (a) found it difficult to use the program, (b) were confused by the organization of information in the program, and (c) were detracted by the graphics. The sounds showed a slight negative effects on students' understanding of the course material. However, the coefficients for these attributes were not statistically significant. The t-ratios were: for legibility and comprehensibility of INTELSTACKS information 0.98, hard to use the program 0.79, graphics detracting from the database 0.72, sounds -0.07, and organization of information confusing 0.44. This lack of signifance implies that it may have been chance alone that the results gave those coefficients in the sample. The coefficient in the population, all international telecommunication majors in the Department of Telecommunication, may well be zero, in which case these attributes would have no relationship with the students' understanding of the course material in class.

3. The coefficient for more fun to use the program was positive (+ 0.70). This suggests that the "Hot buttons", Find, and Sorting tools made it more fun for the students to efficiently access the information, connect facts and concepts together, and better understand the course material. Thus, making INTELSTACKS program enjoyable and appealing to use as an instructional and research tool. The t-ratio for this coefficient was 2.65 which was statistically significant. This tends to rule out the possibility of chance variation producing this result. Controlling for other independent variables, students who thought INTELSTACKS was fun to use were more likely to think it enhanced their understanding of course material.

Our regression equation explained 33.8% of the variation in students' understanding of the course material. The remaining 66.2% of the variation was left unexplained. Again, the output listed two unusual observations. These data points were checked to see if there were mistakes in typing or coding, but no errors were found.

Hypothsis 2:
The legibility and comprehensibility of INTELSTACKS information, the sounds and graphics built into the program, how fun and easy to use the program was, and the organization of information in the program have significant positive effects on students'learning enhancement.

MTB > regr c12 6 c5 c8 c9 c10 c11 c19 c41

The regression equation is:

ENHLRN = - 2.25 + 0.219 LEGCOMP + 0.450 HARD - 0.119 GRPHDTR + 0.156 SONDENH + 0.941 FUNUSE + 0.086 ORGCONF

36 cases used 2 cases contain missing values

Predictor	Coef	Stdev	t-ratio	p
Constant	-2.253	1.035	-2.18	0.038
LEGCOMP	0.2190	0.2046	1.07	0.293
HARD	0.4499	0.1822	2.47	0.020
GRPHDTR	-0.1194	0.1380	-0.87	0.394
SONDENH	0.1561	0.1106	1.41	0.169
FUNUSE	0.9406	0.2204	4.27	0.000
ORGCONF	0.0864	0.2220	0.39	0.700

s = 0.6248 R-sq = 67.4% R-sq (adj = 60.7%

Analysis of Variance

SOURCE	DF	SS	MS	F	p
Regression	6	23.4283	3.9047	10.00	0.000
Error	29	11.3217	0.3904		
Total	35	34.7500			

SOURCE	DF	SEQ SS
LEGCOMP	1	7.3500
HARD	1	1.3636
GRPHDTR	1	1.4912
SONDENH	1	6.0914
FUNUSE	1	7.0730
ORGCONF	1	0.0591

Unusual Observations

Obs.	LEGCOMP	ENHLRN	Fit	Stdev.Fit	Residual	St.Resid
12	4.00	4.000	2.591	0.166	1.409	2.34R
13	4.00	2.000	3.357	0.257	-1.357	-2.38R

R denotes an obs. with a large st. resid.

The coefficient for student ratings of the legibility and comprehensibility of INTELSTACKS information was 0.22, how hard the program was to use 0.45, the extent to which graphics detracted students from the database was -0.12, the extent to which sounds enhanced the database was 0.16, how much fun students thought the program was to use was 0.94, and how much the way information was organized in the program confused students was 0.09. These results suggest that:

1. Controlling for the other independent variables, students who found the program hard to use also felt that it enhanced their learning. How hard it was to use the program had a t-ratio of 2.47, which was statistically significant.
2. Perceived legibility and comprehensibility of INTELSTACKS information and enjoyment of the sounds moderately enhanced students perceived learning. The t-ratios were: legibility and comprehensibility 1.07 and sounds 1.41. These were not statistically significant.
3. How fun it was to use the program was positively related to learning enhancement. The coefficient was highly statistically significant. It has a t-ratio of 4.27, thus ruling out the possibility of chance variation producing this result.

