PD-AAR-796

ISN = 41280

FINAL REPORT

INVESTIGATING, DEVELOPING, ADAPTING, AND TESTING INTERACTIVE VIDEODISC SCIENCE INSTRUCTION FOR LDC'S

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
GRANT NO. DPE-554-2-G-SS-3064-00

TO

UNIVERSITY OF NEBRASKA-LINCOLN
STATION KUON-TV/NEBRASKA ETV NETWORK
NEBRASKA VIDEODISC DESIGN/PRODUCTION GROUP

July 31, 1985

EXECUTIVE SUMMARY

INVESTIGATING, DEVELOPING, ADAPTING, AND TESTING INTERACTIVE VIDEODISC SCIENCE INSTRUCTION FOR LDC'S

PURPOSE

The purpose of this project was to support the development, testing and demonstration of a low-cost version of a computer-controlled videodisc system for use in less developed countries (LDC's). Specifically, the project addressed two major research questions:

1. Can an instructionally useful, inexpensive interactive video system and program be developed to improve post-secondary basic science education in LDC's?
2. If so, how does such instruction compare with traditional teaching and learning, and how useful is such mediated instruction to LDC's?

Toward obtaining answers to these questions, the Nebraska Videodisc Design/Production Group:

1. Put together an integrated videodisc/computer system for the delivery of videodisc instruction based on components whose total cost was less than $1,500.
2. Developed two interactive videodisc science lessons for specific use in an Indonesian institution for postsecondary education.
3. Field tested both the hardware system and the two science lessons at the Institut Teknologi Bandung.

THE LESSONS

Two videodisc/computer based science laboratory lessons were developed for the project, one in chemistry and one in physics. Both lessons are included

in virtually all freshman science curricula. In both lessons, the primary source of information is from the videodisc. The student observes certain events on a television monitor from the videodisc and, by making inputs through the computer, controls the lesson flow or answers to questions posed in the instruction. In the later case, the computer judges the correctness of the answer and either remediates the student or tells the student that he/she was correct and allows the student to proceed.

FIELD/TEST EVALUATION RESULTS

The two lessons were field tested in Indonesia over a four month period from November, 1984 through March 1985. Over 90 students were involved in the field test. Evaluation results were very positive. Major findings include:

-- Students strongly agreed that science laboratory instruction via videodisc could be effective and held their interest;

-- The majority of students felt they learned via the videodisc instruction as well as or better than regular laboratory instruction;

-- Students said they would like to see more science instruction in videodisc form;

--Teaching assistants felt that the lessons strongly held the student's attention;

-- The equipment worked reliably and equipment problems did not interfere in any significant way with instruction.

CONCLUSION

With the very positive indicators generated from the Indonesian field test, and with the project serving as a harbinger, it would seem that

additional research is warranted, and that study in greater depth should be undertaken with respect to the new interactive videodisc technology and its implications and potentials for improving both teaching and learning in less developed countries.

TABLE OF CONTENTS

		Page
I.	INTRODUCTION	1
II.	PURPOSE OF THE GRANT	1
III.	PROJECT PROCEDURE	2
IV.	PROJECT DELIVERABLES	12
V.	PROJECT FINDINGS	13
VI.	CONCLUSION	20
VII.	APPENDICES	
	A. Project Evaluation Report	23
	B. Final Fiscal Report	79

I. INTRODUCTION

This serves as the final report to the U.S. Agency for International Development for the project "Interactive Videodisc Instruction" conducted by the Nebraska Videodisc Design/Production Group, Station KUON-TV/Nebraska ETV Network, University of Nebraska-Lincoln. This report is submitted pursuant to the terms of Grant No. DPE-5542-G-SS-3064-00. Interim progress reports were submitted to the Agency on March 21, 1984 and September 11, 1984. Additional in person verbal progress reports were provided to the AID Project Officer by the principal investigator during periodic visits to the Agency's Rosslyn, Maryland office. The project's Final Financial Status Report is included herein, as is the project's Evaluation Report, which was prepared by an independent evaluator. The project began on September 13, 1983 and concludes with submission of this report.

II. PURPOSE OF THE GRANT

The purpose of the grant was to support the development, testing and demonstration of a low-cost version of a computer-controlled videodisc system for use in less developed countries (LDC's). Specifically, the project was to address two major research questions:

1. Can an instructional useful inexpensive interactive video system and program be developed to improve post-secondary basic science education in LDC's?

2. If so, how does such instruction compare with traditional teaching and learning, and how useful is such mediated instruction to LDC's?

Toward obtaining answers to these questions, the Nebraska Videodisc Design/Production Group:

1. Put together an integrated videodisc/computer system for the delivery of interactive videodisc instruction based on components whose total cost was less than $1,500.

2. Developed two interactive videodisc science lessons for specific use in an Indonesian institution for postsecondary education.

3. Field tested both the hardware system and the two science lessons at the Institut Teknologi Bandung (ITB).

We are happy to report that, with the exception of some logistical problems, the results of the project are quite positive. A videodisc/computer system can, in fact, be put together for $1,500 or less. Such a system holds great potential for use in LDC's. Detailed results are explicated in the several sections that follow.

III. PROJECT PROCEDURE

With execution of the grant contract, reformatting of the two extant interactive videodisc science laboratory lessons provided from the Annenberg School of Communications/Corporation for Public Broadcasting-funded Nebraska project began immediately. The AID-funded project was the unexpected beneficiary of an unplanned visit to Indonesia by the principal investigator from January 9 to 30, 1984. The trip was made on behalf of the Academy for Educational Development, at which time the principal investigator served as a consultant in planning a national Indonesian Open University. As the result of this fortunate circumstance, the principal investigator was able to make preliminary project prepara-

tions with both AID Mission officials, with Indonesian educational authorities, and with those responsible for conducting the AID Rural Satellite Project. As the result of these discussions, it was determined impractical to develop the videodisc project in conjunction with the Rural Satellite Project, because of complexities and logistical problems related to the satellite endeavor. Both AID Mission and Indonesian educational officials also recommended that Eastern Island universities not serve as the site for the videodisc field tests, as planned, but rather that the tests should be conducted at the Institut Teknologi Bandung (ITB) in Bandung, Indonesia. As the result of this decision, arrangements were made and preliminary discussions were held with representatives of the ITB. In addition, the principal investigator arranged to have appropriate Indonesian postsecondary science curricular materials and a technical dictionary forwarded to Nebraska. This advance work, not planned as part of the project, contributed substantially to the future success of the project.

The project proceeded according to three work stages:

- Technical development of a low-cost interactive computer-controlled videodisc system;
- Adaptation and reformatting of the CPB/Annenberg Project pilot discs, computer programs and print materials;
- Field testing, evaluation and preparation of a final report.

According to plan, two trips were made during the project to Indonesia:

The first, from April 6 to 16, 1984 saw the principal investigator, the Nebraska Design/Production Group Videodisc designer and producer, and the Group's videodisc technical specialist meet with AID and Indonesian officials in both Jakarta and Bandung, conduct on-site analyses of the local

postsecondary basic science curriculum, inspect physical facilities at the ITB, visit with physics and chemistry faculty members who would be involved in the project, meet with ITB officials, refine the project procedure, timetable and evaluation plan, interview prospective on-site project coordinators, and arrange for future correspondence and communications. Distinguished Professor Dr. Isjrin Noerdin was appointed by the ITB to serve as senior faculty member responsible for all ITB project involvement. Dr. Noerdin's background and experience, as well as his responsibilities for coordination of freshman science at the Institut, were most important to the success of the project.

The second trip, made between November 2 and 13, 1984, enabled the principal evaluator, the videodisc designer/producer and the project's independent evaluator again to meet with both AID and Indonesian officials in Jakarta and Bandung, to uncrate and make operable the three interactive videodisc delivery systems shipped to Indonesia, to train faculty and graduate students in use of the new technology, to check translation and make necessary changes, to finalize the evaluation instrument, to complete field testing procedures, and to oversee initial testing.

The following six individuals assumed direct responsibility for the conduct of the project:

Principal Investigator: Jack G. McBride, Director of Television, University of Nebraska-Lincoln, Secretary, Nebraska ETV Commission, and General Manager, Nebraska ETV Network;

Science Investigator: Robert G. Fuller, Professor of Physics, University of Nebraska-Lincoln;

Science Investigator: David W. Brooks, Professor of Chemistry, Teachers College, University of Nebraska-Lincoln;

Videodisc Design and Production Investigator: Ronald W. Nugent, Director, Nebraska Videodisc Design/Production Group;

Videodisc Technical Investigator: Darrell L. Schweppe, Technical Director, Nebraska Videodisc Design/Production Group;

Project Evaluator: Roger H. Bruning, Professor of Educational Psychology, Teachers College, University of Nebraska-Lincoln.

As detailed in the Nebraska proposal, a total of 18 project months was projected as required for successful completion (12 months for developmental work followed by 6 months for testing, evaluation and final report preparation). Inasmuch as the AID grant contract was not formalized until September 13, 1983, terminal date for the project thus became March 13, 1985. Because of subsequent delays in shipment of videodisc and computer systems to Indonesia and seeng them cleared through customs, which caused planned field testing to occur over portions of two ITB semesters rather than one, it was necessary for the Nebraska evaluator to request a no-cost project extension until July 31, 1985.

Technical Development

Many videodisc/computer systems have been developed and are in active use in instruction and training environments in the United States and Europe, but the cost of such systems is in the $4,000 to $8,000 range. The goal of this project was to assemble an interactive videodisc system consisting of a videodisc player, a personal computer and a player/computer interface device with a total

was to assemble an interactive videodisc system consisting of a videodisc player, a personal computer and a player/computer interface device with a total system price of under $2,000. Further, such a system would have to stand up to the sometimes harsh environment of LDC's.

At the time this project was conceived in 1983, it was thought that special hardware components, not commercially available, would have to be developed. At that time there were no low-cost, open-market interface devices which would link together a videodisc player and computer. Indeed, in negotiating the subject grant, commitments from Atari Computers and the videodisc player manufacturer, North American Philips, were obtained to undertake the development of a low-cost interface. Shortly after the contract was issued, however, several such devices became available on the open market. It seemed only prudent, then, to use one of these commercially available devices, rather than develop an unique bridge. With permission from AID Washington, the approach was, therefore, changed to design the videodisc/computer delivery system around the best commercially available components that met the overall criteria for project performance. The system components as finally selected were:

1. A Commodore 64 personal computer at $195.00

2. A MicroEd videodisc/computer interface at $195.00

3. A Pionerr 8210 videodisc player at $850.00

4. Either a Commodore floppy disc drive at $250.00
   or a
   Commodore cassette drive at $45.00.

The total system price at full retail was, therefore, $1,285 for a system with cassette drive, or $1,490 for a system with floppy disc drive. Delivery systems

The system ultimately used for the test and demonstration, then, was comprised of readily available commercial components. The only special device employed in the low-cost delivery system was a $5.00 wooden box containing a $20.00 fan to cool the computer. This was a most encouraging development, as it means that components of a low-cost videodisc computer system can be easily obtained and do not require special technical development.

