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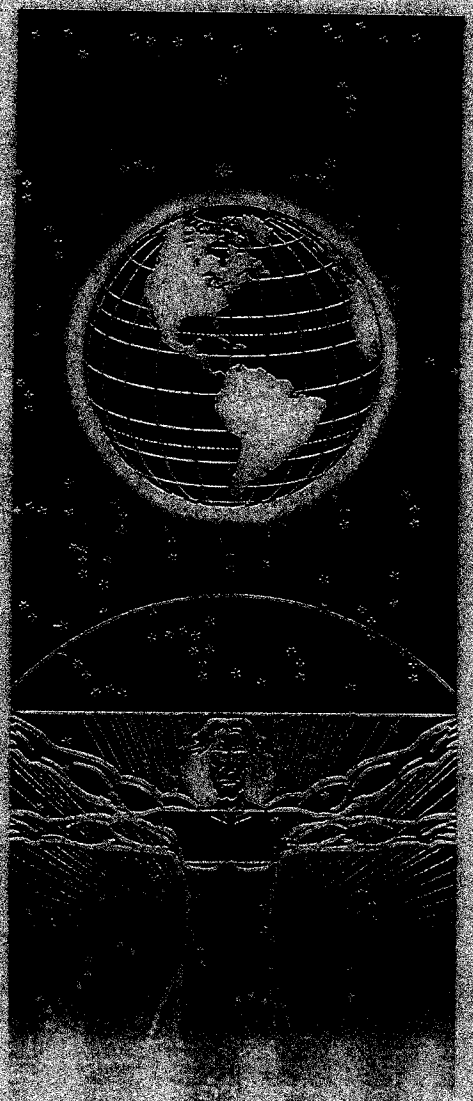

UNITED STATES AIR FORCE RESEARCH LABORATORY

TRAINING INSTRUCTORS TO DEVELOP INTERACTIVE MULTIMEDIA COURSEWARE

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July 2001

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*
July 2001

2. REPORT TYPE
Final

3. DATES COVERED *(From - To)*
Sep 1996 – Dec 1999

4. TITLE
Training Instructors to Develop Interactive Multimedia Courseware

5a. CONTRACT NUMBER
F41624-96-C-5006

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
63227F

6. AUTHOR(S)
Wenzel, B.M

5d. PROJECT NUMBER
2743

5e. TASK NUMBER
A3

5f. WORK UNIT NUMBER
04

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Mei Technology Corporation
8930 Fourwinds Drive
San Antonio, TX 78239

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Air Force Research Laboratory
Warfighter Training Research Division
2509 Kennedy Circle
Brooks AFB, TX 78235-5118

10. SPONSOR/MONITOR'S ACRONYM(S)
AFRL

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
AFRL-HE-AZ-TR-2001-0006

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES
Air Force Research Laboratory Technical Monitor: Dr. Robert Yadrick

14. ABSTRACT

This report documents training ten instructors at Texas Community Colleges on developing interactive multimedia courseware (ICW), using Experimental Advanced Instructional Design Advisor (XAIDA) as an authoring tool. Workshops consisting of two three-day sessions of lecture, demonstration, and hands-on practice with XAIDA were used. The participants as subject-matter experts demonstrated an ability to develop ICW using XAIDA, even though they had no experience doing so. They were able to develop ICW that teaches a topic, how to reason about a topic, and multimedia to communicate about a topic.

15. SUBJECT TERMS
Computer-based instruction; Interactive Multimedia Courseware; Training; Training Development

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Dr. Robert Yadrick
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL	16	19b. TELEPHONE NUMBER *(include area code)*

CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

This research described in this report was conducted for the Air Force Research Laboratory, Human Effectiveness Directorate, Warfighter Training Research Division (AFRL/HEA) (formerly known as Armstrong Laboratory) under Work Unit 2743-A3-04, Advanced Instructional Design Advisor (AIDA), under Contract F41624-96-C-5006, with Mei Technology Corporation. The Laboratory Contract Monitor was Dr Robert Yadrick, AFRL/HEAI, at Brooks Air Force Base, TX. Dr Yadrick is no longer with AFRL/HEA and this report was submitted for publication by Dr Donald L. Harville, AFRL/HEAI.