Our regression equation explained 67% of the variation in students' learning enhancement. The remaining 33% of the variation was left unexplained. Again, the output listed two unusual observations.

Hypothsis 3:
The legibility and comprehensibility of INTELSTACKS information, the sounds and graphics built into the program, how fun and easy to use the program was, and the organization of information in the program have significant positive effects on students' stimulation to think in new ways.

MTB > regr c15 6 c5 c8 c9 c10 c11 c19 c42

Theregressionequationis

STIMU = 0.22 - 0.034 LEGCOMP - 0.090 HARD - 0.258 GRPHDTR - 0.052 SONDENH + 0.643 FUNUSE + 0.606 ORGCONF

37 cases used 1case contains missing values

Predictor	Coef	Stdev	t-ratio	P
Constant	0.223	1.434	0.16	0.877
LEGCOMP	-0.0343	0.2744	-0.13	0.901
HARD	-0.0901	0.2334	-0.39	0.702
GRPHDTR	-0.2576	0.1909	-1.35	0.187
SONDENH	-0.0519	0.1535	-0.34	0.738
FUNUSE	0.6431	0.3047	2.11	0.043
ORGCONF	0.6062	0.3047	1.99	0.056

s = 0.8680 R-sq = 27.2% R-sq (adj) = 12.6%

AnalysisofVariance

SOURCE	DF	SS	MS	F	P
Regression	6	8.4267	1.4044	1.86	0.120
Error	30	22.6003	0.7533		
Total	36	31.0270			

SOURCE	DF	SEQSS
LEGCOMP	1	0.4840
HARD	1	0.0939
GRPHDTR	1	0.6029
SONDENH	1	1.2027
FUNUSE	1	3.0614
ORGCONF	1	2.9817

UnusualObservations

Obs.	LEGCOMP	STIMU	Fit	Stdev.Fit	Residual	St.Resid
30	4.00	5.000	2.761	0.283	2.239	2.73R

The regression coefficients for the attributes were: students' ratings of the legibility and comprehensibility of INTELSTACKS information was -0.03, how hard the program was to use was 0.09, the extent to which the graphics detracted students from the database was -0.26, the extent to which the sounds enhanced the database was -0.05, how fun students thought the program was to use was 0.64, and the way information was organized in the program confused students was 0.61. These results reveal that:

1. Legibility and comprehensibility of INTELSTACKS information, hard to use the program, graphic detracting from the database, and sounds were not statistically significant. Their t-ratios were: legibility and comprehensibility of INTELSTACKS information -0.13, hard to use the program -0.39, graphics distracting -1.35, and sounds -0.34. These make us believe that it might have been chance alone that students were not stimulated by these attributes.
2. The coefficient for feeling that organization of information was confusing was positive. The t-ratio was 1.99, which was statistically significant. Finding that the information was organized in a confusing way actually stimulated students to think in new ways. Perhaps the database organization conflicted with their own mental structure of international telecommunications, but also provided them with a new way of organizing that information.
3. The coefficient for how fun it was to use the program was positive. It has a t-ratio of 2.11, which was statistically significant. This has practical significance: making fun connections to facts and concepts may tend to stimulate high order thinking about the issue.

Our regression equation explained only 27% of the variation in students' stimulation to think in new ways. The remaining 73% of the variation was left unexplained. Again, the output listed one unusual observation.

Hypothsis 4:
The legibility and comprehensibility of INTELSTACKS information, the sounds and graphics built into the program, how fun and easy to use the program was, and the organization of information in the program have significant positve effects on students' discovery of something that they did not know before using the INTELSTACKS program.

MTB > regr c18 6 c5 c8 c9 c10 c11 c19 c43

The regression equation is

DISCOV = 0.96 + 0.289 LEGCOMP + 0.227 HARD - 0.200 GRPHDTR + 0.338 SONDENH + 0.001 FUNUSE + 0.175 ORGCONF

37 cases used 1 case contains missing values

Predictor	Coef	Stdev	t-ratio	p
Constant	0.960	1.792	0.54	0.596
LEGCOMP	0.2893	0.3428	0.84	0.405
HARD	0.2272	0.2915	0.78	0.442
GRPHDTR	-0.1995	0.2384	-0.84	0.409
SONDENH	0.3379	0.1917	1.76	0.088
FUNUSE	0.0014	0.3805	0.00	0.997
ORGCONF	0.1751	0.3806	0.46	0.649

s = 1.084 R-sq = 22.0% R-sq (adj) = 6.4%

Analysis of Variance

SOURCE	DF	SS	MS	F	p
Regression	6	9.930	1.655	1.41	0.244
Error	30	35.259	1.175		
Total	36	45.189			