Lesson Development

Two postsecondary science lessons were developed during the project, one in chemistry and one in physics. Both lessons were adaptations of introductory college level videodisc science laboratory lessons produced for a pilot project in the United States funded by the Annenberg/CPB Project. Both are included in virtually all freshman science curricula. The chemistry lesson was substituted for an originally proposed biology lesson because the content of the chemistry lesson was more easily adapted to the videodisc/computer system that was to be employed for the project, and the subject matter was more appropriate to what is typically covered in introductory college-level science programs.

The physics lesson, entitled "Energy Transformations", employs the bicycle as an example of an energy input/output device to study the laws of the conservation of energy. By observing the effects of such forces as wind resistance, tire friction and gearing, the student is able to test a series of hypotheses concerning the transformation of energy in various physical systems.
The chemistry lesson, entitled "Chemical Decision Making", is a simulation of a common laboratory experiment in solving for unknown chemical solutions. The experiment involves the observation of chemical reactions of several elements as they are mixed in test tubes. Once the student has recorded his/her observa-

tions, he/she must then identify each of the chemicals based on his/her previous observations of the known reactions.

In both lessons, the primary source of information is from the videodisc. The student observes certain events on a television monitor from the videodisc and, by making inputs through the computer, controls the lesson flow or enters answers to questions posed in the instruction. In the later case, the computer judges the correctness of the answer and either remediates the student or tells the student that he/she was correct and allows the student to proceed.

The instructional package for each lesson consisted of a videodisc, computer control software, and a printed manual. The manual contained an instructor's guide, lesson guide materials for the student, and student worksheets. The manual was printed in both English and Bahasa Indonesia. All text on the videodiscs and the computer text was in Indonesian, as well. Narration segments on the videodisc were provided on the two videodisc audio tracks in both English and Indonesian, with the student given at the start of the lesson a choice of which language he/she wanted to hear. Translations were provided by resident Indonesian graduate students at the University of Nebraska-Lincoln, most of whom were science majors. Also, an Indonesian dictionary of scientific and technical terms was used to aid translation.

Formative Evaluation

The videodisc lessons with their computer control programs and printed materials were all put through a formative evaluation process, using resident Indonesian students at the University of Nebraska. Ten students were put through the chemistry lesson and ten through the physics. Evaluation was conducted by Project Evaluator Dr. Roger H. Bruning and his associate, LuAnn Krager. The evaluators

began each session with several information gathering questions: year in college, major, college attendance in Indonesia, comfort with the English language, and background in chemistry or physics. Evaluators remained in the room during the testing for visual observation and to witness first hand any problems the students were having.

On the basis of the formative evaluation, changes were made in both the computer control programs and the text portion of the lessons. Changes were made to make the lessons easier to use and to clear up ambiguities in the translations.

The Nebraska Videodisc Design/Production Group completed the premastering or postproduction phase of the project, and then sent all video and audio materials to the 3M Company plant in Menomonie, Wisconsin for videodisc mastering and replication.

Field Testing

Formal field testing of all project deliverables was conducted from early November, 1984 through March, 1985 at the Institut Teknologi Bandung. Dr. Roger H. Bruning, the Project Evaluator, designed the formal field test procedure and the instruments employed. Dr. Robert Brown was originally to have conducted the valuation but, by the time the project was formalized, was unavailable. Dr. Bruning is a professional colleague of Dr. Brown, and is also a Professor in the Educational Psychology Department at the University of Nebraska-Lincoln.

Dr. Bruning accompanied other project personnel to ITB in November, 1984 to train Institut personnel in the planned evaluation procedures and to observe the first few days of field testing with students. Teaching assistants at ITB were

hired by participating ITB faculty to provide on-going supervision of the field testing. T.A.'s were available to answer questions the students might have regarding operation of the systems, and to activate the systems each day. The teaching assistants also made formal observations of the students as they worked through the lessons, and their comments are incorporated in Dr. Bruning's Evaluation Report.

Dr. Eve Van Rennes, an American resident in Jakarta, Indonesia, was also retained to provide a continuing liaison role during the field test. Dr. Van Rennes visited the ITB campus several times to make sure correct procedures were being followed.

Forty students took part in the field test of the chemistry lesson and fifty students went through the physics. The videodisc/computer systems were set up in isolated rooms adjacent to regular laboratory areas. All field test data were ultimately forwarded to Nebraska where results were collated and evaluated. The complete evaluation report is included as Appendix A of this report.

According to contract, project materials were taken to Rosslyn for review by AID/Washington S&T/Ed and Office of the Science Advisor representatives and invited guests, prior to sending project deliverables to Indonesia to initiate field testing. On October 23, 1984 the low-cost interactive videodisc system was demonstrated and the two science laboratory lessons with accompanying print materials were reviewed, as was the computer control program. All present had the opportunity both to screen the lessons and personally engage in the instructional interactivity.

AID Mission officials in Jakarta helped immensely in making local arrangements for the two project visits to Indonesia, coordinated with Indonesian educational

officials, and otherwise provided excellent support for the project and its investigators. Field testing could not have been conducted without their cooperation.

Similarly, extensive support was provided the project by both the Institut Teknologi Bandung Administration and the faculty members selected by the Institut to oversee and participate in the project. The following ITB faculty were key to the project and its success:

Dr. Isjrin Noerdin, Professor, Chemistry Department, Director, Common First Year Program, Director, ITB/CCTV (appointed ITB Project Coordinator);

Dr. M. Hamron, Associate Professor, Physics Department;

Dr. Hiskia Achmad, Associate Professor, Chemistry Department;

Ir. Reka Rio, Associate Professor, Electrical Engineering Department, Hardware Manager, ITB/CCTV;

Dr. Primadi, Assistant Professor, Fine Arts Department, Production Manager, ITB/CCTV;

Dr. Darmawan, LAPI.

These enthusiastic faculty members provided helpful assistance throughout the project and were vital to its success. Field testing in both the Chemistry and Physics Department was conducted under their supervision and with their skillful assistance.

In addition, the project was blessed through the selection of its on-site Project Coordinator, Dr. Eve Van Rennes. This experienced American living in

Jakarta served as the project's facilitator and coordinated a variety of activities between the ITB, AID/Jakarta and the Nebraska evaluators.

A Memorandum of Agreement directly relative to this project was executed between the Republic of Indonesia (through the Directorate General for Higher Education) and the United States of America on May 17, 1984. According to the Agreement, the three interactive videodisc systems and the project deliverables were, upon completion of field testing, all turned over to the Technical Institute for continued experimentation and usage.

IV. PROJECT DELIVERABLES

As the result of the Interactive Videodisc Instruction project, the following hardware and software deliverables were generated.

Hardware Systems

Three complete low-cost videodisc/computer systems were supplied to the Institut Teknologi Bandung. Two of the systems were used for the field test; the third served as a spare in case of equipment failure. Each system consisted of:

- A Commodore 64 Computer;
- A MicroEd Videodisc/Computer Interface;
- A Pioneer 8210 Videodisc Player;
- A Floppy Disc or Cassette Drive;
- A Voltage Conversion Transformer;
- A Specially Built Storage and Shipping Case.

In addition to the basic systems, three color television monitors were supplied to ITB for the field tests.

Software Packages

The lesson software packages consist of:

- o A two sided videodisc, with the physics lesson on one side and the chemistry lesson on the other;
- o A computer floppy disc or casette with the computer control software;
- o A print manual containing instructor's and students' guides and student worksheets bound in a loose leaf notebook.

The software was packaged in a specially designed box that holds all of the components. Each box was appropriately labeled in Bahasa Indonesia.

According to contract, 100 videodiscs were duplicated and 100 sets of all other software components were produced. Four sets were provided the ITB for continued and unlimited future use. One set was hand-delivered to S&T/Ed, AID/Washington. The remaining software sets are stored at the Nebraska Educational Telecommunications Center in Lincoln, Nebraska.

V. PROJECT FINDINGS

The Nebraska-based project has revealed important data concerning the new interactive videodisc/computer technology and its applications which might assist with improvement of education in less developed countries. This information, admittedly only preliminary, is the first of its type to be generated. As such, the project should be considered an initial pathfinder toward future more extensive, more pervasive probes into the spectrum of important questions inherent in the proposed use of new communications technologies by LDC's.

The science laboratory project was, of necessity, limited in its scope and focus. But it yielded useful information regarding low-cost systems, technical

considerations, production considerations, language translation and educational impact.

System Performance

As reported earlier, one successful project outcome was the delivery of a lower-cost videodisc system without significant loss in either the amount of interactivity or technical quality.

A critical question was that of performance of the videodisc/computer system in the harsh environment of Indonesia. The three pilot systems were placed in ITB rooms without air conditioning with high humidity. They drew their electrical power from the Bandung City system which is subject to considerable power surges. They were also operated by local personnel who were generally unaccustomed to computers and had never seen a videodisc. With one major exception--the computer power supplies, all of the equipment worked quite well.

During the second project visit to Indonesia when the systems were set up, and local ITB personnel began training in their use, there occured a thunderstrom which caused a considerable surge in the electrical system. The power supplies for all three computers were damaged beyond repair. Fortunately, an excellent electronics technician at ITB, Professor Reka Rio, was participating in the project. He was able immediately to build new surge-protected power supplies, so training could proceed with only minimal interruption. The original equipment's power supplies for the low-cost computers proved to be the weakest link in the system.

Importantly though, the power surge did not damage either the computers or videodisc players. One of the players did blow a 10 cent fuse which was easily

replaced. This fuse, designed to protect the player from power surges, did its job perfectly.

Certain minor problems were experienced with both the computers' cassette and floppy disk drives. These components typically are the weakest in a computer system, as they are by far more mechanically complex than any otner component. Unexpectedly, the floppy disk drives performed better than the cassette drives. With the cassette drives, it also takes considerably longer to load operating programs into the computer. Because of this, the cassette drives were seldom used.

The only major problem with the hardware through the entire Indonesian field test was that with the computer power supplies. Clearly, standard power supplies of low-cost computers are not sufficiently reliable execpt when fed by only high quality local power systems. Also, it would seem advisable to try to eliminate cassette and floppy disk drives from the videodisc/computer systems.

These two hardware problems have simple solutions. The standard power supplies of low-cost computers can be replaced with surge-protected power supplies for under $50. These power supplies can also be multi-standard, running off either 220 or 110 volt power systems. The computer disc drives can also be completely eliminated. As the result of recent technological advances, there is now a means for encoding both analog (television) signals and digital (computer information) signals on a videodisc. The videodisc can thus both provide the video and audio for a lesson and program the computer to run the lesson. The videodisc player becomes the only computer peripheral, eliminating both a source of potential hardware failure and the expense of floppy disc or cassette drives.

A Videodisc/Computer Delivery System For LDC's

Based on the results of this project, we propose two possible videodisc/computer system configurations for use in LDC's. One would be a completely self-contained unit incorporating a videodisc player, low-cost computer and a color television monitor. The second would be similar but would not include the television monitor.