Documentation of this research was initiated at Brooks AFB but submission for publication was delayed due to personnel reassignments and the laboratory reorganization. Therefore, this report is being published as received and not edited by AFRL/HEA. The final administrative work necessary to publish this report was accomplished by the Warfighter Training Research Division in Mesa, AZ.

TRAINING INSTRUCTORS TO DEVELOP INTERACTIVE MULTIMEDIA COURSEWARE

BACKGROUND

This report describes the results from accomplishing a major objective of the Computer-based Instruction Component of the State Leadership Consortium for Professional Development. The objective called for instructors from community colleges across the state to be trained on the use of the Experimental Advanced Instructional Design Advisor (XAIDA). XAIDA is an instructional development system that generates interactive multimedia courseware (ICW).

Results from training instructors to develop ICW using XAIDA are contained in this report. XAIDA is a system, developed under the sponsorship of the Air Force Armstrong Laboratory to explore techniques for automatically generating ICW. XAIDA consists of a program called *Develop* for entering and editing lesson topic descriptions and a program called *Deliver* for presenting instruction on the topic. *Develop* provides a subject-matter expert, in this case a community college instructor, with facilities for describing the structure of a topic, describing its characteristics and behavior, associating multimedia with the lesson content, and configuring practice exercises. *Deliver* provides students with an overview of the subject matter, a detailed presentation of lesson material, selective review, and automatically generated practice exercises.

METHODS

XAIDA training was conducted in two workshops. Both training workshops were three days in duration. The training objectives of Workshop 1 were to be able to use XAIDA effectively to develop ICW that describes characteristics of a topic and to become familiar with the XAIDA interface used to develop ICW that teaches theory of operation. The training objectives for Workshop 2 were to be able to create multimedia (e.g., graphics, audio, and video) for XAIDA courseware and be able to use XAIDA to develop ICW that teaches procedural tasks. The training agendas for the two workshops are found in Appendix A.

Observations were made throughout training on changes in participants' abilities to develop ICW with XAIDA, self-reported skills level using XAIDA and computers in general, and attitudes toward XAIDA. Self-rated skills level data and ICW development proficiency data collected from the three veteran participants are not included in the results, due to obvious differences in their level of experience with XAIDA. The veterans' data are included in the results that address attitudes toward XAIDA.

PARTICIPANTS

Thirteen representatives from eleven community colleges around the state of Texas participated in the fist workshop. Eleven representatives attended the second workshop. Ten of the original thirteen representatives were new to XAIDA and three were returning participants from the previous year's project. Two of the ten newcomers attended training as the "colleague-to-be-trained."

Prior to training, participants were surveyed to determine how often they use computers and their level of familiarity with a variety of software applications. Table 1 contains percentages

of participants reporting familiarity with the software applications. Familiarity with a Windows environment and PaintBrush application is advantageous to learning XAIDA, but not necessary. Seventy-seven percent of them agreed with the statement, "I regularly use a computer at work." Sixty-two percent of participants agreed with the statement, "I regularly use a computer at home."

Table 1. Percentage of Participants Reporting Familiarity with Software Applications

Software	Percent Familiar
Microsoft Word	70
Windows Operating System	54
Power Point	30
Paint Brush	25
Authorware®	8

RESULTS

Abilities Using XAIDA

Workshop 1

The most direct evidence that the first workshop's main objective was achieved is the 12 different physical characteristics lessons successfully developed during training. Lesson topics are listed below. The * indicates veteran developers. Two participants from different colleges developed lessons on the Simpson Meter.

1. Respiratory Sound Sites
2. Software Catalogues
3. Simpson Meter (2)
4. Computer Hardware*
5. Linear Equations*
6. Infrared Mouse*
7. Netscape Composer Interface
8. Graph Calculator
9. Road Bicycle
10. Nursing Assessment Process
11. Self-contained Breathing Apparatus
12. Finance Formula

Workshop 2

Following instruction on developing procedural ICW, participants were given the option to work on any of the three lesson types (i.e., physical characteristics, theory of operation, procedural). Three of the 11 opted to continue work on their physical characteristics lessons. The most direct evidence that the second workshop's main objective was achieved in part is the eight different procedural lessons developed during training. Lesson topics are listed below. The * again indicates veteran developers.

