To the Graduate Council:

I am submitting herewith a dissertation written by Christina Marie Goode entitled "Evaluating the Quality, Usability, and Potential Effectiveness of Online Learning Modules: A Case Study of Teaching with Technology Grant Recipients at the University of Tennessee, Knoxville." I have examined the final paper copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Instructional Technology and Educational Studies.

Edward L. Counts, Jr. Major Professor

We have read this dissertation
and recommend its acceptance:

John R. Ray

Laverne B. Lindsey

Carol Tenopir

Accepted for the Council:

Vice Provost and Dean of
Graduate Studies

Evaluating the Quality, Usability, and Potential Effectiveness of Online Learning Modules: A Case Study of Teaching with Technology Grant Recipients at the University of Tennessee, Knoxville

A Dissertation
Presented for the
Doctor of Education
Degree
The University of Tennessee, Knoxville

Christina M. Goode
December, 2003

Thesis
2003b
.G67

Copyright © 2003 by Christina Marie Goode
All rights reserved.

DEDICATION

This dissertation is dedicated to Thomas Charlie Goode, my husband, best friend, and biggest supporter, and to our daughters, Thomya Charie and Christiana Marie, who took care of me and believed in me throughout this journey. May you be inspired to reach your goals and know that you "can do all things through Christ who strengthens you."

ACKNOWLEDGEMENTS

No great feat is ever accomplished without the support of someone. Throughout this dissertation my ultimate help and support was found in my hope and belief in God. For His presence in my life, through the Holy Spirit, I will forever be grateful. Achieving this educational goal was made possible with the additional help and support of many caring people.

Mr. Arthur R. and Mable M. Robinson, you have always encouraged me to strive to be the best I can be and to remember that God is in control. Thank you for believing in me and setting me free to pursue my goals.

Dr. Dale Doak, your belief in me encouraged me to broaden my goals and your dedication to education and the field of instructional technology has inspired me to continue. Thank you for the legacy.

Dr. Ed Counts, as my dissertation chair, you continued to gently nudge and push me along. Thank you for your persistence.

Drs. Laverne Lindsey, John Ray, and Carol Tenopir, your assistance and encouragement as dissertation committee members have been invaluable. I'm truly grateful.

Drs. Jean Derco and Julie Little, I appreciate your mentoring and encouragement more than you'll ever know. Continue to inspire.

Drs. Robin Blackman, Jennifer Gramling, and Jamie Nelson, I appreciate your friendship and compassion as we've struggled together along this journey.

To my Knoxville, TN and Darlington, SC church families, your prayers, support, and encouragement are uplifting. May God continue to bless you all.

ABSTRACT

Online learning has become an ever-increasing means of acquiring knowledge. As educational institutions worldwide are trying to keep pace with the demand, faculty is being urged or mandated to move their curriculum online.

This research addressed selected factors involved in developing quality and effective instruction and how these factors can be applied to the development of quality learning modules that are usable and effective in online teaching and learning. Specific emphasis was given to the pedagogical, instructional design, and developmental support issues involved in developing online learning modules.

Online learning modules (11) submitted in fulfillment of the Innovative Technology Center's 2001 Teaching with Technology Grant were evaluated on quality, usability, and potential effectiveness as a teaching tool. Independent reviewers were in agreement that overall, the modules met the criteria for being quality, and usable online learning modules. However, the reviewers agreed that six (55%) modules did not meet the criteria for potential effectiveness as a teaching tool. In fact, the reviewers were in agreement on the recommendation of only four (36%) modules as effective teaching tools. The developers' agreed as well that overall, their modules rated lower (satisfactory) on potential effectiveness than quality or usability.

Recommendations on factors to consider in developing online learning modules are provided. There are also recommendations for further research.

TABLE OF CONTENTS

CHAPTER **PAGE**

I. INTRODUCTION 1

Statement of the Problem 2
Purpose of the Study 4
Importance of the Study 4
Assumptions 5
Research Questions 5
Limitations 6
Definition of Terms 6
Organization of the Study 8

II. REVIEW OF THE LITERATURE 9

Introduction 9
Pedagogical Issues 10
Instructional Design Concerns 14
Developmental Support 18
Quality 20
Usability 23
Potential Effectiveness 24
Summary 25

III. METHODOLOGY 27

Introduction 27
Participants in the Study 28
Modules 29
Quantitative Research 33
Instrument 33
Reviewers 34
Qualitative Research 36
Instrument 37

IV. RESULTS 39

Quantitative Research 39
Qualitative Research 47

V. OBSERVATIONS, CONCLUSIONS, AND RECOMMENDATIONS .. 52

Observations 51
Conclusions 53
Recommendations 55

REFERENCES/BIBLIOGRAPHY 59

APPENDICES 63

A. Module Evaluation Criteria 64
B. Teaching with Technology Developer' Interview Questions 66
C. Reviewer's Letter 67
D. Developer's Letter 68
E. Multivariate Tests of Reviewers' Means 69
F. Pairwise Comparisons of Reviewers' Means 70
G. Tests of Between-Subjects Effects 71
H. Descriptive Statistics 72

VITA 73

LIST OF TABLES

TABLE **PAGE**

2.1 Sample Learning Theories 11
4.1 Module Ratings by Developers 49
4.2 Developers' Perspective on Key Factors for Online Module Development 49

LIST OF FIGURES

FIGURE **PAGE**

2.1 Generic ISD Model - ADDIE 17
4.1 Overall Means by Module 43
4.2 Quality Means by Module 44
4.3 Usability Means by Module 45
4.4 Effectiveness Means by Module 46

CHAPTER I

INTRODUCTION

Electronic technologies have influenced education for decades. In today's fast-paced technological society, the Internet and the World Wide Web are major electronic technologies influencing the direction of education. The information access provided through these technologies fosters a growing demand toward anytime, anywhere learning. As educators all over the world move to meet this demand, they are challenged to engage the learner through alternative instructional strategies and methodologies – specifically online learning. For many educators, the progression to the online environment has been a daunting task. Designing alternative opportunities for learning has taken them out of their comfort zone and forced them to move into an area in which they have little or no training (Dickinson, Agnew, & Gorman, 1999).

Feeling the pressure from competing institutions and industry, educational administrators are charging faculty to establish an online presence. In response, the solution for some faculty has been a blended learning environment in which the traditional face-to-face class is enhanced with online learning components. Some faculty have chosen a synchronous distance learning environment where the course participants are visible via videoconferencing, and the course is enhanced with asynchronous modules which participants complete at their own pace away from class. Still others have chosen a complete online course with no face-to-face interaction. In all

cases, however, some faculty has been guilty of simply "dumping" their traditional course materials into their online course sites. "Dumping" refers to placing course materials online without regard to designing the content for maximum learner interaction or engagement. This action, which often lowers information retention and leads to ineffective learning, cannot be permitted to suffice.

With the proper training and support, educators in the traditional learning environment can and do produce quality instructional materials which are beneficial to both the learners and the educators. Educational institutions should not expect or accept any less in the online environment.

Statement of the Problem

Research should always be driven by a need to know and subsequently, by a need to make use of that which has been discovered. In instructional technology, the need to know can be constant as technology is ever changing. Online learning is relatively new to the field of education. Thus, more and more obstacles to learning are being discovered in this environment. The task before educators is to alleviate these obstacles for both the instructors and the learners. Of major concern is the quality of online learning materials being used. To address the quality concern, educators must also address issues regarding usability and effectiveness, for these factors are essential to developing quality materials for online learning. In the haste to move online, some educational institutions are opting to hire outside entities to work with their faculty to produce online content. Many educational institutions cannot

afford to hire outside entities even with collaborative efforts. However, traditional learning provides us with numerous examples of quality instruction that is also usable and effective. Educators must learn to take the instruction we have used successfully in the traditional learning environment and establish criteria for what will be acceptable learning materials in the online learning environment.

Educational institutions must provide faculty the necessary training and support in not only teaching online, but also in developing materials to be used online. This helps to ensure that the online learning materials (i.e. stand-alone learning modules) are usable and potentially effective, and that both the teaching and learning do not suffer in the online learning environment.

One of the keys to usability and potential effectiveness in any learning environment is to engage the learner - move him/her beyond simple absorption of information. Engagement is accomplished by incorporating some form of interaction between the learner and the content. This engagement requires consideration of the varied learner needs and learning styles that exist within a typical course. Thus, a variety of learning strategies must be implemented in order to maximize the level of engagement.

When an online module developer takes these issues into consideration and uses learning strategies that require the learner to interact with the content, the learner tends to retain the information longer and thus the module's usefulness and potential effectiveness is enhanced.

Purpose of the Study

The purpose of this study was to examine selected factors involved in developing quality and effective instruction and determine how these factors can be applied to the development of quality learning modules that are usable and effective in online teaching and learning. Specific emphasis was given to the pedagogical, instructional design, and developmental support issues involved in developing online learning modules.

The completed modules, produced by the Innovative Technology Center's (ITC) 2001 Teaching with Technology (TwT) Grant recipients from the University of Tennessee, Knoxville, were analyzed for quality, usability, and potential effectiveness by three independent reviewers using a module evaluation criteria checklist. The checklist was developed from a synthesis of measures addressed in the ITC's module development workshop for TwT grant recipients; from quality measures currently used by educational institutions worldwide who are implementing online learning; and from measures revealed in the literature review. The checklist was field tested on modules submitted by grant recipients for both the ITC's TwT 2002 and Project SET 2002 grant recipients and found to be an acceptable instrument for measuring future online modules submitted to the ITC.

Importance of the Study

Online learning will only increase as an alternative means of instruction. Therefore, it is imperative that educational institutions: (1) determine what factors constitute quality instruction in the online learning environment; (2) set

acceptance standards or criteria for evaluating instructional materials used in the online environment (i.e. online learning modules); and (3) provide faculty with the skill set and resources to meet those criteria/standards to produce quality online learning materials that are usable and potentially effective. This study will be an important resource for those assisting educators in developing online learning materials and those accepting online learning modules as resources for others.

Assumptions

The following assumptions were made regarding this study:

1. The reviewers provided conscientious and honest reviews of each module.
2. The module developers were open and honest about their perception of their module and the issues encountered in the development process.
3. The researcher did not bias the interview responses through knowledge of the subject matter or through the selected questions.