The first system would be a complete work station with all of the necessary components for complete operation housed in its own cabinet. The exterior dimensions of the cabinet would be about 90 cm high, 45 cm wide and 55 cm deep, assuming a monitor of 35 cm or less. The cabinet, if made of a strong material like fiberglass, could also serve as a shipping case. The front and back of the cabinet should be removable for ventilation. A small fan in the bottom of the cabinet would probably be necessary to provide additional ventilation for the delivery system components.

The interactive videodisc components would be in three sections, separated by shelves. The bottom section would contain the computer, with its keyboard able to be pulled out on a long cable for comfortable use. The videodisc player would be mounted in the middle. Virtually all videodisc players now have a slide out drawer for loading the videodisc, and can thus be mounted without the necessity for overhead space for a pop-up lid. A color monitor would be positioned on the top shelf at a natural eye level if the entire self-contained unit were set on a table top. The final component would be a surge-protected power supply located behind the computer.

The second proposed system would be similar to the first except that it would use an external monitor. This would lower the cost of the system in cases where

color monitors were already available. Existing monitors would simply be connected to the cabinet system containing the videodisc player and computer.

Local manufacture or assembly of one of the major components of the interactive videodisc system, the color monitor, would seem reasonable in various developing countries. Many of the larger LDC's are already manufacturing television receivers, such as Indonesia. Such sets of local origin could easily be used with the videodisc/computer system. Manufacture of the computer would be possible if there was already a computer industry, but its very low-cost would make such local manufacture less practical unless thousands were to be produced. Similarly, local manufacture of the videodisc players would seem to be impractical in relatively small quantities, if, indeed, licenses from Japanese and European manufacturers could be obtained.

Local Production And Premastering

Many LDC's have the capacity for local production of videodisc materials up to the point of actual videodisc mastering and replication. Any well equipped video production facility could be employed for the production and postproduction/premastering phases of the videodisc development. Videodisc players are fortunately now available which accommodate both NTSC and PAL video standards (not so at the time of proposal preparation), so mastering and replication would be simply a matter of sending the finished premaster videotape containing all of the audio and video components to an appropriate mastering facility in the U.S., Europe, or Japan. User-recordable videodisc systems are also now available. These are practical at present if only small numbers of copies are required, but prices for the "master blank discs" will undoubtedly come down considerably from their present $250 price.

Language Translation

Every attempt was made to secure the best possible translations from English to Indonesian during the revision of the lessons for use in Indonesia, but certain problems nonetheless prevailed. Three different Indonesian students resident at the University of Nebraska-Lincoln were used to provide the translations. All were science majors. They could not always agree on the correct idiomatic expressions and, as was later discovered, sometimes confusing literal translations were provided. Some of this was discovered and corrected at the formative evaluation stage, but, unfortunately, not all of the problems were discovered until the lessons were shipped to Bandung for field testing.

During the second visit to Indonesia, it was learned that the ITB Project Coordinator, Dr. Noerdin, had a potential source of funding to enable a visit to the United States. The Nebraska evaluators strongly encouraged such a visit which would have afforded the opportunity to spend a week in Lincoln undertaking two very important activities: evaluating the two lessons while still in a formative evaluation stage (wherein recommendations could still have been accommodated), and checking all video and print translation (which also could easily have been changed). Unfortunately, this trip did not materialize.

It would probably not have helped to have sent scripts to Indonesia for review, as interactive videodisc scripts are extremely complex and difficult for even experienced videodisc producers to review. Future projects would seem to demand that there be a formative evaluation stage in the country of use, with full review of all lessons elements by experienced, native instructors.

Evaluation Summary

Evaluation procedures, instruments and findings are provided in detail in Appendix A of this report and will only be summarized here. Forty students participated in the field test of the chemistry lesson and 50 students worked through the physics lesson. Student teaching assistants were present as monitors during all testing. The only disappointment in terms of the field test was the lack of subjects from educational institutions other than ITB. Technical Institute students tend to be "the best and brightest" of Indonesia. With this the case, the Nebraska evaluators encouraged ITB faculty conducting the field tests to bring students from nearby two and four year institutions in to participate in the evaluation. Unfortunately, data from these more typical Indonesian students were not included in the materials received in Nebraska. It should be noted that this participation by external students was not part of the formal agreement with ITB and does not represent a violation of contractual arrangements.

All connected with the project are impressed with the positiveness of the Indonesian field test evaluations. Major findings include:

- Students strongly agreed that science laboratory instruction via videodisc could be effective and held their interest;
- The majority of students felt they learned via the videodisc instruction as well as or better than regular laboratory instruction;
- Students said they would like to see more science instruction in videodisc form;

- Teaching assistants felt that the lessons strongly held the student's attention;
- The equipment worked reliably and equipment problems did not interfere in any significant way with instruction.

In terms of both educational value, production and technical systems, the Interactive Videodisc Instruction project has provided important new information which should be useful to AID planners and developers.

VI: CONCLUSION

With the positive indicators generated from the Indonesian field test, and with the project serving as a harbinger, one could readily conclude that additional research is warranted, and that study in greater depth should be undertaken with respect to the new interactive videodisc technology and its implications and potentials for improving both teaching and learning in less developed countries.

As has been mentioned, this initial venture was just that--a limited testing of the waters brought about by the fact that pilot interactive videodisc science laboratory instruction had been developed for testing in the United States, and could provide the basis for initial investigation of similar research relative to less developed countries. The Agency For International Development quite appropriately took advantage of the half million dollar research and development investment made by the CPB/Annenberg/Nebraska Project.

The new interactive videodisc technology, which combines all of the advantages of computer assisted instruction with all those of audio/visual instruction, becomes a most powerful technological development with great educational and instructional potential. It is, therefore, being rapidly employed by ever

increasing numbers of U.S. corporations for in-service training and by the military for a variety of instructional activities. Though at a slower pace, American education will over the next years most surely apply this technology toward a spectrum of educational objectives. The potential for improvement of teaching and learning, therefore, coupled with the broad potential of the technology suggests that additional studies be undertaken with respect to usage by less developed countries, because of the implications for dramatic and widespread improvements in both teaching and learning as well as the opportunity for leap frogging advances.

The question of cost must surely be given prime consideration. The video and computer communications media continue to advance at a rapid rate; the interactive technology is rapidly evolving and will continue in this manner indefinitely. Capital delivery system costs will continue to decrease in coming months and years. It should be kept in mind that these self-contained videodisc instructional units can be employed by large numbers of students and on a round-the-clock basis. Further, the same video storage capacity of the videodisc can be employed to meet instructional objectives at several educational levels. The relatively high costs of videodisc production can be spread out, therefore. This can be accomplished through use of portions of the same extensive amount of video data contained on the videodisc and inexpensive composition of different computer control programs. This very approach is currently being undertaken in Nebraska. The original Annenberg/CPB-funded science laboratory discs are, with a U.S. Department of Education Secretary's grant, currently being reformatted so that the same college level materials will have direct applicability for high school junior and senior students. Videodiscs might be produced for joint use in several LDC's and adapted to individual requirements through development of

computer programs and textual materials. This potential should be more fully investigated in terms of LDC's.

Attention should also be devoted to determining how developing countries might be able to manufacture or at least assemble components of the interactive videodisc systems. Such could then contribute to a twofold purpose: improvement of education and improvement of the country's economy.

More attention should be given to trying to find additional ways to alter extant videodisc instruction to make it more localized--for example, ways in which native talents can be involved in the video presentations. Additional study should also be given the cultural differences which relate to the use within a country of materials principally prepared for use in another country, as well as ways in which local faculty can be better involved in the preparation of interactive instruction, and can be involved earlier in such projects, and ways through which the instruction can be more appropriately developed to the specific curricula of the country.

The Nebraska Videodisc Design/Production Group, Station KUON-TV/Nebraska ETV Network and the University of Nebraska-Lincoln have appreciated the opportunity to participate in this important research and demonstration project, and hope that the resultant information will be helpful to the future improvement of education, regardless of geographic location.

APPENDIX A

PROJECT EVALUATION REPORT

FINAL EVALUATION REPORT

A.I.D. Indonesian Interactive Videodisc Project

JULY 25, 1985

Evaluator: Roger H. Bruning, Ph.D.

INTRODUCTION

Beginning in early November, 1984, and continuing through March of 1985, an interactive videodisc instructional system was field tested at the Institut Teknologi Bandung (ITB) in Bandung, Java, Indonesia. The project was sponsored by the United States Agency for International Development (A.I.D.) and carried out by the Nebraska Videodisc Group, with the assistance and cooperation of the ITB faculty and staff. Data gathered in this final field test are the focus of the following report.

Two instructional lessons in the Indonesian language were tested, both targeted at introductory college courses in science. The first, Chemical Decision Making (Penentuan Larutan Kimia), is designed to develop those skills involved in identifying chemical unknowns by having students mix those unknown substances and note the reactions. The other interactive videodisc, Energy Transformations (Perubahan Energi), is intended for college-level physics students and illustrates principles by which energy is transformed through mechanical systems. Both videodisc lessons are an outgrowth of extensive development and testing in the United States as part of a major science videodisc project earlier funded by the Annenberg/CPB Project of the Corporation for Public Broadcasting (CPB) and the Annenberg School of Communications. The goals of the current project were to determine if the more sophisticated Annenberg/CPB materials could be adapted to run on a less expensive interactive videodisc system, to determine if the computer hardware and software would work effectively in a less developed

country, and to test the appropriateness of the instructional strategies used in these lessons.

This report is divided into three major sections. The first details the information gathered from students, teaching assistants and faculty from the field test of Chemical Decision Making. The second section focuses on the physics videodisc, Energy Transformation. The final section contains the evaluator's synthesis of the data gathered and his recommendations.

CHEMICAL DECISION MAKING

Participants

A total of 40 students, 20 male and 20 female, took part in the field test of the interactive science videodisc lesson, Chemical Decision Making, at ITB. All were ITB students. Gathering of additional data on a wider range of students (e.g., from other area colleges) had been discussed with ITB representatives at the outset of the field test; however, these additional data were not received by the evaluator. Thus, the present sample of ITB students very likely represents a higher level of ability than one would find across all institutions of higher education in Indonesia.

Twenty-five of the participants were chemistry majors at ITB, eight were majors in environmental studies, six were in pharmacy, and one in petroleum engineering. Ages of participants ranged from 17 to 22; modal (most frequent) age was 19, with a mean (average) age of 19.3. The students at ITB who took part in the field test were very well prepared in chemistry. Most were chemistry majors, and the median number of years of prior instruction in chemistry was 3.04. The ratings of their own prior familiarity with the topic of chemical decision making spanned a wide range, however, ranging from completely

unfamiliar to highly familiar. Most (63%) indicates that they were "somewhat familiar" with the topic. While some (N = 10) indicated they had encountered this topic in their current class, most (N = 30) stated that it was not a class topic, having been encountered earlier in their training.