SOURCE	DF	SEQSS
LEGCOMP	1	1.719
HARD	1	0.956
GRPHDTR	1	1.358
SONDENH	1	5.648
FUNUSE	1	0.000
ORGCONF	1	0.249

Unusual Observations

Obs.	LEGCOMP	DISCOV	Fit	Stdev.Fit	Residual	St.Resid
7	5.00	1.000	3.291	0.399	-2.291	-2.27R
14	4.00	1.000	3.341	0.557	-2.341	-2.52R
25	4.00	5.000	2.463	0.480	2.537	2.61R

R denotes an obs. with a large st. resid.

The coefficients for this analysis were: students ratings of the legibility and comprehensibility of INTELSTACKS information was -0.29, how hard the program was to use was 0.23, the extent to which the graphics detracted students from the database was -0.20, the extent to which the sounds enhanced the database was 0.34, how fun students thought the program was to use was 0.00, and the way information was organized in the program confused students was 0.18. These outcomes tell us that neither the overall regression nor any of the individual coefficients were significant predictors of discovering something interesting.

Our regression equation explained only 22% of the variation in students' understanding of the course material. The remaining 78% of the variation was left unexplained. Again, the output listed three unusual observations.

SUMMARY OF THE HYPOTHESES

The ratings of the 38 students involved in this study did indicate that students who found the program fun to use perceived understanding of the course material, learning enhancement, and stimulation to think in new ways.

On the other hand, the students' difficulty to use theprogram showed statistically significant effect on their learning enhancement. Also, finding the organization of INTELSTACKS information confusing had statistically significant effects with regard to students' being stimulated to think in new ways.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY:

Purpose of the study:

The purpose of this study was to assess the extent to which INTELSTACKS program attributes and the instructional presentation it affords can facilitate students' understanding of complex international telecommunication issues so that they will be able to analyze and give a meaningful account of media impacts on economic, political, social, and cultural developments within and across countries.

Field Test:

In an effort to test educational potentials and production qualities of INTELSTACKS prototype, a field test was conducted during the Spring Term, 1990. The research methodology and procedures were explained. Thus the study sample was described, equipment used was specified, training, demonstration and practice were described, construction of survey instrument was discussed, the hypotheses were stated, data collection, and data analysis procedures were delineated.

Limitations of Operationalizations and Generalizations

The really big limitation of this INTELSTACKS study is that all subjects were exposed to the exact same software. Some found it fun and easy to use, some found it confusing, and some were detracted from the database by the graphics. Also, you rely on self reported enhanced learning and enhanced understanding.

If one were to redo such a study, one should create two versions of the software. One fun to use, with good sounds and graphics, and the other normal plain software. And one should measure learning quantitatively. The study of the INTELSTACKS program has three limitations. First, for the purpose of assessing such content specific program pertinent to introductory course on international telecommunication issues, the sample used for the study was limited only to students at this course level, majoring in international telecommunications. However, due to the scope and relevance of the database, the study could be replicated on all the students majoring in international telecommunication as well as all international telecommunication professionals. Second, the sounds, graphics, and text formats were designed to serve only those who have normal hearing and sight capabilities. In this case the program could be used only by person with no hearing and sight impairements. Third, the cost involved in hiring additional students to work on the documentation, the time limits set to complete the program in order to be able to apply it Fall Term, 1990, and lack of sufficient information on some countries placed some limitations on the volume of information needed to optimize the use of the program. However, this study is likely to have a statistical and practical values for all students majoring in international telecommunications as well all telecommunications professionals.