1. Administering a Z-track Intra-muscular Injection
2. Taking Blood Pressure*
3. Creating A Webpage
4. Chain Rule
5. Installing RAM
6. Administering Oral Medication
7. Donning Self-contained Breathing Apparatus
8. Balancing a Bank Book

Self-perceived Computer Skills Levels

Paper-and-pencil measures of self-perceived computer skills, including newly acquired skills using XAIDA, were taken before and after the workshops. The results of these self-report data are presented in Figure 1. Participants rated their skills levels on a four-point scale where "1" represented *none*, "2" represented *fair*, "3" represented *good*, and "4 represented *expert*. The computer skill of *using a database* was only measured at the first workshop, indicated as (S1) in the figure below. Also the computer skill of *creating audio* was only measured at the second workshop, indicated as (S2) in the figure below. Significant increases in self-perceived skills levels were found with the following computer skills: using XAIDA *Develop* (program for creating ICW), using XAIDA *Deliver* (program for presenting ICW to students), managing files, managing directories, creating graphics, using the scanner, and using DOS. Computer skills unrelated to the training experience, excluding evaluation tasks, showed no change.

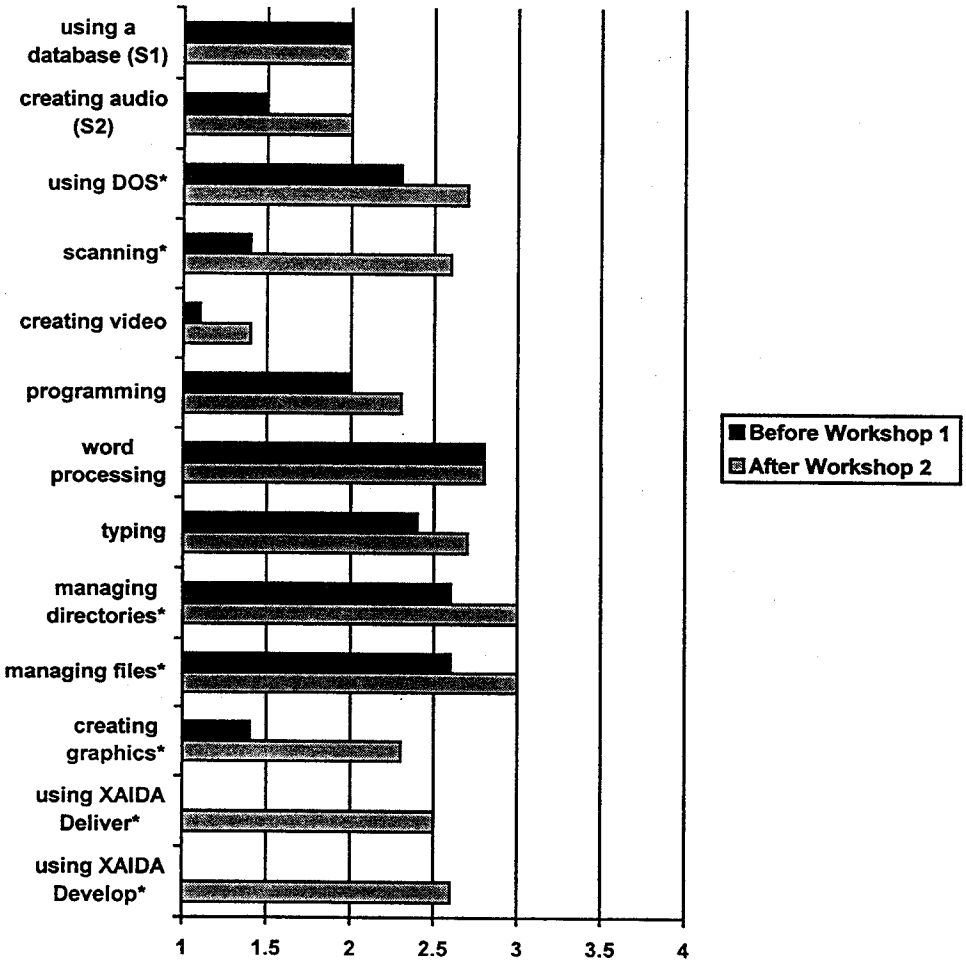

Figure 1. Mean Ratings of Computer Skills of New Participants Before and After Workshops (N=8)

[* Indicates a significant ($p < .05$) gain in skill level after training.]