Research Questions

This dissertation is a means to find effective solutions for developing quality online learning modules that are usable and potentially effective in online teaching and learning. The underlying research questions are:

1. What factors constitute a quality online learning module?
2. What factors constitute a usable online learning module?
3. What factors constitute a potentially effective online learning module?

4. What type of support and resources do faculty need to develop quality online learning modules that are usable and potentially effective?

Limitations

A limiting factor to this research was that the effectiveness of the modules was from the instructors' perspective *only.* At the time the modules were implemented, there was no set instrumentation in place to gather data from the students specifically on the modules. Even though a few faculty members received feedback from the students on the use of the module in their specific course, most of the feedback the developers obtained regarded the course in general.

Another limitation was that the sample size was limited to the number of grants (11) awarded for the 2001-2002 academic year.

Definition of Terms

The context of the definitions provided here is as these terms relate to the instructional technology profession in general, and to online learning more specifically.

1. **Asynchronous** - an event, course, etc. that takes place or exists at a different time, and possibly in a different location.

2. **Blended learning** - using two or more distinct methods of teaching or conveying information i.e. traditional classroom instruction along with online instruction.
3. **Educators/faculty** - (used interchangeably throughout dissertation) those responsible for conveying information to the learner.
4. **Effectiveness (potential)** - the potential ability to produce or achieve a desired effect, outcome, or result.
5. **e-Learning** - content and instructional methods delivered on a computer (CD-ROM, Internet, or intranet) and designed to build knowledge and skills related to individual or organizational goals (Clark, 2002).
6. **Engaged learning** - a learning process in which the learner builds upon prior knowledge by actively participating in various learner-centered instructional activities, individually and collaboratively, using problem solving, synthesis, analysis, and evaluation.
7. **Instructional/learning materials** - (used interchangeably throughout dissertation) materials or resources used to aid in conveying information.
8. **Learning styles** - the different ways in which we think and learn.
9. **Learning modality** - refers to the manner in which learners prefer to acquire information - visually, audibly, or kinesthetically.
10. **Learning module** - a stand alone, self-paced, instructional unit that covers a specific subject matter and provides the learner with interactivity and assessment.
11. **Online learning** - conveying information or concepts to the learner via the Internet or web-based learning environment.

12. **Pedagogical** - relating to the interaction between teaching, training, or imparting knowledge and acquiring and receiving knowledge.
13. **Quality** - exhibiting a high degree of excellence in content accuracy, design, and usability.
14. **Synchronous** - an event, course, etc. that takes place or exists at the same time, usually in a different location.
15. **Usability** - how a module's functionality effectively engages the user toward learning.
16. **Virtual** - created, simulated, or carried on by means of a computer or computer network.

Organization of the Study

This dissertation is composed of five chapters. Chapter I introduces the study, and provides the statement of the problem, the purpose of the study, the importance of the study, the assumption, the research questions, the limitations, the definition of terms, and the organization of the study. Chapter II presents a review of the literature pertaining to how we learn, instructional design for online learning, and faculty training for online development, and how these issues impact the development of online learning modules. Chapter III describes the methodology used in the study including the participants, instruments, and procedures. Chapter IV contains the results and presentation of the data analysis, and Chapter V provides the observations and conclusions of the study as well as recommendations for further research.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

A review of the literature supports the notion that quality assurance is a much-needed component in developing learning materials of any kind for the online environment, and especially when developing stand-alone, self-paced learning modules with limited or no human interaction. Much of the literature relating to online learning refers to courses taught completely online. However, some of the same basic techniques and strategies used in the completely online course evolved from the traditional face-to-face or the blended learning environment which features online components.

The dissertation will cover some of the literature pertaining to pedagogical, instructional design, and developmental support issues involved in developing online learning modules. In developing instructional modules for the online learning environment it is imperative that consideration be given to some of the overall learning theories and instructional principles that have driven education for many years. These theories and principles have included activities in teaching and learning that have very little to do with technology or the latest means of delivering instruction. The theories and principles focus more on the psychology of "how we learn" and "what educators need to provide" by way of curriculum and instruction in order to help us learn effectively or to achieve a desired outcome or objective.

Pedagogical Issues

Alan C. Ornstein and Francis P. Hunkins in *Curriculum Foundations, Principles, and Issues* (1998) provide an overview of the basic concepts within several major learning theories (Table 2.1).

To reach the varied learning styles or modalities of their learners, every effective educator knowingly or unknowingly has implemented several of these concepts in developing learning materials for the traditional learning environment. These same concepts are to be embraced when developing curriculum or content in *any* teaching and learning environment. This is especially true in the online environment where human-to-human interaction is minimal.

Alternative strategies must be implemented to compensate for those concepts that are crucial to effective learning. Otherwise, "dumping" will continue to occur.

Knowing how learning occurs is important to developing course materials for online or e-Learning."Decisions about e-Learning courseware must begin with an understanding of how the mind works during learning and of what research data tell us about what factors lead to learning" (Clark, 2002). Clark also states that, "It's not the medium that causes learning. Rather it is the design of the lesson itself." Using a learner-centered approach rather than a technology-centered one "suggests that we design lessons that accommodate human learning processes regardless of the media involved" (2002).

Table 2.1 Sample Learning Theories

Behavioral Learning
We learn by doing and observing others Reinforcement is essential for learning to occur. Practice (with feedback) improves learning and retention Spaced recalls are essential for remembering information Learning through rewards is preferable than under the conditions of punishment. Learning proceeds from simple to complex and part to whole behavior. Learning should proceed in small, step-by-step, simple units. Learning is hierarchical, based on sequential readiness. Desired performance or learning outcomes should be stated in advance (and by objectives). Learning is observable and/or measurable.
Cognitive-Developmental
Cognitive stages of development are related to age. Cognitive development is sequential and based on previous growth. The capacities of students are important; bright students are capable of learning more and at a more rapid rate than other students. Learning can be modified as a result of the interaction of the self with the environment. Learning involves the assimilation of new experiences with prior experiences. Learning is best achieved through active participation in the environment; the teacher can improve the environment to stimulate learning. There are several components and types of intelligence; there is no one single indicator or type of behavior that connotes intelligent behavior. Students learn best when they can generalize information, that is, whole to part learning. Students who learn how to learn will learn more in school than those who are dependent on the teacher to learn. Transfer of learning increases when students have the opportunity to solve problems.
Humanistic Learning
Teachers are sensitive to the students' world, not just the adult world. Learners are viewed as individuals, with diverse needs, abilities, and aptitudes. The learners' self-concept and self-esteem are considered as essential factors in learning. Learning is considered holistic, not just cognitive; the act of learning involves emotions, feelings, and motor-dependent skills. Learning is based on warm, friendly, and democratic student-teacher interactions; coercive and strict disciplinary measures are minimized. The quality (or processes) of learning is considered as important (in some cases more important) as the quantity (or products) of learning; teachers nurture learners. Students share ideas, work together, and tutor and help each other; homogeneous grouping, academic tracking, and competitive testing or programs are minimized. Students and teachers plan together the experiences or activities of the curriculum. Students are given choices (with limitations) and freedom (with responsibilities); the extent of choices and freedom is related to the maturity level and age of the students. Learning is based on life experiences, discovery, exploring, and experimenting.

In addition to the learning theories described in Table 2.2, another learning theory that has a big impact on online learning is constructivism. The constructivist theory asserts that learners construct or build new knowledge by formulating hypotheses, transforming information, and making decisions based upon existing knowledge and experiences (Bruner, 1960).

Constructive learning involves action and takes place through inquiry including: problem solving and creative and reflective thinking (Bruner, 1966). Constructivist designers for the online environment agree. According to the Virtual University Design and Technology Group at Michigan State University, "constructivist assignments and activities go beyond taking a test. Learners need to do things, try to apply what they are learning" (2003).

These are just a few of the many learning theories in use today, but they cover many of the aspects pertaining to how we learn. Online module developers must incorporate the concepts of these theories into their modules. Developing to a single theory limits the potential to be effective to all end users by ignoring the fact that all users do not learn the same.

In considering how we learn and in developing strategies within online learning to help us learn by engaging us into the learning process, developers must also understand learning styles. The term learning style is often used synonymously with learning modality. Though the terms have similar meanings, there is some difference. Learning style is defined as "the different ways in which children and adults think and learn" (Litzinger & Osif, 1992,). Learning modality refers to the manner in which learners prefer to acquire

information - visually, audibly, or kinesthetically. To develop quality, learning modules that are usable and that effectively engage learners, developers need to understand this difference and develop instructional strategies with both definitions in mind.

Developers also want to consider that all humans have multiple intelligences that play a part in how we learn. Howard Gardner's (1983) Theory of Multiple Intelligences indicates that "we have seven distinct forms of intelligences: linguistic, logical-mathematical, spatial, kinesthetic, musical, personal (inter-and intra-personal), and the naturalist."

Students develop at different paces, thus they exhibit different strengths and weaknesses in the various intelligences. It is not practical for an instructor to teach to every intelligence. However, Lazeer (1992) suggests that an instructor "can show students how to use their more developed intelligences to assist in the understanding of a subject which normally employs their weaker intelligences." For example, the instructor might suggest that students create a word game, puzzle, or song pertaining to the Civil War (major players, location, rationale, etc.).

In striving to reach a class of students with varied learning styles and each student possessing multiple intelligences, "the idea is not to teach each student exclusively according to his or her preferences, but rather to strive for a balance of instructional methods. If the balance is achieved, students will be taught partly in a manner they prefer, which leads to an increased comfort level and willingness to learn, and partly in a less preferred manner, which provides practice and feedback in ways of thinking and solving problems which they may

not initially be comfortable with but which they will have to use to be fully effective professionals." (Felder and Silverman, 2002).

According to Felder, "students preferentially take in and process information in different ways: by seeing and hearing, reflecting and acting, reasoning logically and intuitively, analyzing and visualizing, steadily and in fits and starts." When developers gain an understanding of how learning styles and modalities combine to impact a student's success in the classroom and become willing to adjust their teaching style to accommodate varied learning styles and modalities, then developers can begin to modularize their content into online learning units that will engage varied learners.