Proposed Future Study

In an effort to investigate the nature of students' difficulties in using the program, as encountered by some students and which was proved statistically, the researcher propose the need for an immediate (or in the near future) a study of INTELSTACKS that would control for consequences of content level and design strategies. Specifically, the design should take into account (a) the course

level (e.g., TC 498, TC 869, TC 870, and TC 871) and the modified version of the sounds, graphics, text formats, searching tools, and reorganization of the information in the program. The proposed design should be a true experiment. The researcher suggests two designs: a completely randomized design (CR-p) and randomized block design (RB-p), see tables 5 and 6 below.

Complete Randomized Design (CR-p): This study will principally seek to assess the nature of difficulties that the design techniques might have produced that affected students' ease of use of the program. Regarding the INTELSTACKS design techniques, the sounds can be either eliminated, changed, or reduced to the minimum level, the graphics too can either be eliminated or simplified, the information has to be reorganized in the program, but the searching tools such as the "hot buttons", find, and sorting will be the same as the original. The treatment groups will use the revised version and the control groups will use the original version of INTELSTACK.

TABLE 5: Completely Randomized Block Design (CR-p)

	PROGRAM	
CLASSES: TC 498	TREATMENT	CONTROL
	REVISED VERSION	ORIGINAL VERSION

Random Blocked Design (RB-p): The main purpose of this study is to assess the extent to which both the design techniques and the content complexity or

difficulty may have on students in two different class levels (e.g., TC 498 and TC 870 or TC 871). Here, the researcher will compare the group means for treatment and control groups (a) within classes and (b) between classes. The within class comparisons will test the design techniques whereas that of between classes will test whether the content is appropriate for TC 498 class.

TABLE 6: Randomized Block Design (RB-p)

	PROGRAM	
	TREATMENT	CONTROL
CLASSES: TC 498:	REVISED VERSION	ORIGINAL VERSION
TC 498:	REVISED VERSION	ORIGINAL VERSION

CONCLUSIONS

The results of this study did indicate that, in general, the legibility and comprehensibility of information, the fun to use quality of the program, and sounds showed a statistically significant effects on students learning gain. The study provided a useful information in relation to previous media research findings:

1. Legibility and Comprehensibility of information. The statistically significant effects of these attributes on students' learning gain support the

Olson theory (1976) that attempted to show that in instruction the content of the medium is related to the amount of new knowledge that a learner may acquire.

2. The Fun to use. The findings about this attribute support the views (Gagne and Reiser, 1982) that future media selection schemes should be based on appeal and efficiency rather than presumed learning benefits.
3. Efficiency in accessing information. The students' positive remarks on INTELSTACKS efficiency in accessing information support the views of Reiser and Gagne (1982) that future media selection schemes should be based on appeal and efficiency rather than presumed learning benefits.
4. Software Better. The majority of the students expressed that Intelstacks was better than other software that they have used. This supports the OTA findings (1988) that any new technology is likely to teach better than its predecessors.

The concerns as to whether graphics detracted, whether students experienced difficulty in using the program, and whether the organization of the information in the program was confusing, all these showed extremely low correlations between students' learning gain. With regard to other attributes, 84.21% of the students found the maps very important and 44.74% considered the documentation average.

The practical significance of INTELSTACKS for instruction and research activities is best judged by the overall students' remarks. About half of the students stated that the program is user-friendly, easy to use, a good starting point, and a foundation for research. One student said "INTELSTACKS database is easy to use, no hassle; I prefer it to Lotus because I do not have to continually use those complicated functions." According to some students, once all the necessary information is put into the program and updated annually or

periodically, it will be a great resource, save students' time, and make research a lot more simple. If it is continually updated, it will be a fine tool and easier to use than checking out textbooks. "All software is helpful, however, after a prolonged exposure to any system, shortcomings become evident," said one student. However, some major critiques were made such as "everything seemed empty, the texts looked very small, and the mode of presentation made it difficult to read the data from the overhead projector in the classroom."

About computers in general, one student said "I am very unfamiliar with computers, but the more I have used them, the more I have found them to be beneficial". According to other student, "I am not really knowledgeable about computers because computers are not my friend." Another stated, "I have a very little experience with these systems, however, I am willing to give it a try. It seems like an efficient way to organize this sort of data."

The statistically significant effects of the major attributes of the program on students' learning gain, coupled with the overwhelming satisfaction expressed through individual comments, are clear indication that INTELSTACKS database program effectively and efficiently contributed to the understanding of the complex international telecommunication issues. Again, students' willingness to use INTELSTACKS database again for their subsequent telecommunications research activities, justifies the educational potentials of the program for our college and university students in the country and abroad.