In accord with the evaluation plan, twenty of the particpants worked alone on the lesson and twenty with a partner. Most took part in the field test, they indicated, because of the "desire to learn more about chemistry and its methods" and out of their "curiosity to see what videodisc instruction was like." Only a few (4 out of 40) perceived their participation as being required.

Laboratory Booklets

Accompanying the videodisc lesson was a laboratory booklet; all students reported receiving it. Most (N = 33) reported receiving it a day or two prior to the lesson and reading it just prior to (N = 26) or during (N = 10) the lesson. Most saw the laboratory booklet as moderately useful. Table 1 presents student ratings of the laboratory booklet on selected criteria.

Student Reactions to the Videodisc Instruction

The participants were asked to respond to a variety of aspects of their experience with the videodisc: their progress through the lesson, time spent, how the videodisc instruction compared to the regular laboratory, how effective various videodisc features were, and how, overall, they reacted to the videodisc instruction. Each aspect will be discussed in turn.

Progress through the lesson. Most students (33 of 40) indicated that they moved reasonably directly through the lesson and reported reaching a point where they had successfully solved the required number of unknowns. The median time spent was around one hour; the range, however, was from 30 to 120

Table 1

Ratings of the Laboratory Booklet for

Chemical Decision Making on Selected Dimensions

Dimension	Mode	Median	Mean	SD
Helped me understand what was expected	Somewhat Useful	3.73	3.53	1.41
Helped me feel more confident	Somewhat Useful	3.41	3.16	1.48
Guided the observations I made	Very Useful	3.95	3.55	1.60
Gave me a matrix for recording	Very Useful	3.68	3.37	1.56

minutes. Most students judged this time expenditure as "about right" (N = 12) or "slightly more than necessary" (N = 19). Three students felt that substantially too much time was required, while 5 felt that more time could have been spent on the lesson. Most (90%) stated that they would like to review this same lesson at a later date.

While most completed the lesson successfully, the majority (25 of 40) asked for help sometime during the lesson. Most of this group reported being either unsure about how to begin (N = 10) or confused about what was being required (N = 11). One student reported encountering equipment difficulties and one stated that he was unable to solve the unknowns.

Comparison to regular laboratory experiences. A series of questions on the student opinionnaire asked the students to compare several factors in videodisc instruction to those in their regular laboratory sessions on a scale from 1 (much lower) to 5 (much higher). Table 2 summarizes those comparisons.

Effectiveness of videodisc features. The participants in the field test of Chemical Decision Making also rated several specific features of the videodisc instruction. These ratings are presented in Table 3.

Overall ratings of the videodisc lesson. The final set of ratings provided by the students were in the form of agreement or disagreement with a set of attitudinal statements about videodisc instruction. These ratings are presented in Table 4. The students strongly disagreed with a statement about being bored; most indicated that their attention was kept very well during the lesson. They voiced strong agreement with statements that more labs should be presented via videodisc and that videodisc laboratory instruction can be effective. Almost all participants strongly desired more printed information on videodisc instruction.

Table 2

Student Comparisons of their Experiences with the Videodisc Lesson, Chemical Decision Making, with their Experiences in Regular Laboratory Sessions in Chemistry

Dimension	Mode	Median	Mean	SD
My level of attention	Much more	4.25	3.82	1.5
My interest in the content	Much more	4.08	3.75	1.4
Level of difficulty	About same	2.65	2.27	1.1
Expected memory of content	Much more	4.00	3.68	1.4

Table 3

Student Ratings of Features of the

Videodisc Lesson, Chemical Decision Making

Feature	Mode	Median	Mean	SD
Instructions on the videodisc	Somewhat Effective	3.44	3.70	0.99
Chance to work at own pace	Somewhat Effective	3.45	3.67	0.86
Getting feedback on answers	Somewhat Effective	3.61	3.75	0.98
Overview in the lab booklet	Somewhat Effective	3.19	3.18	1.30
Recording matrix in lab booklet	Somewhat Effective	3.23	3.23	1.33

Table 4

Student Reactions to Overall Aspects of their

Experience with Chemical Decision Making

Statement	Mode	Median	Mean	SD
I was often bored during the lesson	Strongly Disagree	1.24	1.47	0.78
I was frequently confused by the lesson	Strongly Disagree	1.81	1.85	0.77
I would rather learn in a regular lab session	Neutral	2.62	2.43	1.08
I was very interested in the videodisc itself	Agree	4.10	3.98	0.97
Being observed by the teaching assistant made me nervous	Strongly Disagree	1.67	1.80	0.83
I would like to see more labs presented by videodisc	Strongly Agree	3.70	3.65	1.19
I can learn more with a real experiment	Neutral	3.17	3.18	1.11
I would like printed copies of videodisc information	Strongly Agree	4.17	4.13	0.80
For the most part, the lesson kept my attention	Strongly Agree	4.33	4.30	0.69
The videodisc can simulate the laboratory effectively	Agree	4.12	4.05	0.88

Student comments on the videodisc lesson. Written student comments were also solicited by the student opinionnaire. The complete list of these comments is presented in Appendix C. Features of the videodisc lesson that students particularly liked were its ease of use and rapidity with which experiments could be done, its interest value, its safety, its ability to permit close observation, and the fact that the lesson challenged them to think.

In response to a question soliciting suggestions for improvement, the students supplied fewer responses. They asked for more experiments, somehow including the sense of smell, and clarifying the syllabus by making the instructions in it clearer.

A final question asking for overall observations produced comments much like those obtained earlier. A small number of students pointed to the limitations in the videodisc method relating to skill development in mixing chemicals and not being able to use one's sense of smell; the great majority indicated that videodisc instruction should be greatly expanded to provide "more experiments than this one" to permit wider use in their classes and use at other colleges in Indonesia and even at the high school level.

Teaching Assistant Interviews of Students

To supplement and to provide a cross-validation of the student opinionnaire data, a sample of students (N = 30) were interviewed by the teaching assistants. Virtually all of the students (29 of 30) felt that they had adequate background to complete the lesson.

How did they feel about the instruction compared to actual laboratory sessions? The great majority said it was better (57%) or as good as (24%) an actual laboratory session for learning, while all said it was better than (71%) or

as good as (23%) the actual lab for interest and better than (77%) or as good as (23%) the actual lab for enjoyment.

How often should videodisc experiences like this be used in their courses? Most felt it should be used frequently; "for each class", "for every chapter," and "as many times as possible." Their general estimate of the potential for the videodisc lesson in chemistry was very positive. They commented that it is "more interesting" "more practical," "safer," "cheaper", "faster," and "more accurate." Some saw it is a supplement, but not as supplanting their regular labs. One commented that "it's good, but it would be better if we would use it later on and (use it) for more advanced experiments."

Observations by Teaching Assistants

The teaching assistants were also asked to report on the activity of the student participants in the field test via a direct observation form. Their ratings for selected aspects of student activity appear in Table 5. The teaching assistants judged the students to have been highly engaged by the instruction.

In their comments, the teaching assistants amplified on their ratings; generally, the sessions progressed relatively smoothly and they observed that the students could "follow to the end without asking for help from the instructor." The novelty of the videodisc instruction for the students was apparent to the teaching assistants; they commented that some of the students "were still afraid of this new experiment," but that "they like it because of the new technology." The problem solving mode of Chemical Decision Making may have made some of the teaching assistants a bit impatient; one observed that the students "were slow and made a lot of mistakes" and another that "they wasted too much time and hesitate in making decisions."

Table 5

Observational Ratings of the Participants

in Chemical Decision Making by the Teaching Assistants

Dimension	Mode	Median	Mean	SD
Student interest in the videodisc lesson	Very High	4.36	4.26	0.79
Student enjoyment of the videodisc lesson	High	3.90	3.91	0.75
Student learning from the videodisc lesson	High	3.92	3.82	0.67
Prior knowledge of the student about videodisc topic	High	3.76	3.67	0.73
Extent videodisc challenged student to think	High	4.02	3.94	1.04

Group versus Individual Participation

One question that is important for future projects and for implementation decisions is whether there are any noticeable effects of (1) working alone versus (2) working in pairs on student learning, interest, or enjoyment. Several interesting differences did, in fact, appear when these two groups (N = 20 each) were contrasted to one another. Table 6 displays items on the student opinionnaire in which there were statistically significant differences between those working alone and those working with a partner.

On the basis of these data, one might surmise that when students learned alone, they apparently made significantly greater use of the laboratory booklet that accompanies Chemical Decision Making. With a partner, however, the laboratory booklet became much less important as a resource.

The students' interest, however, seems to have been enhanced by their working with other students. Those working in pairs indicated significantly greater interest in the lesson content than those working alone and a significantly greater preference for the videodisc over the regular laboratory experience. While ratings of the amount learned were also in a direction consistent with this (X alone = 3.40; X together = 3.95), this latter difference was not statistically significant.

These findings seem somewhat paradoxical, however, when taken together with information from a question that asked students to state their preference for working alone or with another students on a future videodisc lesson. Most (33 of 40) indicated a preference for working alone. Thus, while their interest ratings and preference for the videodisc over the regular laboratory went up under conditions where pairs of students worked together, most nonetheless

Table 6

Significant Differences in Opinions between Those Working Alone and Those Working Together on Chemical Decision Making

Opinion Statement	t value	Difference in Favor of Those Working:
Lab book helped me understand what was expected	3.40*	Alone
Lab book helped me feel more confident	3.85*	Alone
Lab book guided the observations I made	3.05*	Alone
Lab book gave me a recording matrix	2.73*	Alone
My interest in the content	2.01*	In Pairs
I would rather learn in a regular laboratory session	2.31*	In Pairs

* Significant difference, $p < .05$

would opt for individual instruction over pairwise instruction in a future lesson.

A second contrast of interest was prior familiarity with the topic and the impact this might have had on students' reactions to the videodisc instruction. Rated familiarity with the topic of Chemical Decision Making had little if any effect on student reactions to any aspects of the lesson. Of 21 comparisons targeted for inspection and covering all of the dimensions explored by the student opinionnaire, teaching assistant observation, and interview, none was significant ($p > .05$).

Evaluator's Comments on the Chemistry Data

In these students' minds, this experience compared very well to their regular laboratory experiences. They indicated that their attention, their interest, and the amount learned were all better than they were in their regular laboratory experience. They indicated very small amounts of boredom or confusion in their responses to structured questions, in their written comments, or in interviews. These data were consistent with observations made by the teaching assistants. Students strongly agreed with statements that more lab sessions should be presented via videodisc. The great majority of them, in response to a question about whether they would like more information, said that they would.

The time spent on the lesson — about an hour — was a reasonable amount for most of them.

The interactive videodisc equipment worked reliably for the most part. Equipment problems had relatively little impact on the impressions of this group; only one reported a break in the videodisc lesson due to an equipment problem. Most reported needing some help at some point in the lesson, however, either at

the beginning of the lesson or due to some confusion they had. Most of this appears to have stemmed from translation difficulties, rather than from the content itself.