The major points to consider in using sound pedagogy in developing online learning modules is to combine the learning style, the learning strategies, and the technology with a focus on interactivity that is learner-controlled, and on content that allows the learner to build upon prior knowledge with real life application.

Instructional Design Concerns

Once it is understood how learning occurs, educators must determine how they will convey information to their learners in a way(s) that allows the learner to take an active part in acquiring the information. Conveying information through module development is one way that can incorporate several of the learning theories mentioned earlier.

One of the main reasons for the demand for online learning modules has been accessibility. The instruction is available 24 hours via the Internet and

can be accessed simultaneously (as opposed to traditional instructional media, such as an overhead or video tape, which can only exist in one place at a time).

An instructional benefit is that the content is generally designed to be flexible for use by other disciplines, and chunked into smaller portions for ease of understanding and also for ease of viewing in the online environment. These significant differences between online learning modules and other instructional media that have existed previously, have been some cause for the growth in using this means of instruction (Reigeluth, 1983).

Module development can be most successful when the educator/developer collaborates with a team of other specialists. "A team approach to Web-based course [module] development is not only convenient and helpful, but perhaps necessary to ensure quality instruction" (Hoffman and Ritchie, 2001). Team members may include a subject matter expert, instructional designer, graphic artist, technology support specialist, or a web designer.

Though there are modules created successfully by sole developers, there is a greater probability for developing an effective module when each team member focuses on their particular specialty. This also helps alleviate one are being slighted or underdeveloped. The "specialist" team brings input that addresses many of the criteria listed in the module evaluation checklist. For instance, the subject matter expert would be concerned with the content, while the graphic designer would be concerned with making sure the content and the user connects through the goals and objectives, assessment, evaluation, etc. Simultaneously, the web designer might focus on the navigation and how the

audio, video, etc. all work together while the technology support specialist would be concerned with addressing the technology needs (networking, communication, operating systems, and Internet connections.

Another plus for online learning modules is that in the development stage, the team members can collaborate on and benefit immediately from new versions. In developing effective instruction for the online environment, this team (or a sole developer) will probably go through an instructional design strategy that is used in all learning environments, but can be modified to include more multimedia as is often used in developing effective online courses. This strategy should include the main stages of instructional design: needs analysis, selection of instructional methods and materials, and evaluation (Boyle, 1997).

Needs analysis outlines what the learner will need to do in order to acquire the knowledge. It includes goals and sub-goals and objectives that are stated in measurable terms. The instructional methods and materials are selected based on what's needed to achieve the stated objectives. Prototypes are then developed and assessed through evaluation and testing before releasing the instruction for general use (Boyle, 1997).

The team may then institute an instructional systems design (ISD) model to ensure that learning does not occur haphazardly and that outcomes can be measured (Seels and Glasgow, 1998). There are several ISD models used successfully today that have similar components. These models all contain the basic processes of instructional design that can be formulated into a generic ISD model as demonstrated by Seels and Glasgow in Figure 2.1.

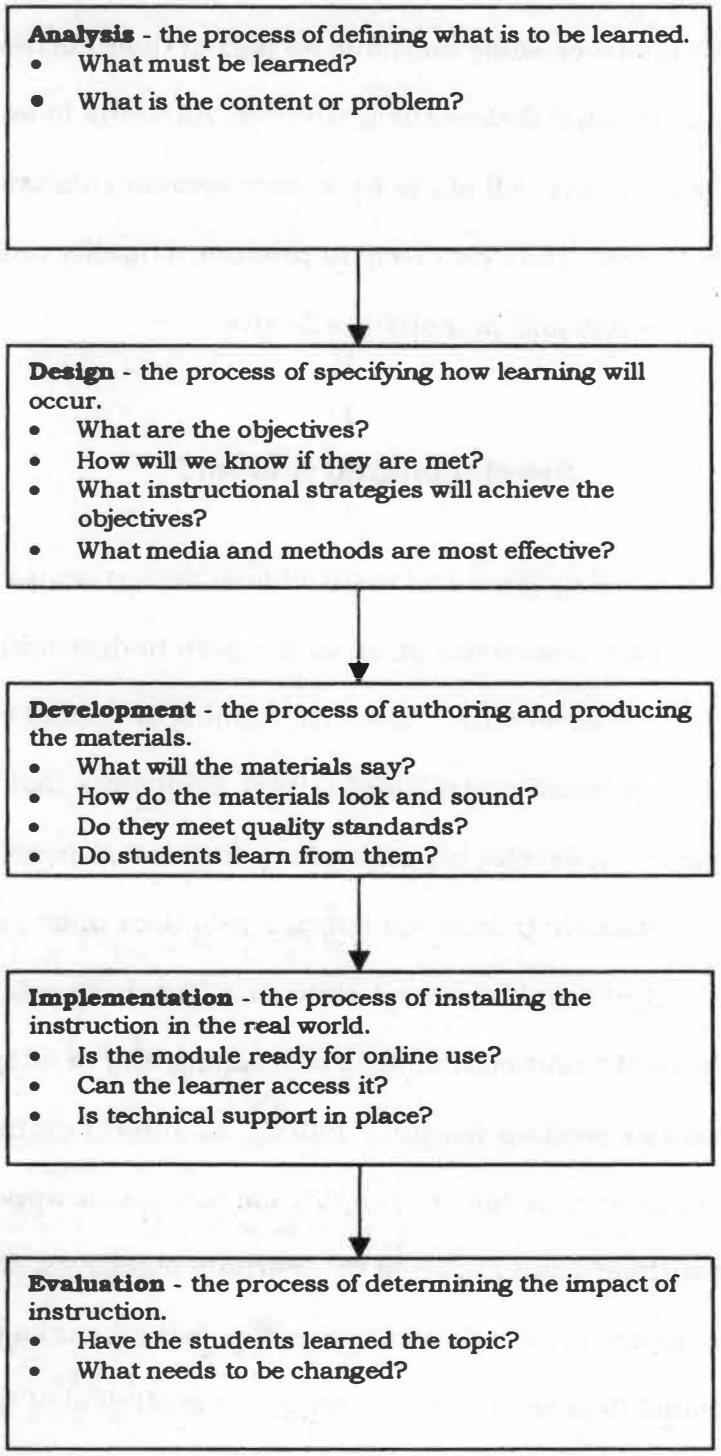

Figure 2.1 Generic ISD Model - ADDIE
(modified for online learning module development)

Most effective educators (perhaps unknowingly or from formal education) incorporate an ISD model or some facsimile as part of their curriculum planning. It is a part of what makes them effective. Adhering to an ISD model helps the sole developer cover all of the necessary components and helps the development team to work collaboratively to produce a quality online learning module that is also usable and potentially effective.

Developmental Support

Along with the pedagogical and instructional design issues of developing online learning modules, consideration must be given to developmental support. According to Sharon Gray, "Effective training is critical to successful implementation of web-based instruction" (1997). Educators that are properly trained and supported in developing online learning materials are less likely to "dump" information from instructor-led courses into their online sites.

Rudestam and Schoenholtz-Read state that "Teaching online requires faculty to move beyond traditional models of teaching and to adopt new practices that facilitate student learning" (2002). As subject matter experts, faculty will have to determine how to simplify current coursework into an online learning module without compromising the learning objectives. Even if faculty members are developing their modules alone, this feat may take the help of at least an instructional designer, and may require a great deal of time and effort.

Many educational institutions have established a means for helping their faculty enhance their curriculum with technology either through an on-campus department or through partnership with an outside corporation. This aid has

been in the form of workshops or training, equipment (hardware and/or software), and educational resources. Educational institutions and faculty have also engaged in partnerships with outside entities where the institution or faculty maintains the copyright to the content, and the technical delivery and support is provided by the outside entity.

However, when most educational institutions are faced with budget cuts, educators are often forced to seek support on their own. Grant opportunities are an excellent source of help for faculty caught in the constraints of budget crises. Some faculty have been successful leveraging one grant to acquire another and thus develop another module with a different concept(s) or extend the development of their original learning module.

Another form of internal support has come from faculty members who have taken on the role of in-house expert or mentor in regards to online teaching and learning. This may be someone who is known as an "early adopter" of technology, who may have always been challenged and motivated by technology to the point of being able to learn what needs to be done to use it effectively and to also be able to share that knowledge with others.

An advantage to having assistance from someone within an educational institution is that in-house experts or mentors are often "seen as more credible resources than non-teachers for providing information about utilizing technology in teaching" (Gray, 1997).

Another very valuable source of developmental support for faculty has been students. Many college students today have grown up using computers and many other forms of technology at home and in school, and have even

become very adept at putting them together and taking them apart! Many rewarding educational experiences can occur when faculty members (subject matter experts) work as a mentoring and collaborative partner on specific projects with a technically savvy student.

Once the module is developed, pre-testing and evaluation will help the developer determine what changes need to be implemented to achieve the desired learning outcomes. This will require the help of colleagues and/or others, familiar and unfamiliar with the content or concept(s), to test the prototypes and provided formative feedback.

Quality

Throughout educational literature we see references to quality learning materials. Exactly what is meant by quality? Generally quality is achieved or awarded on the degree to which a standard or measure has been met. In terms of an online learning module, the researcher has defined a quality module as one exhibiting a high degree of excellence in content accuracy, design, and usability. A set of criteria (standards) has been established for the quality of the content and design of each module.

Throughout the online environment, there are standards for evaluating everything from a single web page to a year-long online course. In the realm of online learning modules there are several databases or repositories for online resources. One such entity is the Multimedia Educational Resource for Learning and Online Teaching (MERLOT). MERLOT is a consortia of over 20 partners who provide a means of evaluating the quality of instructional

materials developed for use in teaching in institutions of higher education. MERLOT also serves as a repository of examples of the best practices in online instructional units (MERLOT, 2001).

MERLOT is a resource of instructional materials for adaptation in specific classes as well as a qualitative assessment of the quality of the instructional materials developed. The quality assessment is modeled on the type of peer evaluation that scholarly research papers receive when submitted to referred journals. The evaluation is communicated in a report that summarizes the positive and negative features of the learning materials. The evaluation also awards "stars" to provide a relative evaluation among the learning materials, with five stars being the highest rating (MERLOT, 2001).