RECOMMENDATIONS

The researcher has a few reflections to share with the authors of INTELSTACKS program as well as the Department of Telecommunications. Many educational programs, developed or purchased with the hard currency, have failed to respond to the needs of our traditional and local educators, that is, incompatible

with the traditional systems of education. The major concerns of the researcher are:

1. To realize the full potentials of INTELSTACKS program and to facilitate the ease of use of the program the authors of INTELSTACKS should consider a built-in tutorial. This should take a form of "Help Hot-buttons" that may:
   - provide guidelines or a checklist for operating a Macintosh microcomputer, especially for new users
   - offer some basic concepts about hypercard. For example, browsing, input data or updating the INTELSTACKS database.
   - briefly explain each stack in the program.
2. The statistical tool built within the program should be activated so that INTELSTACKS users can have the opportunity to instantly run some statistical analyses. In addition to that, the authors should provide the means of presenting the data in graphs, especially for those non statisticians.
3. The Department of Telecommunications should provide both technical and financial support for updating the data. I recommend a graduate student in International Telecommunications Area should be hired to assist the content expert (instructor) with documentation and updating of the program periodically.
4. The authors should consider converting the text from black and white to colored form. Also, the content per card should be reduced so as to make room for larger boldface graphics or text. These may enhance classroom group presentations.
5. The authors should consider building additional stacks that may incorporate some basic or general concepts and facts taught in other

undergraduate and graduate courses in telecommunications. Such integration would help users at different levels to relate and better understand the general telecommunications issues.

6. Considering the scope of the database and the pedagogical values of the program, the authors should submit the program to all telecommunications agents, especially International Telecommunications Union, for their appreciations. Not only their feedback would provide a means of updating the data but also serve as a relevant resource for research in International Telecommunications.

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Appendix A: Questions On INTELSTACKS

Name:_____

Class:_____

Date:_____

Please, rate your agreement or disagreement with the statements below based on your reactions to INTELSTACKS, the International Media Database used in class. Choose "5" if you strongly agree, "1" if you strongly disagree, or the number between those two that best describes your attitude.

	STRONGLY AGREE				STRONGLY DISAGREE
The database has enhanced my understanding of course material	5	4	3	2	1
The information presented in the database was legible and comprehensible	5	4	3	2	1
The database was an efficient way to access information	5	4	3	2	1
Databases are not a very good way to learn about media from other countries.	5	4	3	2	1
The database was hard to use	5	4	3	2	1
The graphics detracted from database information	5	4	3	2	1
The sounds enhanced the database information	5	4	3	2	1
The database was fun to use	5	4	3	2	1
The database has enhanced my learning from class	5	4	3	2	1
I would rather not have used the database myself	5	4	3	2	1

Appendix A (Continued)

	STRONGLY AGREE				STRONGLY DISAGREE
The database is better for in-class presentation than for individual exploration	5	4	3	2	1
The database program (how it works) is close to what it should be in the final version	5	4	3	2	1
It is not important to include world maps as a method of navigating within the database	5	4	3	2	1
I discovered something interesting I did not know before when I used the database myself	5	4	3	2	1
The way information is organized in the database is confusing	5	4	3	2	1
In general, I don't like using computers	5	4	3	2	1
The database for class seems different from other software I have used	5	4	3	2	1
I like this software much less than the other software I have used	5	4	3	2	1
I like this software better than the other software I have used	5	4	3	2	1
The training I received was insufficient	5	4	3	2	1
The written documentation was sufficient	5	4	3	2	1

Appendix A: (Continued)

These next questions are about computers and software in general.

What kind(s) of computers do you use the most?

_____ IBM Compatibles _____ Macintosh _____ Others

What kind(s) of software have you used for courseware and personal assignments?