Participants' rated their levels of proficiency developing ICW with XAIDA. The results from both 3-day workshops are represented in the next figure. Participants rated their proficiency on a 10-point scale where "1" represented a *novice* user and "10" represented an *expert* user of XAIDA *Develop*. Significant increases in perceived levels of proficiency were found at the end of the first two days of training, regardless of the training workshop. The first two days were spent learning new skills. At the end of the final days of training, no significant increases in proficiency were reported. The final day of the first workshop was spent introducing participants to the theory of operation interface. They did not have an opportunity to use the interface to develop their own lessons. The final day of the second workshop was spent developing procedural lessons and completing physical characteristics lessons.

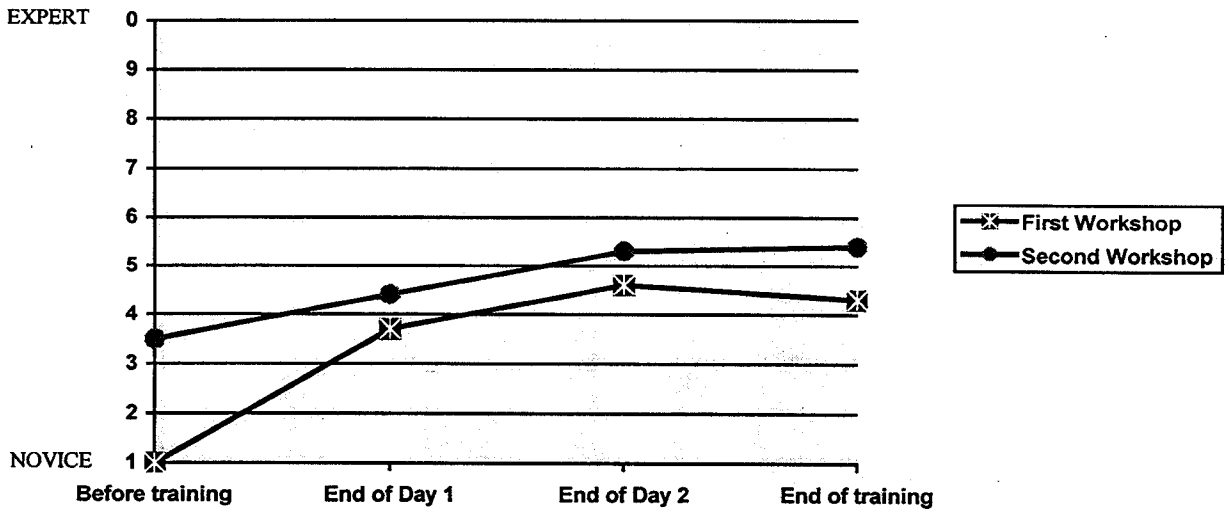

Figure 2. Mean Ratings of Proficiency with XAIDA Develop for New Participants Across Workshops (N = 9)

On average participants rated themselves 3.3 points higher on the 10-point scale after the first workshop compared to before the first workshop. This increase was statistically significant ($t(7) = 5.3$, $p < .001$). On average participants rated themselves 1.8 points higher on the 10-point scale after the second workshop compared to before the second workshop. This increase was also statistically significant ($t(7) = 5.0$, $p < .002$). The second workshop was found to have an overall positive effect on participants' proficiency levels ($M_{\text{End of Workshop 1}} = 4.3$, $M_{\text{End of Workshop 2}} = 5.4$, $p_{\text{difference}} < .05$).