Another entity that has standards for evaluating online instruction and delivery is the Electronic Learning Institute (ELI), which has developed six broad criteria that encompasses 96 quality process standards. The criteria are: Flexibility of learner interaction and communication with faculty, peers, and course materials; Attention to detail in the course and its materials; Attention to detail in the web design; Detailed faculty communication to learners; Clear timelines and due dates; and Creating a sense of collaborative teamwork and "groupness" (Electronic Learning, 2003).

The Department of Education for the Tasmanian Government also has a depository of online modules for use by educational institutions at all levels kindergarten through higher education. The depository is housed on their NetLearners site, which is the online learning center for Discover, the

department's main Web site. NetLearners provides online modules, projects and experiences for classroom access. There is also an Online Professional Development Program which provides access to the Discover Team of professionals: graphic designer, multimedia specialist, etc., as well as an Instructional Design and Quality Assurance Checklist to assist in online development.

From the quality criteria used by MERLOT and the Electronic Learning Institute, the following factors can be used in evaluating online learning modules:

- clear and concise directions on how to complete the module
- proper sequencing
- accurate content
- enough detail for student to progress through instruction without an instructor
- provides a complete demonstration of the concept
- provides opportunities to practice new concepts, skills
- provides detailed and appropriate feedback for the practice opportunities
- provides consistent feedback
- can be shared across it's own academic discipline and/or others
- instruction follows a logical hierarchy of skill and knowledge development
- content and text font are easy to read (appropriate size, color, and style)
- content and text are clearly written
- content engages the learner
- audio and video used are appropriate

•graphics and titles match content

•abbreviations and references are consistent

•content has no spelling errors

Usability

Usability in regards to online learning refers to the interaction between the user and the computer - how the functions performed on the computer enhances the user's learning. It's the quality of a system [module] that makes it easy to learn, easy to use, easy to remember, error tolerant, and subjectively pleasing (Usability First, 2002). The term usability is often associated with software engineering, and is referred to as the degree to which computer software assists a user in completing tasks (Levi & Conrad, 1998). The term can be associated with learnability, efficiency, memorability, handling of user errors, and user satisfaction (Nielsen, 1993).

Usability is important in online learning modules because from the user's perspective, it can make the difference between performing a task accurately and completely or not, and enjoying the process or being frustrated. From the developer's perspective, it can mean the difference between the success or failure of a system [module] (Usability First, 2002).

One of the biggest areas of concern with usability is navigation. If the module is poorly developed, it can result in disorientation for the end users, thus distracting from the learning. Conklin (1987) asserts that extra pressure

or cognitive overhead placed on the user when navigating large quantities of information may be the cause for disorientation.

When developers maximize the usability of their online modules, it helps the effectiveness as well. Clear instructions or careful arrangement of the information (chunking, linking) and providing accurate navigation help decrease the level of disorientation (Shubin and Meehan (1997). The key principle is to refine the design through evaluation from the early stages of design. The evaluation steps enable the designers and developers to incorporate user and client feedback until the [module] reaches an acceptable level of usability.

Key usability factors used in evaluating online learning modules include:

- interface is easy to navigate
- navigational options are always available to the user
- layout is visually appealing (color, text, amount of information per screen
- load time is sufficient
- menus, buttons, and icons are easily understood and consistent
- hyperlinks and buttons work
- scripts and functions work in multiple browsers and on multiple platforms
- animations, audio, and video run in multiple browsers and on multiple platforms
- plug-ins, software, and platform requirements are specified

Potential Effectiveness

Effectiveness is a rather subjective term. In relationship to online learning modules it refers to producing or achieving a desired effect, outcome,

or result. The variable used throughout the dissertation is potential effectiveness, because to truly measure the effectiveness of an online learning module requires assessing the outcome with the original goal(s) and objective(s). However, the developers did not have an instrument in place for the end user to evaluate the module upon completion. In assessing the potential effectiveness of materials submitted to MERLOT, the Electronic Learning Institute, and Discover, the following factors were considered:

- has clear and concise learning objectives
- identifies prerequisite knowledge
- has activities, practices, or quizzes that reinforce the content
- offers timely and relevant feedback
- builds on prior concepts
- demonstrates relationships between concepts
- is very efficient (one can learn a lot in a short period of time)

Summary

In summarizing the factors involved in developing quality, usable, and potentially effective learning modules for the online learning environment, one essential element to evaluating the modules would be to use the Seven Principles of Good Practice in Undergraduate Education as outlined by Chickering and Ehrmann (1996). These seven principles have been used time an again to review educational materials for different delivery modes. Though the principles may seem more directed toward traditional and online learning courses, these same principles are very much in keeping with several of the

courses, these same principles are very much in keeping with several of the factors outlined by MERLOT and others for single instructional units such as online learning modules. The factors include:

- Encourages contact between students and faculty
- Develops reciprocity and cooperation among the students
- Encourages active learning
- Gives prompt feedback
- Emphasizes time on task
- Communicates high expectations
- Respects diverse talents and ways of learning

CHAPTER III

METHODOLOGY

Introduction

Quality, usability, and effectiveness are often difficult to measure for the terms rely on one's perspective. Therefore, to provide a more valid, non-biased measurement, the methodology implemented in this dissertation began with a reliance on the definitions of quality, usability, and potential effectiveness as outlined in the Definition of Terms section. The methodology was driven by the research questions, which were derived from the observation and use of online learning modules previously submitted to the Innovative Technology Center (ITC), and by the literature review. The research questions focused on the factors required for developing online learning modules that exhibit quality and usability, and have potential effectiveness as a teaching tool and also the support and resources required for faculty to develop these types of modules.

This dissertation asserts that a quality online learning module is one that exhibits a high degree of excellence in conveying a specific subject matter to the learner by interactively providing stand alone, self-paced, instruction and assessment in an online learning environment.

Also, the usability of an online learning module is based on the degree to which the module's functionality effectively engages the user toward learning.

Furthermore, a potentially effective online learning module is one whose learning outcomes and objectives are aligned with the module's content and met by the learners.

Participants in the Study

The research group for this dissertation is the 2001 Teaching With Technology (TwT) grant recipients. Since 2000, the ITC at the University of Tennessee, Knoxville has awarded a TwT grant to full-time faculty members for the development and implementation of an online learning module. In 2001, eleven (11) faculty members received TwT grants to develop online learning modules for implementation in Spring 2002. This target audience was chosen because they represented a diversity (intermediate to advanced) in technology skills and educational disciplines. They also had a higher module completion rate than the 2000 TwT recipients. There was a 100% participation rate from the developers.

This dissertation used the triangulation of both quantitative and qualitative research methods for evaluating the quality, usability, and potential effectiveness of the 2001 TwT online learning modules. The use of triangulation was an attempt to substantiate or complete the data derived from one research method alone. There are several types of triangulation used in research. The two used in this study included: methods triangulation - using more than one research method or data collection technique because each tap different dimensions of the problem; and analysis triangulation - having more than one strategy to analyze the same data set for validation (Hinton, 1999). The data gathered from each method was combined to address all of the research questions.

Modules

For research purposes, the researcher arbitrarily assigned alphabetical identifiers to each module (a-k representing the 11 modules) to maintain the developers' anonymity. The following brief descriptions of the modules are provided randomly without the alphabetical identifiers to further maintain developer anonymity. The modules can be viewed at the following url: http://itc.utk.edu/grants/twt2001/twt2001.shtml.

Motivation Enhancement Therapy - This module can be used as an initial exposure to the content area of Motivation Enhancement Therapy or as review material. Motivation Enhancement Therapy (MET)is an empirically supported model for evoking change in substance abusers and other individuals seeking to alter behavioral patterns. This interactive module uses a range of media to convey the theory and application of MET. The web-based module contains video taped examples of MET interview skills, diagrams, figures and text that portray the MET theory, and integrated knowledge testing.

Diagnosis of Retinal Disease in Animals - This module teaches students proper methods of visualizing animal retinas by displaying numerous images of normal retinas of a wide variety of species with annotations to describe normal variation. The module is used primarily by sophomore veterinary students as an initial exposure to diagnosis of retinal disease in animals. It can also be reviewed during the senior clinical year prior to entry into the ophthalmology rotation. The module would also be useful as an adjunct to undergraduate courses in anatomy, biology, and animal science to give

students exposure to the eye's retinal structure that they otherwise would not obtain.

Basic Landscape Plants - The module provides both initial exposure to the identification and naming of the woody landscape plants and is valuable for students desiring to review the identification, plant names, and specific information regarding the assigned plants for tests. The module lists 80 woody ornamental landscape trees and shrubs that are commonly used in residential and commercial landscapes. For each listed plant, original images are linked to show: mature specimen in full foliage, flowers and fruit (if appropriate), specific features used in identification, and four season characteristics (when appropriate).

Graphic Organizers - This module prepares students to understand the nature, purpose, and function of graphic organizers as a cognitive tool to represent information and support learning. It consists of a Web-based, self-paced tutorial that targets five areas: developing a conceptual understanding of graphic organizers, (2) learning about various types of graphic organizers, (3) understanding the role of purpose and function when selecting the most effective graphic organizer for a given situation, (4) recognizing which software applications support the creation of electronic graphic organizers, and (5) accessing additional online resources about graphic organizers.

Using Music Journal Databases - This module provides learners with a comparison of the scope and content of three music journal databases and when to use each. It also offers instruction on effective searching techniques

and shows learners how to locate the journals once appropriate articles have been identified.

Principles of Taxation - The module consists of a self-contained program that leads students through the development of four tax strategy models that measure the impact of taxes on investment/financing decisions. The models highlight the principles underlying tax strategy. Students can work with the models to answer various planning questions and to perform sensitivity analysis on the models by inputting different assumptions. In addition to presenting the models, the module also provides graphical analysis and presentations. Student exercises are also provided.

Z Matrix Data Structure - This module introduces undergraduate chemistry majors to the Z-matrix, a data structure used to specify molecular geometries in commercial molecular modeling software packages. Students learn the fundamental geometric concepts used in molecular modeling.