In judging the impact of these lessons, it should be remembered that these students were motivated to participate; most (90%) were volunteers according to their self-report. They were also quite familiar with the general topic; most had extensive background in chemistry and considered this concept to be a fairly basic one. Whether the relatively high knowledge level of this group is a positive or negative factor in their evaluation of the materials is hard to say, however. Less well prepared students may have found the content more challenging and hence even more interesting than did the test group.

In this lesson, the students plainly preferred to work alone. Those who worked together, however, were significantly happier with their experience on interest and enjoyment dimensions. It may be that in an initial encounter with the videodisc, students perceive less anxiety and pressure if they work in pairs. In subsequent encounters, with the initial experience behind them, they may feel themselves to be quite capable of working alone and prefer it based on their judgment of added benefits for themselves from working alone.

ENERGY TRANFORMATIONS

Participants

A total of 50 students, 43 male and 7 female, completed the field test for Energy Transformations. All were ITB students. Most (N = 36) were physics majors, eight were from environmental studies, four from mathematics, and one each from petroleum engineering and chemistry. As a group, these students indicated a considerable amount of prior coursework in physics (Median = 6 years). As specified by the evaluation plan, twenty of the 50 worked alone, while the remaining 30 worked in pairs. When asked about their preference in future lessons for working alone or together, most of those indicating a preference (27 of 46) stated that they would prefer to work alone.

Although this lesson was quite long, the majority (57%) reported completing it in one session; most of the rest (22%) used two sessions. The median time spent on the lesson was nearly four hours (238 minutes); the mean was somewhat lower, however (190 minutes), indicating that a few participants had completed it in a quite short period of time.

Thirty-eight (76%) of the participants stated their participation was voluntary; the remainder viewed their participation as required. Among reasons given for participation were: (1) to learn more about physics (67%), (2) curiosity about videodisc instruction (64%), and (3) recommendation of the professor (43%). Much smaller numbers took part because of their desire to do better on examinations (8%) or recommendations from the teaching assistants or from other students (4%).

Familiarity with the topic. Most (76%) indicated it was their first contact with the topic of energy transformations, but reported a moderate prior degree

of familiarity with related topics of calculus (Mode = "somewhat familiar," Median = 3.27 on a 5 point scale from "not familiar at all" to "highly familiar"), rectangular and polar coordinates (Mode = "somewhat familiar," Median = 3.08), and concepts of work and energy (Mode = "somewhat familiar," Median = 3.47).

Laboratory Booklets for the Videodisc Lesson

All participants reported having the laboratory sheets and reading them just prior to (68%) or during (32%) the lesson. Ratings for aspects of the laboratory booklet are presented in Table 7. Overall, there were almost no negative comments on the laboratory booklets; the majority indicated moderate to high levels of usefulness for the printed materials.

Student Reactions to the Videodisc Instruction

Like the chemistry students, the physics students taking part in the Energy Transformations lesson were asked to respond to several aspects of their instruction, including their recall of their progress through the lesson and time spent, comparisons to regular laboratory experiences, the features of the videodisc, and overall aspects of videodisc instruction.

Progress through the lesson. Energy Transformations is designed in multiple segments and is much longer than the Chemical Decision Making lesson. Accordingly, the students spent much more time, most from three to four hours, as reported earlier. Also, as the the reader will recall, most students completed the lesson in a single session. In light of these circumstances, it is not surprising that 22 (44%) indicated that "somewhat more time than necessary" was required and 8 (18%) indicated that "much more time than necessary" was required. Nine (18%) stated that the time spent was "about right" and nine that they could have spent more time on the lesson. Over 2/3 of them (72%), however, said that they

Table 7

Ratings of the Laboratory Booklet for

Energy Transformations on Selected Dimensions

Dimension	Mode	Median	Mean	SD
Helped me understand what was expected	Somewhat Useful	3.59	3.69	0.80
Helped me feel more confident	Somewhat Useful	3.24	3.39	1.04
Guided the observations I made	Very Useful	4.17	4.08	0.95
Gave me a matrix for recording	Very Useful	3.43	3.47	1.21

would like to review the lesson if given the opportunity.

Most (90%) reported needing some assistance with this lesson. Their reasons were varied, including being unsure at the beginning and confusion about what the videodisc was asking for. Most confusions were minor and appeared to have been created by translation difficulties. Only a small number (N = 2) reported needing assistance because they were unable to solve the problems..

Comparison to Regular Physics Laboratory

Students were asked to compare their experience with tthe videodisc to "laboratory sessions in this course and elsewhere." Ratings on several comparative dimensions are presented in Table 8. As can be seen, they rated their attention, interest, and learning as higher than in the regular laboratory session, and judged the difficulty of Energy Transformations to be about the same as they had experience in the regular laboratories.

Effectiveness of Videodisc Features

Students also were asked to rate dimensions of videodisc instruction that might or might not enhance instruction. These ratings are presented in Table 9. They show that most of the features of the videodisc lesson, such as the ability to work at one's own pace and having the chance to receive feedback, were judged as useful by the students.

Overall Reactions to the Videodisc Lesson

Student Ratings. Students who tested Energy Transformations rated several aspects of their experience upon completion of the lesson. These ratings appear in Table 10. As can be seen, overall reactions were very positive. In spite of the length of the lesson and the fact that most participated in a single session, none voiced a preference for the regular laboratory. Most agreed that

Table 8

Student Comparisons of their Experiences with the Videodisc Lesson, Energy Transformations, with their Experiences in Regular Laboratory Sessions in Physics

Dimension	Mode	Median	Mean	SD
My level of attention	Higher	3.95	3.83	1.07
My interest in the content	Much Higher	4.13	4.04	0.96
Level of difficulty	About same	2.53	2.38	1.06
Expected memory of content	Higher	3.98	3.76	1.16

Table 9

Student Ratings of Features of the

Videodisc Lesson, Energy Transformation

Feature	Mode	Median	Mean	SD
Instructions on the videodisc	Somewhat Effective	3.27	3.37	0.95
Chance to work at own pace	Somewhat Effective	3.37	3.44	0.79
Getting feedback on answers	Somewhat Effective	3.38	3.27	1.17
Overview in the lab booklet	Somewhat Effective	3.17	3.18	0.95
Recording matrix in lab booklet	Somewhat Effective	3.16	3.06	1.03

Table 10

Student Reactions to Overall Aspects of their

Experience with Energy Transformations

Statement	Mode	Median	Mean	SD
I was often bored during the lesson	Disagree	2.25	2.27	0.91
I was frequently confused by the lesson	Disagree	2.22	2.25	0.78
I would rather learn in a regular lab session	Disagree	2.32	2.47	1.08
I was very interested in the videodisc itself	Agree	4.16	4.06	0.97
Being observed by the teaching assistant made me nervous	Disagree	2.53	2.49	1.08
I would like to see more labs presented by videodisc	Agree	3.89	3.82	0.97
I can learn more with a real experiment	Neutral	3.07	3.14	0.96
I would like printed copies of videodisc information	Strongly Agree	4.27	4.20	0.79
For the most part, the lesson kept my attention	Agree	3.93	3.86	0.96
The videodisc can simulate the laboratory effectively	Strongly Agree	4.32	4.22	0.80

the lesson kept their attention and strongly agreed that the videodisc can be used effectively for instruction in physics.

Student Comments. Written comments were gathered from students about Energy Transformations; the full list of comments is presented in Appendix D. The students appeared to react very well to the format and content of this lesson. They felt that the instructions were clear, and particularly appeared to like Unit III. They liked the way that simple, realistic examples were used to illustrate physical principles. As one student said, "It's easier to observe, so it's easier to understand it."

Many commented that they were very interested in and satisfied with the videodisc lesson and felt it was very helpful. Many commented that they would like to see it tried in additional classes. One felt in reading the comments that the students were interested in the videodisc per se as well; some wanted to try the videodisc by themselves and to do the programming for it. This view is substantiated by the extremely high rating on the statement, "I would like more printed information about the videodisc." The majority of the students checked "strongly agree."

Most seemed to want to work on their own and to have wanted greater preparation for the lesson. Some mentioned a preparatory lecture, while several spoke of the desire to have the printed materials a few days in advance so they could thoroughly prepare themselves.

Observations by the Teaching Assistants

The teaching assistants completed observation forms for many of the students and commented on their observations. While some personally expressed some understandable boredom with their task of observing and interviewing the

students through extended sessions, they judged the student interest to be good and the students to be taking it very seriously. They felt contrained by time, but this appears to be to some extent an artifact of the way sessions were arranged. Nonetheless, there seemed to be a feeling among these raters that the total time spent was too long. Ratings by the teaching assistants are presented in Table 11.

Interviews of the students by the teaching assistants substantiated the teaching assistants' observations that the videodisc made an effective contribution to the total program of instruction. When they asked students to compare this instruction to their regular laboratory experience, eighty-four percent said that their learning was better with the videodisc, eleven percent said that it was about the same, and only a single person indicated that he had learned less. Results were parallel for interest and for enjoyment — in both cases over 80% of the students indicated that they were more interested and enjoyed it more that the regular lab; none said he or she enjoyed it less.

Suggestions for amount of use of the videodisc instruction were varied, ranging from "one time" to "1/3 of the times," to "every week," to "as many times as possible." On student said, "Videodisc experiments are more practice than in regular labs." Perhaps the simplest but strongest testimonial came from one student who wrote, "This experiment makes me like physics."

Group versus Individual Participation

Did it make a difference if individuals worked alone as opposed to working with a partner on Energy Transformations? Students responses were analyzed to determined if any differences existed on dimensions measured by the student questionnaire, direct observation, or interview. Like the chemistry videodisc, a significant difference existed in favor of those working in pairs on

Table 11

Observational Ratings of the Participants

in Energy Transformation by the Teaching Assistants

Dimension	Mode	Median	Mean	SD
Student interest in the videodisc lesson	High	4.20	4.12	0.98
Student enjoyment of the videodisc lesson	High	4.00	3.92	0.99
Student learning from the videodisc lesson	High	3.68	3.54	0.82
Prior knowledge of the student about videodisc topic	Medium	3.03	3.10	1.05
Extent videodisc challenged student to think	High	3.67	3.58	0.98

the item, "My interest in the content" ($t = 2.15$, $p. < .05$). Unlike chemistry, however, no other differences were present.

Prior Training in Related Areas

A second set of statistical analyses were undertaken to determine if student preparation and background might affect aspects of the effectiveness of the videodisc lesson, Energy Transformations. Three areas of preparation were analyzed: (1) familiarity with calculus, (2) familiarity with rectangular and polar coordinates, and (2) concepts of work and energy.

Degree of familiarity with calculus had little detectable impact on the student ratings of learning; most reported quite high levels of preparation, which may have truncated possible effects. Some impact of familiarity with physics concepts was noted, however. Students who rated themselves as more advanced in knowledge of concepts of "work and energy" reported being significantly ($p < .05$) less confused ($F = 3.45$, $df = 2, 45$), and wanted to see more labs presented by videodisc ($F = 3.26$, $df = 2, 45$). They also reported that the lesson "kept their attention" significantly more ($F = 5.48$, $df = 2, 44$) than those who were less well prepared.