Participant Attitudes toward XAIDA

Acceptance and willingness of personnel to adopt new technology is imperative to organizations planning to successfully integrate new technology. Therefore, an exploration was made of the participants' attitudes toward XAIDA. Across the two workshops, participants responded to open-ended items asking for their impressions of XAIDA. Participants' comments to the items were collected before training and at the end of the first, second, and final day of training, during both workshops. Participants' comments were coded into seven categories that

have been found to reflect users' concerns when adopting educational innovations (Hall, 1979; Hall, George, & Rutherford, 1986; Bailey & Palsha, 1992). Comments were further coded as positive, negative, and neutral statements. Results are presented in Figure 3 and Figure 4. Users who become accepting of an innovation tend to express positive concerns that fall into the higher categories--*consequences*, *collaboration*, and *refocusing*.

The seven categories and examples of coding criteria follow:

1. *Awareness*-- have or have not heard of it, interested in the area;
2. *Information*-- limited knowledge about it, what are the possible applications;
3. *Personal*-- effects on professional status, how my tasks will change;
4. *Management*-- coordination of tasks and people, conflict between interests and responsibilities;
5. *Consequences*-- how it affects classroom training, its application to training;
6. *Collaboration* --coordinating efforts with others, help others with the innovation; and
7. *Refocusing*--revise the approach, modify based on use.

Two different patterns of concerns emerged across the workshops. The pattern found in the first workshop revealed that participants came to training looking for more information about XAIDA. During the course of the first workshop, comments made were of the personal nature. Concerns shifted to the higher level categories as the first workshop ended. Participants then expressed as many *personal* as *consequence* concerns.

The pattern of concerns found at the beginning of the second workshop suggests that participants began considering what ICW had to offer them and their colleagues. Day 1 of the second workshop involved learning how to create multimedia, which raised *management* concerns—equipment needs and technical support. Day 2 involved developing procedural ICW. This training activity stimulated *personal* concerns. At the end of both workshops, over half of participants' concerns addressed *consequences*, *collaboration*, and *refocusing* issues. This pattern indicates that participants are likely to be early adopters of new technology.