Linguistic Analysis of the ASL Classifier System - This module introduces students to classifiers, one of the most complex and challenging aspects of learning ASL which has important implication for students learning ASL as a second or foreign language, for sign language interpreters, and for teachers of the deaf. It provides videotaped examples of the extensive ASL classifier. Students can access these data through the module on the Web and through a module CD that is made accessible to them. The module contains a description of the ASL Classifier system with video examples, practice exercises, and on-line/web-based assignments to reinforce the content that students are studying.

Planning and Conducting Action Research - This module contains a framework for planning and conducting action research. Entitled "DATA-DATA", the framework provides a cyclic, stepwise approach to conceptualizing a practice-based problem or initiative, analyzing the problem, developing a strategy for dealing with the problem, identifying research questions or objectives, designing a study, collecting data, analyzing data, theorizing practical implications of the findings and acting on the basis of a new understanding of practice. DATA-DATA is an acronym for the following (First DATA) D = Describe; A = Analyze; T = Theorize; A = Act.) Second DATA) D = Design; A = Analyze; T = Theorize; and A = Act.

Developing Lesson Plans - serves as an auxiliary module to assist pre-service teachers who are learning to develop curriculum. The module serves as an introduction to lesson plan development. The content includes an introduction to the process and the plan, including its purpose, essential components (goal, objectives, procedures, tools/resources/materials, and assessment) and their functions. The module includes a tutorial section on writing instructional objectives. Additionally there is a brief introduction to the TN Curriculum Guidelines with an external link to the resource.

Core Concepts in Limnology - Using animation, and interactive illustrations, this module allows students to master the fundamentals of limnology, the study of the physical, chemical, and biological functioning of lakes and streams, at their own pace.

Quantitative Research

Instrument

The quantitative research consisted of a module evaluation criteria checklist (Appendix A) applied to the 2001 TwT online learning modules by three independent reviewers to address research questions #1 - #3 pertaining to the module's quality, usability, and potential as an effective teaching tool. The researcher used SPSS 11.5 for the PC to input and calculate the collected data.

A statistical means of the reviewers' responses to each module was conducted to determine if the reviewers agree overall on the quality, usability, and potential effectiveness of each module. A multivariate Analysis of Variance (ANOVA) was conducted on the means to determine the degree of variance between the reviewers for each variable: quality, usability, and potential effectiveness.

The ANOVA resulted in a statistically significant difference between the reviewers, which indicated that there was not interrater reliability. Interrater reliability refers to the level or extent to which two or more independent raters or judges agree or are consistent. To determine the extent to which the two reviewers agree, a t-test of significance was conducted and there was no significant difference between the two reviewers. Thus, interrater reliability was achieved.

The module evaluation checklist was developed from a synthesis of quality measures addressed in the ITC's module development workshop for TwT grant recipients; quality measures currently used by educational institutions worldwide that are implementing online learning; and quality measures

revealed in the literature review. ITC's Evaluation and Assessment Committee for Online Learning evaluated and approved the checklist for acceptance of online learning modules. The checklist has been used by the ITC, module developers, and the developers' peers, to evaluate modules in other ITC-sponsored grant programs. Section I of the checklist addresses the quality of the modules' content. Section II addresses the modules' usability, and Section III addresses the modules' potential effectiveness as a teaching tool.

Reviewers

A module evaluation committee consisting of three (3) persons involved in the implementation and design of online learning served as reviewers (raters) in applying the checklist to each module. Interrater reliability was used to determine the extent to which the reviewers agreed or were consistent. The reviewers evaluated the modules using a Likert scale ranging from 1 to 6 on whether they agreed or disagreed that the module met the criteria for quality, usability, and potential effectiveness. An additional set of open-ended questions addressed changes (if any) the reviewers recommended to make the module more effective. The reviewers also rated, yes or no, a set of questions pertaining to the use of the module as a teaching tool. The review committee consisted of:

(1) a faculty member of the University of Tennessee, Knoxville who has taken an online course, develops online learning materials, and teaches a completely online course;

(2) an instructional designer who facilitates an online course and instructs the development of traditional and online learning materials including stand-alone modules; and

(3) a graduate student who has facilitated and taken an online course, and has developed online learning materials. The committee members will remain anonymous to the recipients.

Each reviewer was personally asked to participate in the study. Upon agreement, they received a formal letter (Appendix C) via mail that described the study and provided the online location of the 2001 TwT modules along with a Module Evaluation Criteria form for each of the 11 modules. The reviewers were advised to be as open and honest as possible in their responses. The completed evaluations were returned to the researcher for SPSS data input. The open-ended questions were analyzed and categorized by the researcher.

A few adjustments were made in inputting the data in order to calculate the means effectively. First, the order of the Likert scale was reversed from ratings ranging 1 through 5 to ratings 5 down to 1 with 5=Strongly Agree; 4=Agree; 3=Neither Agree nor Disagree; 2=Disagree; and 1=Strongly Disagree. Second, all blank responses received a 3=Neither Agree nor Disagree rating. Third, the 6=Not Applicable rating was treated as missing and was thus not calculated in the means.

Though the reviewers had similar knowledge and experience with developing and using online learning materials, one reviewer was consistently in disagreement with one or the other of the reviewers on various criteria within each variable. Thus, the researcher decided to withdraw the data reported by

rater #2 from the statistical calculations. With only two (2) reviewers, the researcher switched from the ANOVA to the t-test to analyze the level of agreement or consistency.

Qualitative Research

The qualitative research consisted of a phenomenological interview conducted with each of the module developers to address research question #4 pertaining to the module developers' experience in teaching and learning in the online environment, their skill set in developing online learning modules, and the developmental support they required.

The purpose of the interview was to discover what factors the TwT grant recipients encountered in developing their online modules and examine any themes, patterns or relationships between specific variables that may have contributed to the module development, as well as substantiate the module evaluation criteria.

The interview questions were also developed to gain the developers' perspective on the quality, usability, and potential effectiveness of their modules and to substantiate the findings of the literature review and module evaluation checklist.

Each developer received a letter via mail (Appendix D) requesting their participation in the dissertation. They received a follow up phone call or email requesting to schedule an interview. The researcher met each developer at an agreed upon time and place and conducted the interviews individually. Each

recipient was asked the same questions and the interview was recorded via audiotape and a micro cassette recorder.

Upon transcribing the interviews, a few responses were inaudible and some data was missing. These developers were contacted by phone and email and were asked for a second interview either by phone (with speakerphone for recording) or in person. The responses were transcribed and added to the original transcription for analysis.

Instrument

The developer interview questions (Appendix B), were designed to address specific research questions. Research question #1 regarding module quality was addressed in interview questions 1, 2, 12, and 13. Research question #2 regarding module usability was addressed in interview questions 3, 4, 12, and 13. Research question #3 regarding the module's potential effectiveness was addressed in interview questions 5, 6, 12, and 13. Research question #4 regarding the module developers' experience or skill set was addressed in interview questions 7, 8, 9, and 10. Research question #4 regarding module developmental support was addressed in interview question 11.

From the interviews, the researcher derived a set of themes, patterns, or generalizations that were applied to answer research questions #1-3 pertaining to the quality, usability, and potential effectiveness of the modules from the developers' perspective, and more specifically to research question #4 pertaining to the types of support and resources faculty need to develop quality online learning modules that are usable and potentially effective. The researcher

transcribed the responses via a micro cassette transcriber, headphones, and a computer. The responses were then analyzed and categorized for use in the dissertation.

The themes were derived from a technique known as word repetition where you observe the text and note the words or synonyms used most often (Ryan and Bernard, 2000). The developers' individual responses (the transcriptions) will remain anonymous. However, their overall perspectives are outlined in the Results.

CHAPTER IV

RESULTS

Quantitative Research

The purpose of this research was to seek the factors necessary for developing a quality online learning module that is usable and potentially effective as a teaching tool. The literature review indicated several factors that were substantiated in both the quantitative and qualitative research methods used.

The quantitative research consisted of a module evaluation criteria checklist (Appendix A) applied to the modules by three independent reviewers (raters). A statistical means was conducted independently on the three variables: quality, usability, and potential effectiveness as a teaching tool. The significant mean difference between the variables is within the 95% confidence interval on each variable.

The study originally included three (3) reviewers (raters) evaluating online learning modules on three (3) variables: quality, usability, and potential effectiveness as an online teaching tool. The reviewers' means represent a combination of each reviewer's individual mean. The observed mean difference is significant at the .05 level. The Multivariate Tests for the reviewers indicated a statistically significant difference (Appendix E). Using Pillai's Trace, the significant difference was p=.026. Pillai's Trace is one of several tests used for multivariate analysis of variance. Pillai's Trace was chosen because it appears

to be the preferred statistics for maximum protection against finding a statistical significance, when there is none, with small samples (Krus, 2003).

The quality mean for each reviewer (rater) was: #1 (m=3.88); #2 (m=3.40); and #3 (m=4.13). The Pairwise Comparisons (Appendix F) indicated that reviewer #2 was significantly different than #1 (p=.04) and #3 (p=.00). There was no significant difference between reviewers #1 and #3 (p=.32).

The usability mean for each reviewer was: #1 (m=4.06); #2 (m=3.35); and #3 (m=3.65). The Pairwise Comparisons indicated that reviewer #1 was significantly different than #2 (p=.01), but there was no significant difference between reviewers #1 and #3 (p=.18) nor reviewers #2 and #3 (p=.32).

The effectiveness mean for each reviewer was: #1 (m=3.38); #2 (m=2.93); and #3 (m=3.58). The Pairwise Comparisons indicated that reviewer #2 was significantly different than #3 (p=.04), but there was no significant difference between reviewers #2 and #1 (p=.12), nor #3 and #1 (p=.50).

The statistical significance indicated that there was no interrater reliability. Thus, the data reported for reviewer #2 was removed from the study and the study was conducted with only two reviewers.

Each section of the module evaluation criteria checklist related to one of the three variables: quality, usability, and potential effectiveness as a teaching tool. Several factors were outlined pertaining to the variable's role in module development for online learning.

The reviewers evaluated the modules using a Likert scale ranging from 1 to 6 as follows: 1=Strongly Agree; 2=Agree; 3=Neither Agree nor Disagree; 4=Disagree; 5=Strongly Disagree; 6=Not applicable. As mentioned in the

Methodology, the scale ratings were reversed for calculating the means effectively.