Evaluator's Comments on the Physics Data

The videodisc Energy Transformations is a fundamentally different instructional package than Chemical Decision Making, in that it is much longer, organized into units, and designed for use over multiple sessions. Some features of the lesson seem not to have been used exactly as designed; for example, most of the students used a single session to complete the entire videodisc and most appeared not to have used the laboratory booklet very effectively. Nonetheless, they rated the videodisc lesson very favorably compared to regular laboratory

instruction with respect to the interest, learning, and attention. Like the students who completed Chemical Decision Making, they judged videodisc instruction to be highly promising for providing laboratory experiences.

Although there was some feeling voiced that time spent was more than needed, these students professed that they had felt little boredom or confusion when they completed the student opinionnaire and were interviewed. Over two-thirds of them stated that they would like to review the videodisc at a later point, even though they stated that they had learned as much as in the regular laboratory. Almost all saw the videodisc as interesting in and of itself; almost universally they wanted more information. When asked about their belief as to whether the videodisc could be used effectively in physics laboratory instruction, they almost all strongly agreed. It could be used, they believed, not only in this course, but in other courses at all levels.

GENERAL EVALUATIVE COMMENTS

Overall, the evaluator judges the field test of the videodisc instruction and of the equipment to have been an outstanding success. Results of the field test, carred out with great diligence by the ITB faculty and staff under the direction of Professor Isjrin Noerdin, showed that Indonesian students at ITB responded very favorably to interactive videodisc instruction. On two quite different lessons, students rated their interest, their enjoyment, and their learning as very high; these subjective impressions were confirmed by the observations of the teaching assistants and by interviews with the students. They saw great potential for interactive videodisc instruction and for its application and expansion both in their own laboratory classes and into other areas and levels.

Students and faculty in both subject areas saw a need for additional lessons covering more content. In the case of chemistry, the Chemical Decision Making videodisc was perceived by most as rather "elementary," and many wanted more advanced content. This judgment, of course, covaries with the preparation of the students which, in the case of these participants, was substantial. In physics, most did not comment on the difficulty level of the videodisc, but simply stated a desire for a broadening of the topics covered by videodisc instruction.

Few participants and observers felt that videodisc instruction should completely replace current laboratory experiences. Instead, most saw it as complementing or supplementing current instruction, in arrangements by which perhaps up to half of the present laboratory experiences might be replaced by videodisc experiments. Those involved as participants and as observers pointed out the unique aspects of the videodisc, particularly its ability to repeat experiments safely and without additional expense, the speed with which experiences can be accumulated, and its ability to provide feedback to the learner.

At the same time, limitations of the videodisc as implemented in this field test seem to have been clearly recognized. In the chemistry lab, only sight and sound can be duplicated; the sense of smell could not be and students pointed this out. In the physics laboratory, however, some students saw the videodisc as a unique tool for showing them the ordinarily unseeable, such as the drag of the wind and the forces that work through the machines of everyday life.

On balance, the equipment seems to have worked quite well, even though some equipment—the three power supplies, the tape recorder/players, and a

videodisc controller--did fail initially. None of these seriously impeded the progress of the field test, however. In the case of the power supplies, substitute transformers were quickly fabricated by the ITB staff and worked without any problem throughout the field test. While the tape recorders did not work well, the alternative storage devices, disc drives, were much preferred because of their ease of use and speed and were used throughout the test. One of these, according to the coordinator, needed to be rebooted occasionally. The videodisc controller was one of three; the other two were operational and worked without problems on the two machines used in the field test.

Thus, while there were no serious equipment failures, there were enough problems that some question remains as to whether this particular configuration of equipment can perform reliably and be maintained in institutions with lower levels of technological support and skill. Unless implementation in developing countries is to be restricted only to institutions such as ITB where such support is available, it will be necessary to continue to search for and to find even more reliable, yet still reasonably priced, components for such systems.

It is unclear what impact the scaling back of interactive programming features in the original Annenberg/CPB videodiscs into the present low-cost system had upon the overall impact of the videodisc instruction in this field test, since there was no way to obtain data that would permit such a comparison. While students clearly enjoyed the interactive aspects of programming that still were present and were very favorable in their judgments about their experience

and the videodisc's potential, one can surmise an even more positive response to a more fully interactive system. As computers continue to increase in power, capability, and reliability, such systems, reasonably priced, should be readily available.

Some occasional confusions appeared to arise as a result of translation problems. In general, these did not appear to be serious and, on balance, the materials were remarkably error-free because of the extensive contact the Nebraska Videodisc Group had with the ITB and A.I.D. staff prior to the field test. An additional step of having one or more ITB staff members visit the Nebraska facilities during early production stages, however, likely would have eliminated almost all of the remaining problems. Although this procedure was proposed by the Nebraska group and desired by both the Nebraska and ITB staff, it was not possible in this case to bring the faculty coordinator, Dr. Noerdin, to the U. S. to review all materials. Had it been, it is likely that any remaining translation subtleties would have been clarified. Perhaps more importantly, this activity undoubtedly would have produced a better "fit" of the videodisc instruction into the ITB curriculum, both by creating modifications in the videodiscs themselves and by helping the institution plan for optimal use of the videodisc experiments in its instruction.

In the evaluator's judgment, the results of this field test give a great deal of cause for optimism about the potential of interactive videodisc instruction in developing countries. Because these instructional systems are so versatile and powerful, they have a tremendous potential for providing a wide range of laboratory experiences, from simple to complex, using a variety of interactive, responsive instructional methods. At the same time, there is an

elegant simplicity from the standpoint of the users. Staff members encounter no particular obstacles to implementation or complexities of installation; a few pieces of equipment simply need to be attached to one another. And from the students' perspective, the field test clearly demonstrated the comprehensibility of the system in that not a single student reported problems related to understanding the system and its use. The system worked as designed on two different lessons and students and faculty reacted to it very well. No one saw any serious limitation to its use; most just wanted more lessons, not only for themselves in their own classes, but for other schools and other areas of the country.

A final comment: the success of the present field test also attests to the wisdom of extensive involvement of many persons in interactive videodisc planning and development, as extensive communication and planning led to the desired outcomes. Perhaps the only missing link in the present test, had it been possible, was a visit to the production site in Nebraska by the ITB faculty coordinator, as discussed above. It likely would have produced additional beneficial outcomes. While such visits by faculty of host institutions may be quite inconvenient and perhaps seem to be an unnecessary expense, this evaluator joins the designers and coordinators of this project in believing that time and funds spent on this activity are well-invested, paying rich dividends in improved instructional design, elimination of translation problems, and generation of feelings of joint ownership of the instructional videodisc materials. All are factors critical to successful implementation of an innovative instructional system such as this in developing countries.

Appendix A:

Evaluation Instruments for Chemical Decision Making

A.1 Student Opinionnaire

A.2 Direct Observation Form

A.3 Interview Guide

A.I.D. Videodisc Project
CHEMISTRY: Chemical Decision Making
Student Opinionnaire

Instructions: Please give your reactions to assist in the improvement of this videodisc lesson. Your comments are confidential and will not affect your grade in this course.

---

1. Student Name_____ 2. Date_____

3. Age_____ 4. Gender (circle) M F 5. Major_____

6. Before entering ITB where did you study? _____rural school, _____regional center, _____urban (what city_____)

7. Number of years of prior coursework in Chemistry (including high school) _____

8. How did you work with the videodisc? ___Alone ___With a partner

9. If you were to complete another videodisc lesson, would you prefer to work alone or with a partner? ____Alone ____With a partner

10. How many different times did you work on the lesson?_____

About how much time did you spend on the lesson in total?_____

11. Was it required that you work this videodisc lesson? __Yes __No

If NO, what reasons led to your participation (check ALL that apply)

a. ___Recommendation of professor
b. ___Recommendation of teaching assistant
c. ___Recommendation of another student
d. ___Desire to learn more about chemistry and its methods
e. ___Desire to do better on examinations given in the course
f. ___In order to obtain extra credit for the chemistry course
g. ___As a substitute for another assignment, quiz, or test
h. ___Curiosity to see what videodisc instruction is like
i. ___Other (please specify)_____

12. In one or two sentences, please state the main concept that you learned from studying this videodisc lesson.

56

13. When did you work the videodisc lesson in relation to when the topic of UNKNOWNS was presented in your class or regular chemistry lab?

a. ___Several weeks after topic was presented in class or lab
b. ___Within a few days after topic was presented in class or lab
c. ___We have not yet encountered this topic in our class

14. When were you given the Student Guide for Making Chemical Decisions?

a. ___One or more days before completing this videodisc lesson?
b. ___Just prior to beginning work on this lesson
c. ___During the videodisc lesson
d. ___I did not have copies of the student lab sheets.

15. If you received copies of the Student Guide, when did you read them?

a. ___One or more days before completing this lesson
b. ___Just prior to beginning work on this lesson
c. ___During the videodisc lesson
d. ___I did not read the Student Guide

16. If you received AND read the Student Guide, please rate the extent to which the guide was useful to you on each of these dimensions.

	Not at all useful		Somewhat useful		Highly useful
a. Understanding what was expected	1	2	3	4	5
b. Helped me feel more confident	1	2	3	4	5
c. Guided the observations I made	1	2	3	4	5
d. Gave me a matrix for recording	1	2	3	4	5

17. Did you ask for help at any point during the lesson?___YES ___NO

If YES, why did you ask for assistance? (check all that apply)

a. ___Was unsure what to do at the very beginning of the lesson
b. ___Became confused about what the lesson was asking me to do
c. ___The videodisc was not working properly
d. ___Was unable to solve the unknowns
e. ___Other (please specify)_____

18. Did you reach the point in the lesson at which videodisc gave you the option to quit? ___YES ___NO

57

19. How did you feel about the amount of time you spent working on the videodisc lesson?

a. ___Spent much more than was necessary to learn the information
b. ___Spent somewhat more time than was necessary
c. ___Spent about the right amount of time on the lesson
d. ___Could have spent somewhat more time on the lesson

20. If given the chance, would you like to review this same lesson at a later date? ___YES ___NO

21. Compared to lab sessions in chemistry that you have experienced in this course or elsewhere, how would you rate the following dimensions for the videodisc you just completed.