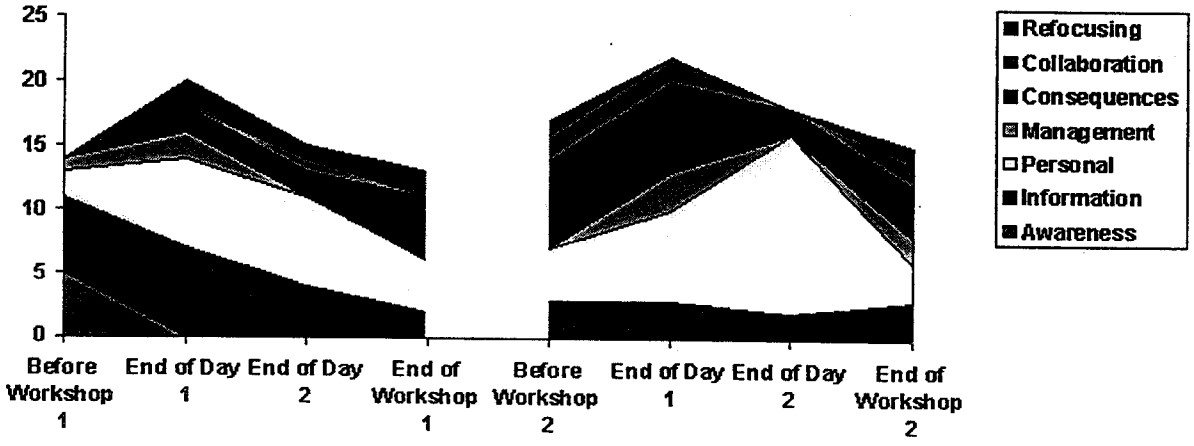

Figure 3. Proportion of Comments in Each Concern Category across Workshops

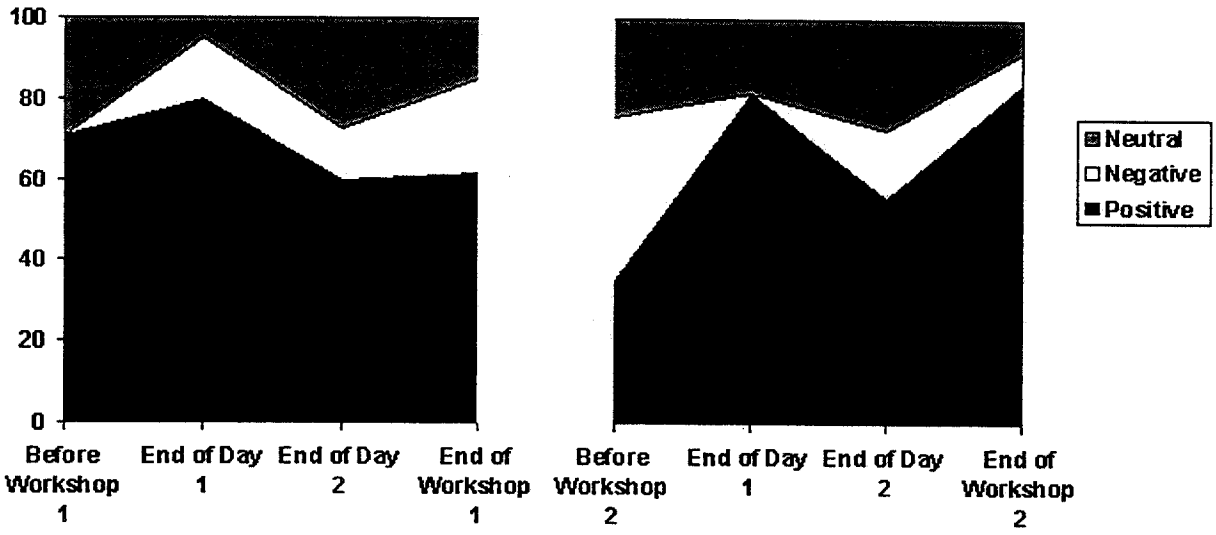

Figure 4. Proportion of Positive, Negative, and Neutral Comments about XAIDA across Workshops

Overall the majority of participants' comments, as shown in Figure 4, were positive. The increases in negative comments are largely due to participants developing ICW on their own. Developing ICW with XAIDA required participants to think differently about subject matter for which they possessed expertise. XAIDA requires that you think about *how to describe* a characteristic, rule of behavior, or procedural step, not *how to teach* it. The fact that the majority of participants' comments were positive further indicates that participants are behaving as early adopters of new technology.

Appendix B contains randomly selected comments made by participants during the first and second workshops, respectively.

DISCUSSION

Each instructor who completes the workshops possesses the skills necessary to develop ICW. Each is capable of developing ICW that teaches the structure of a topic and its characteristics, how to reason about a topic, procedures associated with a topic, and multimedia to communicate information about the topic.

Ten of the instructors completed their ICW modules in preparation for classroom-evaluations. The next step was preparation for the classroom evaluations. Eight of the ten instructors incorporated their courseware modules into their curriculum. Two instructors did have access to students during the course of the project.

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APPENDIX A: WORKSHOP 1 AND WORKSHOP 2 TRAINING AGENDAS

Workshop 1 Training Agenda

Day 1	Day 2	Day 3
Introduction by Linda Rivas Welcome to Training A. Discuss of the research and development project B. Brief introduction on what XAIDA is and what XAIDA does Pre-training assessment View physical characteristics and theory of operation lessons in XAIDA *Deliver* Presentation of Lesson Introduction interfaces/editors in XAIDA *Develop* for physical characteristics	Review Lesson Introduction and Lesson Body interfaces/editors Begin developing own physical characteristics lesson	Presentation of theory of operation lesson View theory of operation lesson in XAIDA *Deliver* Present theory of operation interfaces/editors in XAIDA *Develop* Pair-up to develop theory of operation practice lesson from tutorial
Lunch	Lunch	Lunch
Begin developing a physical characteristics practice lesson Presentation of Lesson Body interfaces/editors in XAIDA *Develop* Continue developing the physical characteristics practice lesson Discuss lesson topics and materials brought for lesson development Distribute XAIDA user manuals End of day assessment	Continue lesson development Present Practice interfaces/editors in XAIDA *Develop* Show-and-tell End of day assessment	Documentation for Reimbursement session by Linda Rivas Review theory of operation interfaces/editors Continue developing theory of operation practice lesson Post-training assessment