The Test of Between-Subjects Effects (Appendix G) indicated that the reviewers/raters had no statistically significant differences among the modules overall nor for each variable.

In Appendix B, Section I dealt with the quality of the module's content and design. Section II dealt with the module's usability. Section III dealt with the module's potential as an effective teaching tool.

There were four (4) open-ended questions pertaining to: the type of browser and operating system used to review the modules; what was liked least; and liked most about the modules; and what changes would the reviewers recommend. Consistently the reviewers substantiated the literature and the developers' perspectives.

Overall, the reviewers least liked factors such as: following a sequential format, downloading plug-ins, scrolling, viewing multiple screen transitions, inoperable buttons and links, having no interaction, no pagination, no instructions, and in some cases, no objectives. Factors the reviewers liked most included: detailed information, visual layout, clear presentation, humor, audio, video, and good: interface, navigation, images, examples, and resources. They also liked a module's duration and the opportunities to practice concepts.

Some of the recommendations the reviewers made were to: chunk the information smaller, use more explanations, provide more activities, try a different layout, add self-assessment, provide goals and objectives, add:

feedback, more graphics, and page numbers, and view module on different browsers and operating systems.

The last two questions on the module evaluation criteria checklist asked the reviewers to agree, yes or no, on whether they would use the module as a teaching tool, and whether they would recommend the module as an effective teaching tool. The reviewers were in unanimous (100%) agreement that they would use modules b, d, g, and j, and that they would recommend these modules as effective teaching tools. One of the reviewers (50%) indicated that they would also use modules c, e, and h and that they would also recommend these modules as effective teaching tools.

The reviewers unanimously (100%) agreed that they would *not* use nor recommend modules a, f, and i.

A graphical representation is used to indicate the quantitative data (reviewers' means). As mentioned earlier, the reviewers' means represent a combination of each reviewer's individual mean. The graphical representations (representing the Descriptive Statistics from Appendix H) provide a visual display of the modules by:

- Overall means
- Quality means
- Usability means
- Effectiveness means

The "y" axis represents the type of mean, with the range of means from the combined reviewers. The "x" axis represents the 11 modules listed (a-k). The line graph indicates each module's mean point. The overall means graphic is a

combination of all three variables. Each graphic indicates the mean midpoint (in red) with a reference range measuring +/- an interval from the midpoint to emphasize the spread of the means.

Overall Means - Figure 4.1 indicates the reviewers' overall means (combined variables) by module with an interval (.2) between the means. The midpoint of the overall means is 3.8. The reference lines at 3.6 and 4.0 indicate that the majority of the module means fell within +/- one interval (.2) from the midpoint. Module d had the highest overall mean rating (4.35). The modules within and above the mean range scored high on individual quality, usability, and potential effectiveness criteria (factors). Thus, the reviewers were in agreement that overall, module d met the most criteria for being a quality and usable online learning module with potential effectiveness as a teaching tool.

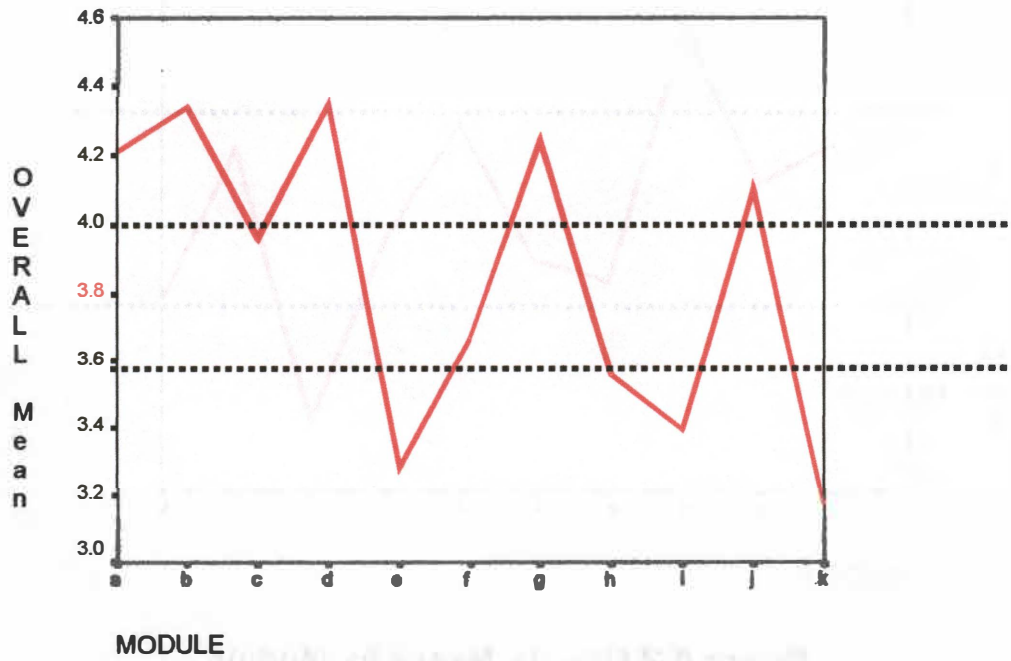

Figure 4.1 Overall Means by Module

Quality Means - Figure 4.2 represents the quality means by module with an interval (.5) between the means. The midpoint of the quality means is 4.0. The reference lines at 3.5 and 4.5 indicate that the majority of the module means fell within +/- one interval (.5) from the midpoint. Module d had the highest quality mean rating (4.91), with module i receiving the lowest rating (2.88). The modules within and above the mean range scored high on individual quality criteria (factors). Thus, though six of the modules (a, e, f, h, and i) received a quality mean below the mean range, the reviewers were in agreement that overall, the modules (91%) met the criteria for being a quality online learning module.

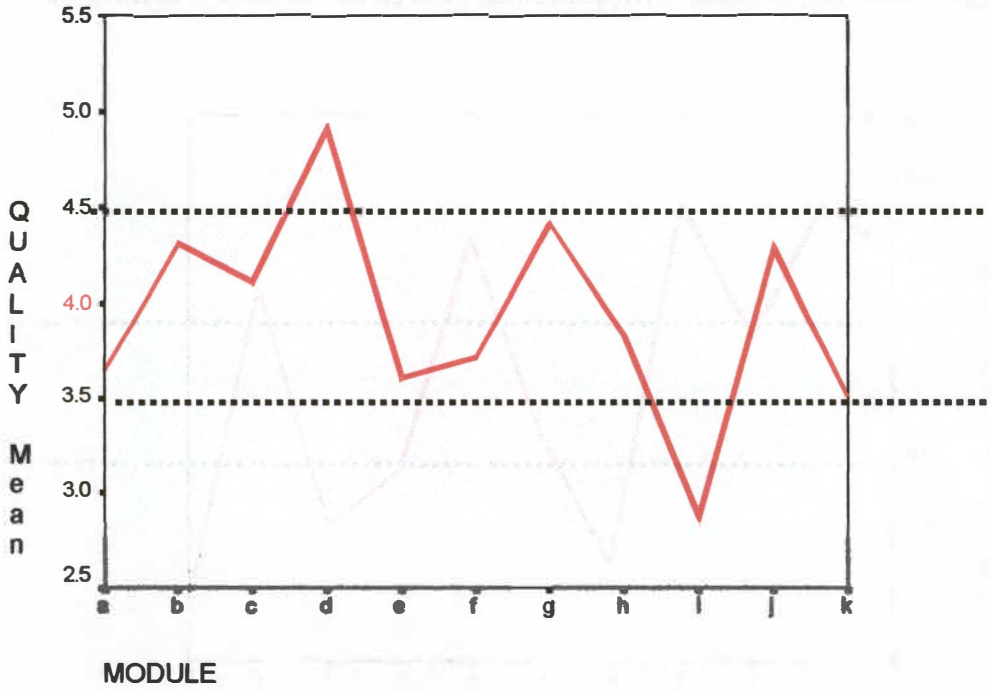

Figure 4.2 Quality Means by Module

Usability Means - Figure 4.3 represents the usability means by module with an interval (.25) between the means. The midpoint of the usability means is 3.75. The reference lines at 3.5 and 4.0 indicate that the majority of the module means fell within +/- one interval (.25) from the midpoint. Module c had the highest overall mean rating (4.7), with module i receiving the lowest rating (3.0). The modules within and above the mean range scored high on individual usability criteria (factors). Thus, with only four of the modules receiving a usability mean below the mean range, the reviewers were in agreement that overall, the modules (64%) met the usability criteria (factors) for an online learning module.

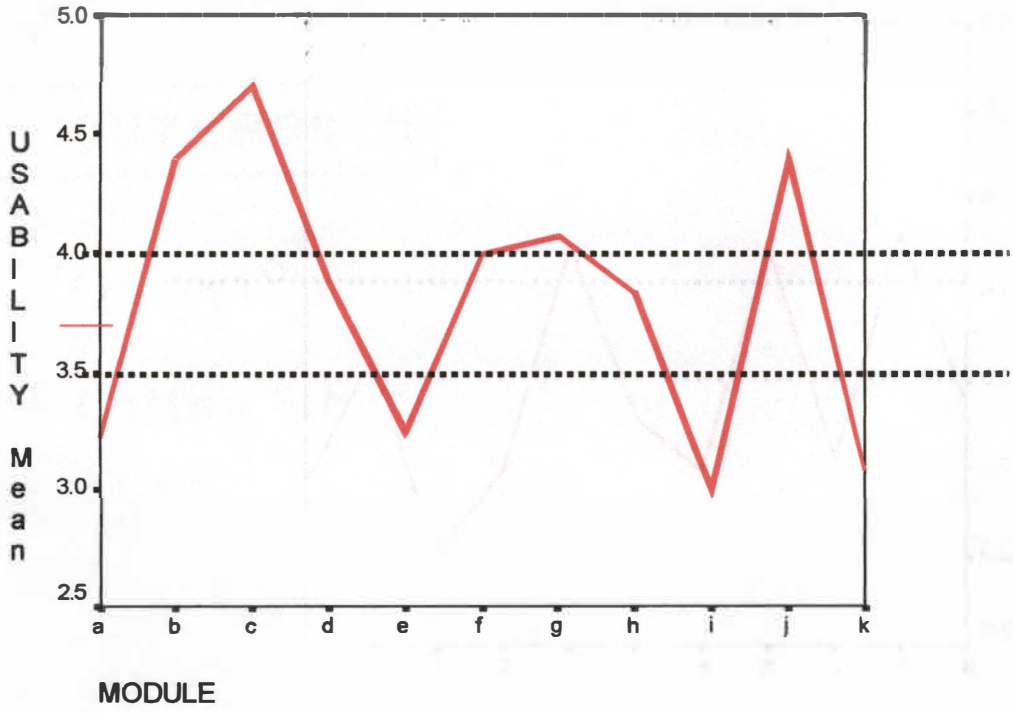

Figure 4.3 Usability Means by Module

Effectiveness Means - Figure 4.4 represents the effectiveness means by module with an interval (.2) between the means. The midpoint of the effectiveness means is 3.75. The reference lines at 3.5 and 4.0 indicate that most of the modules fell outside of the +/- one interval (.25) from the midpoint. Module b received the highest mean rating (4.4) for potential effectiveness as a teaching tool, with module i receiving the lowest rating (2.5).