	Much Lower		About the Same		Much Higher
a. My level of attention	1	2	3	4	5
b. My interest in the content	1	2	3	4	5
c. Level of difficulty of content	1	2	3	4	5
d. Amount of learning	1	2	3	4	5
e. Your expected memory of what you learned today	1	2	3	4	5

22. Please rate the effectiveness of each of the following features of the videodisc.

	Not Effective		Somewhat Effective		Highly Effective
a. Instructions on the videodisc	1	2	3	4	5
b. Chance to work at own pace	1	2	3	4	5
c. Getting feedback on answers	1	2	3	4	5
d. Chance to look at reactions again	1	2	3	4	5
e. Overview provided by Student Guide	1	2	3	4	5
f. Recording matrix in Student Guide	1	2	3	4	5

23. Prior to working this lesson, how familiar were you with the methods of finding UNKNOWNS in chemistry?

Not at all Familiar		Somewhat Familiar		Highly Familiar
1	2	3	4	5

55

24. Please indicate your agreement or disagreement with each of the following statements.

	Strongly Disagree				Strongly Agree
a. I was often bored during the lesson	1	2	3	4	5
b. I was frequently confused by the lesson	1	2	3	4	5
c. I would rather learn in a regular lab session	1	2	3	4	5
d. I was very interested in the videodisc itself as an instruction method	1	2	3	4	5
e. Being observed by the teaching assistant made me somewhat nervous	1	2	3	4	5
f. I would like more labs presented by videodisc	1	2	3	4	5
g. I can learn more with a real experiment than from the videodisc lesson	1	2	3	4	5
h. I would like to get printed copies of the information on the videodisc	1	2	3	4	5
i. The lesson kept my attention	1	2	3	4	5
j. The videodisc can be used effectively in simulating chemistry lab experiences	1	2	3	4	5

25. What did you like <u>most</u> about the videodisc lesson?

26. What suggestions do you have for revision of the videodisc lesson?

27. Other comments.

THANK YOU VERY MUCH!

A.I.D. Videodisc Project
Direct Observation Form

1. Student Name_____ 2. Videodisc Lesson (check) ____Chemistry ____ Physics

3. Date_____ 4. Time on lesson (minutes)_____ Time on questionnaire _____

5. How many students were working in this session? ___One ___Two

6. Which session was this for this student? ___First ___Second ___Third or more

7. Please make your best estimate of the percentage of time the student devoted to each of the following activities during the session. Your percentages should total to 100%.

   a. ___Getting oriented to the videodisc/getting started

   b. ___Observing the videodisc material/making observations

   c. ___Making calculations or recording information

   d. ___Reading the Student Guide/Student Lab Book

   e. ___Talking to a student assistant or professor

   f. ___Talking to another student

   g. ___Looking up information in a textbook or other source

   h. ___Completing the student opinionnaire form

   i. ___Interruptions (e.g., equipment problems, etc.)

   j. ___Other (Please specify)_____

8. How did the student finish the videodisc lesson? (Check any that apply.)

   a. ___Stopped after successful completion of part of the videodisc
   b. ___Stopped after successful completion of the entire lesson
   c. ___Stopped because of repeated failure to understand the content, frustration with the lesson
   d. ___Stopped because of equipment problems
   e. ___Stopped for reasons external to the videodisc (e.g, session time ran out, interruptions, etc.)

9. For each of the following dimensions, make your best judgment about student reactions: (NO=Not Observed)

	Low				High	
a. Student interest in the videodisc lesson	1	2	3	4	5	NO
b. Student enjoyment of the lesson	1	2	3	4	5	NO
c. Student learning from the lesson	1	2	3	4	5	NO
d. Prior knowledge of the student in the area covered by the videodisc lesson	1	2	3	4	5	NO
e. Extent to which the videodisc challenged the student(s) to think	1	2	3	4	5	NO

10. In a sentence or two, please give your general impression of this session and the performance of the student(s) in it..

_____
Observer Signature

A.I.D. Videodisc Project
Interview Guide

1. Student Name_____ 2. Date_____

3. Videodisc Lesson ___chemistry
___physics

4. Worked ___Alone
___With another student

5. Student major_____

6. Number of prior years of coursework in
chemistry _____
physics _____

7. Gender of student (circle) M F

8. Did you feel that you had adequate background to complete this videodisc lesson?

9. Did you become confused at any time during the lesson? If YES, what was confusing to you?

10. How does the videodisc compare to an actual laboratory session in terms of:

Learning

Interest

Enjoyment

11. How often would you suggest that videodisc laboratory experiences like this be used in a course such as this one?

12. Six months from now, what do you think you will remember from this session with the videodisc?

62

13. What is your general impression of the potential of the videodisc technology?

14. Do you have any other ideas you would like to share with the designers of the equipment and of the chemistry/physics lesson?

Thank you very much for your help.

Interviewer Signature

Appendix B

Evaluation Instruments for Energy Transformations

B.1 Student Opinionnaire

B.2 Direct Observation Form

B.3 Interview Guide

A.I.D. Videodisc Project
PHYSICS: Engergy Transformations
Student Opinionnaire

Instructions: Please give your reactions to assist in the improvement of this videodisc lesson. Your comments are confidential and will not affect your grade in this course.

---

1. Student Name_____ 2. Date_____

3. Age_____ 4. Gender (circle) M F 5. Major_____

6. Before entering ITB, where did you study?

   a. ___Rural school
   b. ___Regional center
   c. ___Urban school
   What city? _____

7. Number of years of prior coursework in PHYSICS (including high school) _____

8. How did you work with the videodisc? _____Alone? _____With a partner?

9. If you were to complete another videodisc lesson, would you prefer to work alone or with a partner? _____Alone _____With a partner

10. How many different times did you work on the lesson?_____

    About how much time did you spend on the lesson in total?_____

11. Was it required that you work this videodisc lesson? ___Yes ___No

    If No, what reasons led to your participation (check ALL that apply)

    a. ___Recommendation of professor
    b. ___Recommendation of teaching assistant
    c. ___Recommendation of another student
    d. ___To learn more about physics and its methods
    e. ___To do better on examinations given in the course
    f. ___In order to obtain extra credit for the physics course
    g. ___As a substitute for another assignment, quiz, or test
    h. ___Curiosity to see what videodisc instruction is like
    i. ___Other (please specify)_____

65

12. In one or two sentences, please state the main idea that you learned from studying this videodisc lesson.

13. When, if ever, have you encountered the topic of ENERGY TRANSFORMATION in physics?

a. ___I learned about it in an earlier class
b. ___The topic was presented earlier in this class
c. ___This is my first contact with this topic

14. When were you given the Student Guide on Energy Transformations?

a. ___One or more days before completing this videodisc lesson?
b. ___Just prior to beginning work on this lesson
c. ___During the videodisc lesson
d. ___I did not receive copies of the student lab sheets.

15. If you received copies of the Student Guide, when did you read them?

a. ___One or more days before completing this lesson
b. ___Just prior to beginning work on this lesson
c. ___During the videodisc lesson
d. ___I did not read the Student Guide

16. If you received AND read the Student Guide, please rate the extent to which they were useful to you on each of these dimensions.

	Not at all Useful		Somewhat Useful		Highly Useful
a. Understanding what was expected	1	2	3	4	5
b. Helping me feel more confident	1	2	3	4	5
c. Guiding the observations I made	1	2	3	4	5
d. Provided a format for recording	1	2	3	4	5

66

17. Did you ask for help at any point during the lesson? ___YES ___NO

If YES, why did you ask for assistance? (check all that apply)

a. ___Was unsure what to do at the very beginning of the lesson
b. ___Became confused about what the lesson was asking me to do
c. ___The videodisc was not working properly
d. ___Was unable to solve the problems
e. ___Other (please specify)_____

18. Did you reach points in the lesson at which the videodisc gave you the option to quit? ___YES ___NO

19. How did you feel about the amount of time you spent working on the videodisc lesson?

a. ___Spent much more than was necessary to learn the information
b. ___Spent somewhat more time than was necessary
c. ___Spent about the right amount of time on the lesson
d. ___Could have spent somewhat more time on the lesson

20. If given the chance, would you like to review this same lesson or parts of it at a later date? ___YES ___NO

21. Compared to lab sessions in physics that you have experienced in this course or elsewhere, how would you rate the following dimensions for the videodisc you just completed.

	Much Lower		About the Same		Much Higher
a. Your level of attention	1	2	3	4	5
b. Your interest in the content	1	2	3	4	5
c. Level of difficulty of content	1	2	3	4	5
d. Amount of learning	1	2	3	4	5
e. Your expected memory of what you learned today	1	2	3	4	5

22. Please rate the effectiveness of each of the following features of the videodisc.

	Not Effective		Somewhat Effective		Highly Effective
a. Instructions on the videodisc	1	2	3	4	5
b. Chance to work at own pace	1	2	3	4	5
c. Getting feedback on answers	1	2	3	4	5
d. Overview in the student lab sheets	1	2	3	4	5
e. Recording guides on the lab sheets	1	2	3	4	5

67

23. Prior to working this lesson, how familiar were you with the methods used in solving energy transformation problems?

	Not at all Familiar		Somewhat Familiar		Highly Familiar
a. Calculus	1	2	3	4	5
b. Rectangular and polar coordinates	1	2	3	4	5
c. Concepts of work and energy	1	2	3	4	5

24. Please indicate your agreement or disagreement with each of the following statements.

	Strongly Disagree				Strongly Agree
a. I was often bored during the lesson	1	2	3	4	5
b. I was frequently confused by the lesson	1	2	3	4	5
c. I would rather learn in a regular lab session than in a videodisc session	1	2	3	4	5
d. I was very interested in the videodisc itself as a instruction method	1	2	3	4	5
e. Being observed by the teaching assistant made me somewhat nervous	1	2	3	4	5
f. I would like more labs presented by videodisc	1	2	3	4	5
g. I can learn more with a real experiment than with the videodisc experiment	1	2	3	4	5
h. I would like to get printed copies of the information on the videodisc	1	2	3	4	5
i. For the most part, the lesson kept my attention	1	2	3	4	5
j. The videodisc can be used effectively in simulating physics lab experiences	1	2	3	4	5

25. What did you like most about the videodisc lesson Energy Transformations?

26. What suggestions do you have for revision of the videodisc lesson?

27. Other comments.

THANK YOU VERY MUCH!

A.I.D. Videodisc Project
Direct Observation Form

1. Observer_____ 2. Videodisc Lesson ____Chemistry
(check) ____ Physics

3. Date_____ 4. Time on lesson (minutes)_____
Time on questionnaire _____

5. How many students were working in this session? ___One ___Two

6. Please make your best judgment of the percentage of time the student devoted to each of the following activities during the session. Your percentages should total to 100%.

a. ___Getting oriented to the videodisc/getting started

b. ___Observing the videodisc material/making observations

c. ___Making calculations or recording information

d. ___Reading the Student Guide/Student Lab Book

e. ___Talking to a student assistant or professor

f. ___Talking to another student

g. ___Looking up information in a textbook or other source

h. ___Completing the student opinionnaire form

i. ___Interruptions (e.g., equipment problems, etc.)

j. ___Other (Please specify)_____

7. How did the student(s) finish the videodisc lesson? (Percentages should add up to 100%.)

a. ___Stopped after successful completion of part of the videodisc
b. ___Stopped after successful completion of the entire lesson
c. ___Stopped because of repeated failure to understand the content, frustration with the lesson
d. ___Stopped because of equipment problems
e. ___Stopped for reasons external to the videodisc (e.g, session time ran out, interruptions, etc.)