Workshop 2 Training Agenda

Day 1	Day 2	Day 3
Pre-training assessment Interested in using Theory of Operation? Learn how to create multimedia	Review XAIDA editors Developing procedural lessons	Work on lesson type of choice
Lunch	Lunch	Lunch
Introduction to procedural lesson View example XAIDA procedural lesson Pre-plan procedural lesson Gather and create lesson media	Continue developing lessons	A moment with Linda! Continue developing lessons Setup dates for classroom evaluation
End of day assessment	End of day assessment	Post-training assessment

APPENDIX B: INSTRUCTOR COMMENTS ABOUT XAIDA

Workshop 1: Comments about XAIDA

Before Training	End of Day 1	End of Day 2	After Training
Good development tool for tutorials. Easy to design lessons. Easy to add resources. Easy to navigate. I'm impressed but implementation will be a big step. We currently have 29 courses. Each course is 96 hours in length and we have 3 instructors who currently work 10-12 hours per day at work and then do the L/P at home. I will do everything I can to bring into classroom however time is critical. Impressive. I hope it will work for our program. I think it is a good tool we can use on a permanent basis. I hope that we could develop a series of lessons. Sounds good-I'm ready to see it!	This version has more features than the previous version I used. It is a very interesting software package. I am anxious to learn how flexible it will be to adapt to a broad variety of tutorials. More intuitive than the older versions. Still restrictive for possible lesson topics. I think it will take much less time to develop a lesson with this version. XAIDA seems powerful in that it does a lot of the development work for you. The interface is not as intuitive as I would like to see. Some points require buttons that are not exactly prominent. Still up for grabs. I feel it is going to take time and practice to get comfortable but it will happen if you all stay with us.	I am a little more comfortable than yesterday. But have a long way to go. I am not going to say that this is user friendly since I'm not familiar with like programs. It should be a useful resource to me. It imposes some restrictions on presentation; however, none that I can see that can't be overcome. I'm still very high on it! I've learned a lot today, and hope to learn more tomorrow. I've come a long way but have miles to go before I feel comfortable with it. Pretty big!! I think I can get it in time	Good tool to use, very easy to put together! A very useful program for teaching a physical description. Very useful for practice with questions. Busy interface, not very intuitive. I feel I've got a fairly good grasp on this because it's what we worked with in most of the workshop. -Very good—straightforward if the topic can be placed in a physical paradigm. Complex, yet simple—still need to practice. It can be useful for several different fields.

Workshop 2: Comments about XAIDA

Begin Training	End of Day 1	End of Day 2	End of Training
Very good for tutorials. Parts identification has limited use in mathematics; procedural lessons should be much more useful. I think it will greatly enhance learning inside or outside the classroom. I went through the student program that I developed and felt that it was user friendly and interesting. My problems are creating the questions and getting resources into the lesson. I've spent most of my time doing (attempting) these tasks. Still very impressive, however, not too sure how or if it will be so user-friendly to my colleagues—they question how to use it in the academic setting, i.e., English, history, government.	I think this is an excellent teaching tool for the classroom. It is easy to operate (as a student) and very interesting using the multimedia. I need lots of technical support but am very impressed with the program. Procedural lessons will be more useful for multimedia and multimedia will make the program more interesting. Appears to have far more utility than what we learned about it in December. After seeing a procedural lesson, it seems to possess some utility in adding a visual element to the learning process. Creating the multimedia elements is fun. Multimedia really enhances the XAIDA lesson. Equipment will be needed at our level.	It's going to be good, but now I need to change some of the "canned" statements as that they will apply to procedures rather than parts. Good program. I haven't yet, but I know this will be <u>great</u>! XAIDA can probably be used for math procedures. Cool stuff! I feel I understand it better, however, implementing still seems to be a problem for me. I spent a lot of time setting up bitmaps for the presentation. I really did not progress far.	I like it more. It really was great. Now I feel so much better. This program <u>can</u> be used if given a chance, even by English/History. Still convoluted, counter intuitive, hard to use. More trouble than it's worth, for my subject. Powerful, flexible, still complex, but extremely usable. A good program for my field. The trend in the safety field is CBT. I plan to go back and put several training programs on XAIDA. Well, I think this will have a lot of uses. I'm looking forward to going back to my campus and introducing the program to other faculty and students.