Seven modules overall (a, c, e, f, h, i, and k) received ratings below the mean range. The modules below the mean range scored low on individual potential effectiveness as a teaching tool criteria (factors). Thus, the reviewers were in overall agreement that over half of the modules (63.6%) did not meet the criteria for potential effectiveness as a teaching tool.

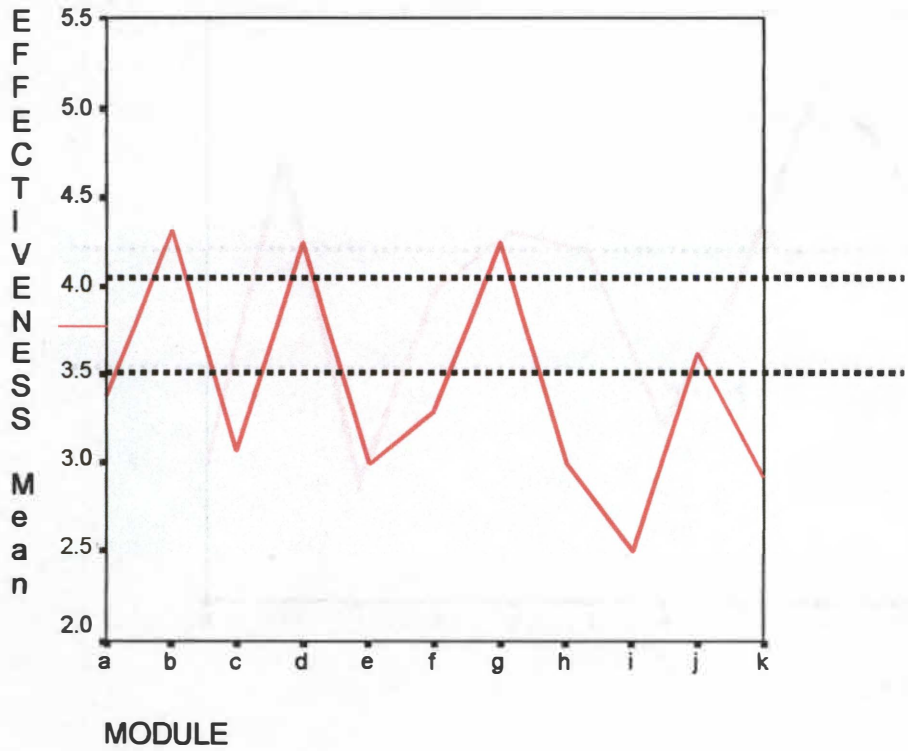

Figure 4.4 Effectiveness Means by Module

The Descriptive Statistics (Appendix H) indicate that module b received the second highest rating overall. It received the highest effectiveness rating (4.31), and the second highest quality (4.31) and usability (4.34) ratings. Thus, although module d received the highest rating with the combined variables, module b received higher ratings in certain individual criteria (factors) within the variables.

Qualitative Research

There was a 100% participation rate for the qualitative research. It consisted of a phenomenological interview (Appendix B) of each module developer. The rating scale was different from the checklist used by the module reviewers. The developers' rated their modules as excellent, good, satisfactory, or poor, and they explained what they felt contributed to the rating. Table 4.1 indicates how the developers' rated their modules pertaining to the study variables.

In some cases the developer could not decide between one rating or another (i.e., excellent or good). Therefore, an asterisk (*) indicates a selection between two ratings reading left to right (i.e., Excellent* means the developer felt the module should be rated between "Excellent" and "Good").

Fifty-percent of the modules rated as excellent and/or good by their developers under the three variables of quality, usability, and potential effectiveness, was also favored highly among the reviewers under those variables.

Table 4.2 outlines the developers' perspectives. The results of the qualitative analysis (developers' perspective) substantiated the quantitative analysis (reviewers' perspective, module criteria, and literature review) and answered the research questions regarding the factors that contributed to developing quality, usable, and potentially effective online learning modules as well as the support and resources required to develop the modules. The factors, as well as the support/resource needs, were keywords the developers mentioned in the interviews that contributed to them developing or completing their modules.

The apparent themes or patterns in the developers' responses are:

1. Faculty need more development time and incentives to develop. Several developers mentioned that a big factor for them in using technology is finding the time and the funding. The grant provided a major incentive for them to try something innovative. It helped provide funding for graduate assistants as well as equipment and software needs.

2. There exists a steep learning curve for some of the software needed to do a good job. The findings indicate that faculty possessed the basic skills necessary for developing their modules. However, there were several developers that wanted to implement some new technique or technology that required more expertise in the use of the software or technology than they possessed. This required training and extra support and resulted in much more time spent in certain stages of the development than the developer had allotted.

Table 4.1 Module Ratings by Developers

Developer	Excellent	Good	Satisfactory	Poor
a		Quality Usability Effectiveness*		
b		Quality Usability Effectiveness		
c		Quality Usability	Effectiveness	
d	Quality	Usability Effectiveness*		
e	Quality	Effectiveness Usability		
f		Quality Usability Effectiveness		
g	Quality Effectiveness	Usability*		
h	Usability	Quality	Effectiveness	
i	Usability		Quality Effectiveness	
j		Quality Usability Effectiveness		
k		Quality	Effectiveness Usability	

Table 4.2 Developers' Perspective on Key Factors for Online Module Development

Quality Factors	Usability Factors	Effectiveness Factors	Support/Resource Needs
• Well-organized • Good content • Resources • Clearly written • Feedback	• Easy to navigate • Simple structure • Detailed instructions • Easy to understand	• Setting objectives • Following outline • Using step-by-step procedures • Designed for specific audience	• Training • One-on-one consultation • Checklist/Rubric • Assistant/Helper • Grants/Funding

3. Incorporating training into the grant is essential. of their modules. All developers attributed the training (workshops) as very important to the development. Some needed just the initial workshop on developing for the online environment. Others took advantage of the workshops offered throughout the year on various ways to integrate technology into the curriculum. One also mentioned the online resources provided during the workshops as helpful.
4. Assistance (student, staff, professionals) is invaluable. The assistance from the ITC professionals was a big help to the developers. Having a professional available on campus and by phone or email made it easier to get through the project. Some developers received tremendous help from graduate students as well as staff within their department.

The Observations, Conclusions, and Recommendations will address how these findings come together to advance online module development.

CHAPTER V

OBSERVATIONS, CONCLUSIONS, AND RECOMMENDATIONS

Observations

So what factors do the study reveal that would formulate exemplar or "best practices" criteria for those seeking to develop a quality, usable, and potentially effective online learning module? There were several factors (criteria) within each variable that the reviewers gave the highest score (5=Strongly Agree) for a particular module. Each of these factors is listed in the researcher's required factors below. Of all the modules, module d received the highest overall and quality ratings. This module received the second highest rating in effectiveness and the third highest on usability. On individual criteria or factors, it scored the highest or second highest more often than the other modules. Module b also scored highest or second highest on several factors.

After reviewing the factors listed in the literature review and seeing the ratings presented by the reviewers and the developers, the researcher considers the factors outlined below as required factors for developing online learning modules. These factors were exhibited in both modules d and b.

A module that exhibits "best practices" in **Quality** includes:

- clear and concise directions on how to complete the module
- accurate content

- a complete demonstration of the concept
- opportunities to practice new concepts, skills
- detailed and appropriate feedback for the practice opportunities
- instruction which follows a logical hierarchy of skill and knowledge development
- easy to read content and text font (appropriate size, color, and style)
- clearly written content and text
- content that engages the learner
- appropriate audio and video
- graphics and titles that match the content
- content with no spelling errors

A module that exhibits "best practices" in **Usability** has:

- an easy to navigate interface
- navigational options that always available to the user
- a visually appealing layout (color, text, limited information per screen)
- sufficient load time
- hyperlinks and buttons that work
- scripts and functions that work in multiple browsers and on multiple platforms
- animations, audio, and video that run in multiple browsers and on multiple platforms
- plug-ins, software, and platform requirements specified

A module that exhibits "best practices" in **Potential Effectiveness**:

- has clear and concise learning objectives

- identifies prerequisite knowledge
- has activities, practices, or quizzes that reinforce the content
- builds on prior concepts

Conclusions

Most of the major points stated throughout the research fell into one of three categories essential to developing quality, usable, and potentially effective online learning modules. These were the necessity to:

- understand how people learn (pedagogy);
- engage the learners through interactive learning strategies, practice opportunities, and feedback. (instructional design); and
- use a team approach and assistance as needed in evaluating and assessing the module throughout the development. (instructional design and developmental support).

From both the independent reviewers ratings and the developers' perspectives, the research indicates that the modules overall were of sound quality and usability. The modules' potential effectiveness as learning tools is where there appears to be a deficiency.

This may be due to the fact that though several developers have taught a completely online course or developed online learning materials for a blended learning course, none had actually taken an online course! Three developers (27%) indicated that they had gone through (completed or reviewed) online tutorials prior to developing their module.