_____ Word Processing _____ Spreadsheet _____ Database

_____ Hypercard _____ Other (please list) _____

Questions about Hypercard

I have used Hypercard for _____ years _____ months or _____ weeks

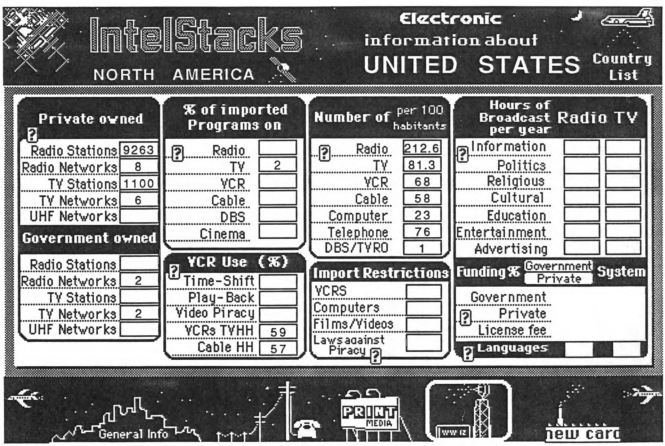
I work with Hypercard approximately _____ hours per week

I would like to use Hypercard again _____ Yes _____ No

On the back of this page, please comment on INTELSTACKS—

Things you like and things you would change about the software and the way it has been used in class !!!!!!!!

---THANK YOU---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information about
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Radio Networks 8
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TV Networks 6
UHF Networks
Government owned
Radio Stations
Radio Networks 2
TV Stations
TV Networks 2
UHF Networks
% of imported Programs on
Radio
TV 2
VCR
Cable
DBS
Cinema
YCR Use (%)
Time-Shift
Play-Back
Video Piracy
VCRs TVHH 59
Cable HH 57
Number of per 100 habitants
Radio 212.6
TV 81.3
VCR 68
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Computer 23
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DBS/TYRO 1
Import Restrictions
YCRS
Computers
Films/Videos
Laws against Piracy
Hours of Broadcast per year Radio TV
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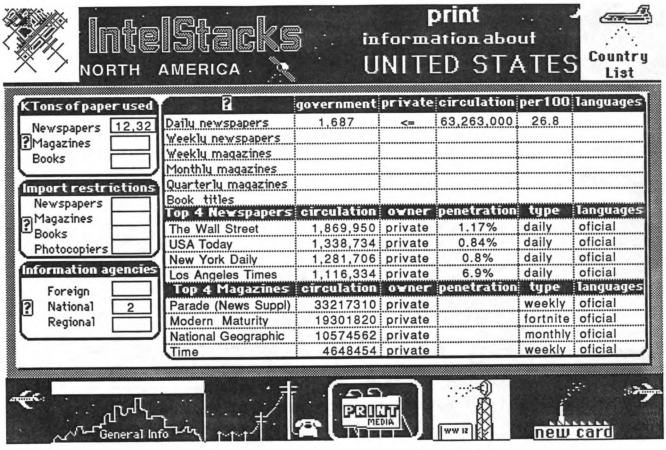
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UNITED STATES
Country List
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Regional
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Weekly newspapers
Weekly magazines
Monthly magazines
Quarterly magazines
Book titles
Top 4 Newspapers circulation owner penetration type languages
The Wall Street 1,869,950 private 1.17% daily oficial
USA Today 1,338,734 private 0.84% daily oficial
New York Daily 1,281,706 private 0.8% daily oficial
Los Angeles Times 1,116,334 private 6.9% daily oficial
Top 4 Magazines circulation owner penetration type languages
Parade (News Suppl) 33217310 private weekly oficial
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PRINT MEDIA
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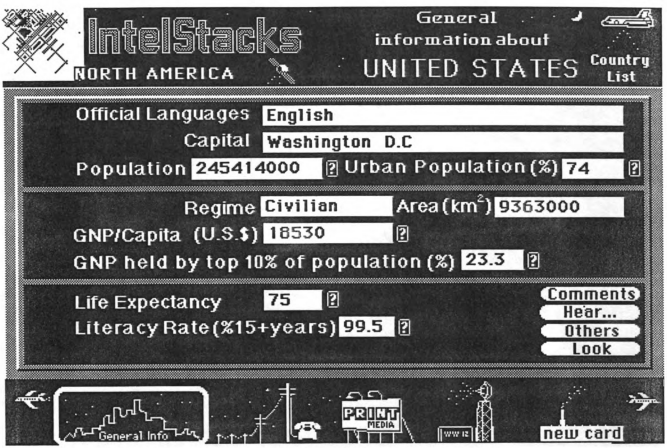
IntelStacks
NORTH AMERICA
General
information about
UNITED STATES
Country
List
Official Languages
English
Capital
Washington D.C
Population
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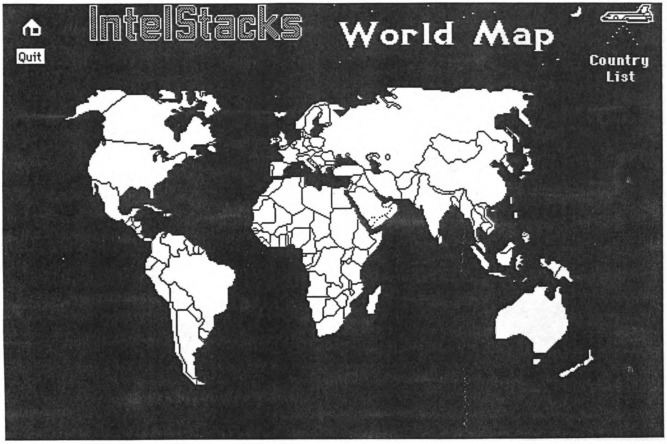
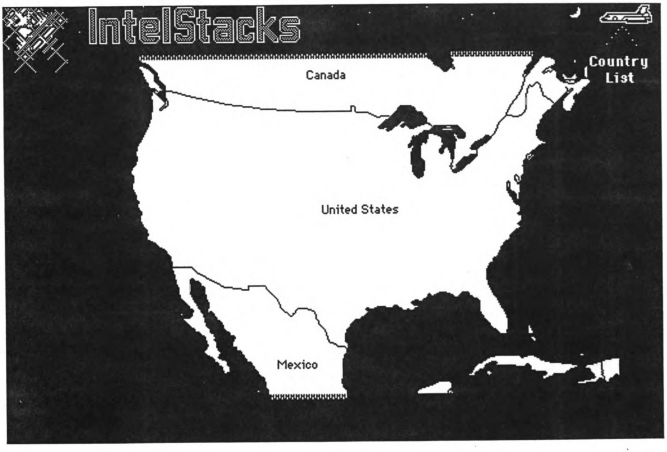
Urban Population (%)
74
Regime
Civilian
Area (km²)
9363000
GNP/Capita (U.S.$)
18530
GNP held by top 10% of population (%)
23.3
Life Expectancy
75
Literacy Rate (%15+years)
99.5
Comments
Hear...
Others
Look
General Info
PRINT
MEDIA
WWW
new card