8. For each of the following dimensions, make your best judgment about student reactions: (NO=Not Observed)

	Low					High
a. Student interest in the videodisc lesson	1	2	3	4	5	NO
b. Student enjoyment of the						

70

lesson	1	2	3	4	5	NO
c. Student learning from the lesson	1	2	3	4	5	NO
d. Prior knowledge of the student in the area covered by the videodisc lesson	1	2	3	4	5	NO
e. Extent to which the videodisc challenged the student(s) to think	1	2	3	4	5	NO

9. In a sentence or two, please give your general impression of this session and the performance of the student(s) in it.

A.I.D. Videodisc Project
Interview Guide

1. Interviewer_____ 2. Date_____

3. Videodisc Lesson ___chemistry
___physics

4. Worked ___Alone
___With another student

5. Student major_____

6. Number of prior years of coursework in
chemistry _____
physics _____

7. Gender of student (circle) M F

8. Did you feel that you had adequate background to complete this videodisc lesson?

9. Did you become confused at any time during the lesson? If YES, what was confusing to you?

10. How does the videodisc compare to an actual laboratory session in terms of:

Learning

Interest

Enjoyment

11. How often would you suggest that videodisc laboratory experiences like this be used in a course such as this one?

12. Six months from now, what do you think you will remember from this session with the videodisc?

13. What is your general impression of the potential of the videodisc technology?

14. Do you have any other ideas you would like to share with the designers of the equipment and of the chemistry/physics lesson?

72

Appendix C

STUDENT COMMENTS: CHEMICAL DECISION MAKING

Question: What did you like most about the videodisc lesson?

Easy to observe and easy to remember it

It is a new method to us

It is easier to understand it

The results are more accurate

It's safer

Helped us to understand the lectures

I like the instructions that were given in the experiment

It's new, so very interesting to us

When we mixed all of the substances together and tried to identify what the result was

We could see the results clearly

We paid more attention to this experiment

With this video, we can solve harder problems faster and with less equipment

We can control the experiment better (more accurate)

The handouts (syllabi) are clear

The experiment was not tiring and we had fun

When we observed the experiment

Deciding the results after observing the substances' characteristics

Question: What suggestions do you have for revision of the videodisc lesson?

Provide more lectures to us

It's good now, but please develop it

Because we sit too close to the TV screen, please change the TV

Provide more videodiscs and teacher assistants to us

The pictures on the TV screens were not clear enough, and you should tell us what kind of gas (smell) that was produced

Give us more chances to try it by ourselves

We want more materials and more lectures; more experiments besides this one

Provide this experiment to other students from chemistry college too

I don't understand the instruction from the syllabus; make the instruction clearer please

Other Comments:

By using video we do not learn to mix the substances which we could learn in regular lab

I suggest videodisc will be the supplements in support of our chemistry class

I suggest videodisc experiments should be given to all colleges in this country. If it's possible, give this experiment to high schoolers, too.

I like it because this is new technology and also can compare results form the regular lab

In the regular lab, we can tell whether the gas has been produced by the smell and the sound (noise), but in the video only the sound

The results from the videodisc experiment is more accurate

I hope we can use the video to do other experiments at least once a week

I like it, because we can see the results of experiments right away (save time)

Appendix D

STUDENT COMMENTS: ENERGY TRANSFORMATIONS

Question: What did you like most about the videodisc lesson?

Instructional method and life vision concepts

The part that shows sitting positions that influence the speed

The method and clear explanations. It is interesting

We know what we are going to accomplish in the experiments and it explains the basic things we need to know

Very good explanations

The way the materials are presented and good explanations

The way the equations were explained

Energy lost concept

Know the new equipment

I feel this videodisc is realistic

By using simple examples to explain complex things. And systematic explanations

The way the instructor explains it

I like the speed of bike which works against the wind

Forces work against free rolling

Calculating input forces and output forces

I like all of them

Video describes the transformation of energy clearly

Energy input and transfer of energy

Energy input, kinetic energy, and forces work against the wheel

It shows us how it work, so we understand it nnow

We do this experiment with more confidence

Forces work against the wheel

The examples in the beginning cause us to be curious

Using the technology to help the students to learn

Using the videodisc to explain is a great help

Transfer of energy

The way it was explained made it easy to understand

Third section, transfer of energy

Transfer of energy

Experiment that was presented by the physicist

Energy output

The benefits from mechanical theory

The calculation of energy needed and energy that was wasted

Calculation and observational techniques

Transforming of energy

Third unit

Third unit

This experiment caused me to want to know more about the videodisc, which I wasn't interested in before

The films explained how energy was tranformed

It is easier to observed, so it's easier to understand

Question: <u>What suggestions do you have for revision of the videodisc lesson?</u>

My suggestion is to give videodisc lectures (explanations) a few days before we we see the videodisc film

How about in every experiment, each group has not more than two persons

Give the students chances to try the equipment after the lectures

Have a special videodisc laboratory (do not mix with other labs)

Have more equipment

Give more lectures about videodisc; please give more information about it

It would be better to give some examples or illustrations in hard lectures

I agree to have (that we need) experiments in the laboratory

Give lectures before experiments

It would be better if fewer students; I hope we can use the videodisc outside lectures and the laboratory

Give more videodisc lesson and more often

Don't hold the sessions too long; it causes boredom and tires us; or have the class twice a week, each two hours

Disc video is very helpful in learning physics; Give the lectures first and then let the students try it by themselves

Let each person try it by him/herself

Tell the students just before lectures were given so they can prepare before they go to class

Give some rough ideas before the session, so the students can be prepared

Give more information

Give the lectures a few days before the experiments are given

Use the time more efficiently, because there was wasted time during the class

Give more information; shorten the class times; have more equipment

Use the time more effeciently; Give more chances to the students; overall, it was quite good

I wish lectures were given before the experiments, at least one day before so the students can prepare themselves

Give the lectures step by step, so it can give more time to the students to think of some questions

I would like to see these classes given regularly and have more information

It would be better if the problems were solved step by step

Actually I like the videodisc, but I don't like it because the students only have have the chance to press the buttons only

The break between each section shouldn't be that long

The class room (lab) was too small

The explanations about the video were too fast

The explanation about the video was too fast

Give more chances to the students to try it by themselves; give more information give the handout sheets three of four days before the lectures

Tell more about how to use the equipment; then have lectures a few days before the experiments

I prefer the students have their own numbers for their own calculations

I hope the students have a chance to use this facility continuously

The information in the experiment was not clear

Each person should be allowed to use one piece of equipment

This should have been given in the first semester, when the students learned this

basic topic

It is very interesting in learning basic physics

I hope this class is given to everybody

Additional Comments

I'm very interested in the experiments. It helps me remember better. I also like the examples and the calculations. I would like to use this experiment in the future and continuously. Allow the student to have this equipment

It like it and it's very interesting

I'm very interested

Give the chance to the students to do the programming

I hope we could use videodisc in other labs. It will help the students learn more about videodisc

It would be better if we could use videodisc in other regular lab experiments

I like it and I'm more interested in it now

This class seems to go smoothly, even though the lecturer has to keep on repeating

I think this class is interesting, but sometimes the explanations are confusing

The handouts were given too close to the experiment time. The students did not have any time to look at them

I'm more interested now, after the experiment

Satisfied

Satisfied. I would like to try it in other classes too.

In this second semester, I think it is better to give the related topics that will support our physics class

Satisfied enough

I suggest there is some student student assistant to help us in the lab

I don't have much of an impression yet, maybe next time I can give some

My question is after this introduction of the videodisc, whether there will be some other videodisc lectures for us. As you know our class schedule is very dense now

We hope the videodisc class won't stop at her; it is very useful

I'm very glad with the videodisc class; it helps me want to study physics

I wish some outlines were given, one day ahead of the experiment

I'm very interested in it; I hope there will be other topics given to us in the future

The videodisc helps us understand forces that can't be seen

I hope the videodisc will be a part of our class schedule; it is very helpful

You should teach us and let us do it ourselves

The handout sheets should be given a few days ahead

We want to see greater development of this method

We hope the videodisc will be helpful to all of us here

I hope we can learn more about how videodiscs work; give us more chances to try it by ourselves; we only push the buttons and that's not enough for us

We hope the videodisc will be used more often

APPENDIX B

FINAL FISCAL REPORT

FINANCIAL STATUS REPORT

(Follow instructions on the back)

1. FEDERAL AGENCY AND ORGANIZATIONAL ELEMENT TO WHICH REPORT IS SUBMITTED: U.S. Agency for International Development

2. FEDERAL GRANT OR OTHER IDENTIFYING NUMBER: DPE-5542-G-55-3064-0

OMB Approved No. 80-R0180

PAGE 1 OF 1 PAGES

3. RECIPIENT ORGANIZATION (Name and complete address, including ZIP code)

University of Nebraska
Administration 414
Lincoln, Nebraska 68588-0431

4. EMPLOYER IDENTIFICATION NUMBER: 47-0491233

5. RECIPIENT ACCOUNT NUMBER OR IDENTIFYING NUMBER: 87-316-223-01

6. FINAL REPORT: [X] YES [ ] NO

7. BASIS: [X] CASH [ ] ACCRUAL

8. PROJECT/GRANT PERIOD (See instructions): FROM (Month, day, year) 8-31-1983 TO (Month, day, year) 1-31-1985

9. PERIOD COVERED BY THIS REPORT: FROM (Month, day, year) 1-1-1985 TO (Month, day, year) 1-1-1985

10. STATUS OF FUNDS

PROGRAMS/FUNCTIONS/ACTIVITIES ►	(a)	(b)	(c)	(d)	(e)	(f)	TOTAL (g)
a. Net outlays previously reported	$ 148,767.78	$	$	$	$	$	$
b. Total outlays this report period	5,946.68						
c. *Less:* Program income credits	- 0 -						
d. Net outlays this report period (*Line b minus line c*)	5,946.68						
e. Net outlays to date (*Line a plus line d*)	154,714.46						
f. *Less:* Non-Federal share of outlays	- 0 -						
g. Total Federal share of outlays (*Line e minus line f*)	154,714.46						
h. Total unliquidated obligations	- 0 -						
i. *Less:* Non-Federal share of unliquidated obligations shown on line h	- 0 -						
j. Federal share of unliquidated obligations	- 0 -						
k. Total Federal share of outlays and unliquidated obligations	154,714.46						
l. Total cumulative amount of Federal funds authorized	159,400.00						
m. Unobligated balance of Federal funds	4,685.54						

11. INDIRECT EXPENSE

a. TYPE OF RATE (*Place "X" in appropriate box*) [ ] PROVISIONAL [ ] PREDETERMINED [X] FINAL [ ] FIXED

b. RATE	c. BASE	d. TOTAL AMOUNT	e. FEDERAL SHARE
26.30%	113,675.52	29,896.66	29,865.00

12. REMARKS: *Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation.*

13. CERTIFICATION

I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL: Kersi Pajnigar

TYPED OR PRINTED NAME AND TITLE: Kersi Pajnigar, Assit. Fiscal Manager, Grants & Contracts

DATE REPORT SUBMITTED: 9-19-1985

TELEPHONE (*Area code, number and extension*): (402)472 2884

269 102

STANDARD FORM 269 (7-76)
Prescribed by Office of Management and Budget