IntelStacks
World Map
Quit
Country
List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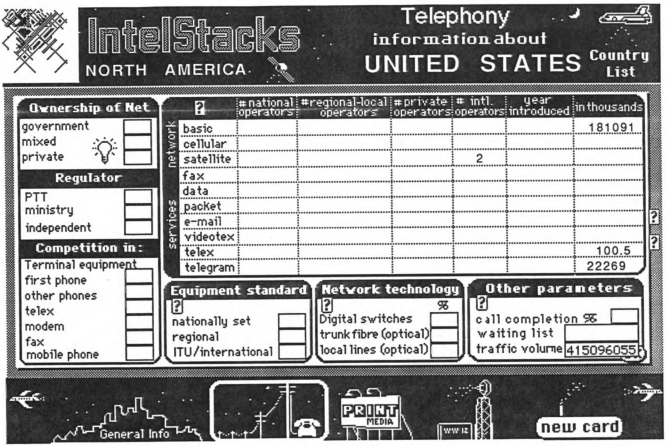
United States
Mexico


IntelStacks
NORTH AMERICA
Telephony
information about
UNITED STATES
Country List
Ownership of Net
government
mixed
private
Regulator
PTT
ministry
independent
Competition in:
Terminal equipment
first phone
other phones
telex
modem
fax
mobile phone
network services
national operators
#regional-local operators
private operators
intl. operators
year introduced
in thousands
basic
cellular
satellite
fax
data
packet
e-mail
videotex
telex
telegram
181091
2
100.5
22269
Equipment standard
nationally set
regional
ITU/international
Network technology
%
Digital switches
trunk fibre (optical)
local lines (optical)
Other parameters
call completion %
waiting list
traffic volume
415096055
General Info
PRINT MEDIA
new card