Also, those developers who rated their modules as satisfactory in the category of potential effectiveness, and a few of those who rated their modules as good, indicated interaction or interactivity would enhance their module. Some of these same modules received low ratings from the independent reviewers regarding their potential effectiveness. Therefore, it can be concluded that the developers' lack of participation in online learning from the student/learner perspective had some impact on the developers' failure to include more interaction or more engaging strategies in their modules.

Having gone through the online learning process from the student's perspective would have given the developers' more insight into how their modules may be viewed or understood and possibly would have increased the modules' potential effectiveness.

It terms of developmental support, a few developers expressed concern that they "didn't have enough time" to either (1) learn what they needed to know in order to carry out a planned idea or task, or (2) to enhance or implement changes after the module was submitted. Both of these concerns fall into the category of developmental support. Faculty need more time for developing learning materials for the 21st century and more incentives to help cover the expenses associated with learning and using the newer technologies.

The developers could use their grant monies for hardware, software, conference attendance/presentations, student assistance, etc., and in many cases, they chose to have a student assistant(s). However, some only considered the need for assistance during the initial development period. Thus, when the module was submitted as complete and the student had left the university, they

no longer had the funds or knowledge/assistance to maintain or continue the module.

Therefore, the researcher concludes that to ensure that quality, usability, and potential effectiveness endures with the module, the developers need to have adequate training in the entire development process, and contingency plans for future enhancements.

All of the developers indicated that the training provided by the ITC was quite beneficial toward the understanding of developing online learning materials and the completion of their online learning modules. Many were most appreciative of the one-on-one assistance they received from the ITC's professional staff. Others cited the additional ITC-sponsored resources or other on-campus resources recommended by ITC (i.e., Digital Media Services), as being beneficial. Very few received support from their departments outside of the student assistant(s) that were funded through the ITC grant.

Thus the researcher concludes that the ITC-sponsored training is and should remain a vital part of the grant offering.

Recommendations

The researchers' requirements for best practices can be considered a base for online module developers. Other factors mentioned in the dissertation can be added as well. This research did not evaluate whether or not learning occurred upon completion of the online learning modules. It's focus was on the factors that lead to potential learning if included in module development. Thus, these recommendations are made accordingly.

It is supported by the research and recommended that anyone developing learning modules for the online environment receive adequate training and support in the entire developmental process including the culminating evaluation, follow-up, and maintenance.

There were only 11 modules evaluated in this research. However, the factors discovered for developing online learning modules that exhibit quality, usability, and have potential effectiveness as a teaching tool, are desirable in all online learning materials, thus, it is recommended that anyone interested in developing online learning modules, or making online learning modules available for use by other educators, other disciplines, etc., follow these same procedures:

1. develop a set of criteria/standards for each selected variable
2. establish developmental training and support
3. request adherence to the criteria by the developers
4. use the criteria for peer review as well as acceptance into repository, etc.
5. require evaluation, follow-up, and a maintenance plan upon module completion
6. establish a professional development plan that includes time, funding, etc., for faculty to learn how to implement technology into their curriculum, especially preparing content for the online environment.
7. establish a support system to assist faculty in the development and maintenance of online learning modules.

Furthermore, higher education could follow the lead of the K-12 requirement that educators plan their lessons in accordance with state and

national standards. Institutions of higher education should require a set of standards/criteria for faculty developing learning materials, modules, and even courses for the online learning environment. Variations of the module evaluation used here are in existence throughout the online environment, and there are some educational institutions with mandatory training for faculty developing online courses. Each institution needs to establish some form of gate keeping to help regulate the quality, usability, and potential effectiveness of online learning materials representing their institution.

Until then, utilizing the researcher's best practices factors in the module development and following the above procedures will help ensure that both learners and developers will benefit greatly from future online learning modules.

Further research is needed to evaluate the true effectiveness of each module. Incorporating an evaluation instrument would enhance the learning by providing an insight to the effectiveness of the module during the development stage (prototype and pre-testing) as well as informing the instructor if the goals and objectives have been achieved upon completion.

Another area of further research would be to determine the impact of the various factors on specific learning styles. What learning styles show increase/decrease in retention from specific module criteria? The best practices criteria (factors) gleaned from this study on the TwT modules could be utilized to delve further into how we learn and how our learning style is impacted by certain criteria in the online learning environment. The results of these studies could enhance online module development tremendously.

If this study is continued further or redone, it is recommended that there be at least three reviewers and that they participate in a mock review process to help insure that interrater reliability is achieved.

REFERENCES/BIBLIOGRAPHY

REFERENCES/BIBLIOGRAPHY

Boyle, T. (1997). *Design for Multimedia Learning.* Europe. Prentice Hall

Bruner, J. (1960). *The Process of Education.* Cambridge, MA: Harvard University Press.

Chickering, A. W., & Ehrmann, S. C. (1996). Implementing the seven principles: Technology as lever. *American Association for Higher Education*, 3-6.

Clark, R. (2002). Six Principles of Effective e-Learning: What works and Why. *e-Learning Developers' Journal,* September 10, p.1-6.

Cunningham, D.J., Duffy T.M. and Knuth R. (1993). *The Textbook of the future.* In C. McKnight, A. Dillon and J. Richardson (Eds.), Hypertext: a psychological perspective. Ellis Horwood.

Dickinson, G., Agnew, D., & Gorman, R. (1999). Are teacher training and compensation keeping up with institutional demands for distance learning? *Cause/Effect Journal,* 22(3). Available: http://www.educause.edu/ir/library/html/cem9939.html

Electronic Learning Institute (2003). "Criteria and Standards Used in Evaluating Web-Based Instruction and Delivery Guidelines." Available: http://www.electronicleanring.edu/certification/checklist.html

Fallah, M., & Ubell, R. (2000). Blind scores in a graduate test: Conventional compared with web-based outcomes. *ALN Magazine,* 4(2), 35-51.

Flowers, J. (2001). Online learning needs in technology education. *Journal of Technology Education,* 13(1), 17-30.

Gagne, M., & Shepherd, M. (2001). Distance learning in accounting: A comparison between a distance and traditional graduate accounting class. *T.H.E. Journal,* 29(9), 58-65.

Gray, S. (1997). Training Teachers, Faculty, and Staff. In B. Kahn (Ed.), *Web-Based Instruction* (pp. 329-332). Englewood Cliffs, NJ: Educational Technology Publications.

Hoffman, B. & Ritchie, D. (2001). An Instructional Design-Based Approach to Developing Online Learning Environments. In B. Kahn (Ed.), *Web-based Training* (pp.213-218). Englewood Cliffs, NJ: Educational Technology Publications.

Johnson, S. D., Aragon, S. R., Shaik, N., & Palma-Rivas, N. (2000). Comparative

analysis of learner satisfaction and learning outcomes in online and face-to-face learning environments. *Journal of Interactive Learning Research, 11*(1), 29-49.

Krus, David J. (2003) *Visual Statistics with Multimedia.* Chapter 43. Available: http://www.visualstatistics.net/

Levi, M.D., & Conrad, F.G. (1998). Usability testing of World Wide Web sites. Washington, DC: Bureau of Labor Statistics. Available: http://stats.bls.gov/ore/htm_papers/st960150.htm

Meehan, M., & Shubin, H. (1997). Navigation in Web applications. Interactions, November/December, pp. 13-17.

Multimedia Educational Resource for Learning and Online Teaching (MERLOT) (2003). Available: http://www.merlot.org/home/PeerReview.po

Nielson, J. (1994). Analyzing user interactions with hypermedia systems. Computer Graphics, 28(1), 43-45.

Ornstein, A.C., and Hunkins, F.P. (1998). *Curriculum Foundations, Principles, and Issues*, 3rd Edition. Boston: Allyn and Bacon.

Rudestam, K.E., and Schoenholtz-Read, J. (2002). *Handbook of Online Learning: Innovations in Higher Education and Corporate Training.* Thousand Oaks: Sage Publications.

Reigeluth, C. M. (1983). Instructional design: What is it and why is it? In C. M. Reigeluth (Ed.), Instructional design theories and models: An overview of their current status (pp. 3-36). Hillsdale, NJ: Lawrence Erlbaum Associates.

Seels, B., and Glasgow, Z. (1998). *Making Instructional Design Decisions*, 2nd Edition. New Jersey: Prentice-Hall.

Tasmania Government (2003). Department of Education. Available: http://www.discover.tased.edu.au/netlearn/support/develop.htm

Virtual University Design and Technology Group, Michigan State University, (2003) Teach Online, *Constructivism.* Available: http://teachvu.vu.msu.edu/public/

BIBLIOGRAPHY

Bruner, J. S. (1966) *Toward a Theory of Instruction.* Cambridge, Mass.: Belkapp Press.

Dick, W. & Carey, L. (1990). *The Systematic Design of Instruction* (3rd ed.). New York: Scott Foresman.

Gagné, R.M., Briggs, L.J., & Wager, W. (1987). *Principles of Instructional Design* (3rd ed.). New York: Holt, Rinehart, & Winston.

APPENDICES

Appendix A

Module Evaluation Criteria

I. Quality of Content **The Module...**	Strongly Agree **1**	Agree **2**	Neither Agree Nor Disagree **3**	Disagree **4**	Strongly Disagree **5**	Not Appli-cable **6**
has clear and concise directions on how to complete the module						
is properly sequenced						
has accurate content						
is detailed enough for a student to progress through the instruction without an instructor						
provides a complete demonstration of the concept						
provides opportunities to practice new concepts, skills						
provides detailed and appropriate feedback for the practice opportunities						
provides consistent feedback						
can be shared across it's own academic discipline and/or others						
Comments:						
The Module's...						
instruction follows a logical hierarchy of skill and knowledge development						
content and text font are easy to read (appropriate size, color, and style)						
content and text are clearly written						
content engages the learner						
audio and video used are appropriate						
graphics and titles match content						
abbreviations and references are consistent						
content has no spelling errors						
Comments:						

II. Usability **The Module's...**	Strongly Agree **1**	Agree **2**	Neither Agree Nor Disagree **3**	Disagree **4**	Strongly Disagree **5**	Not Appli-cable **6**
interface is easy to navigate						
navigational options are always available to the user						
layout is visually appealing (color, text, amount of information per screen						
load time is sufficient						
menus, buttons, and icons are easily understood and consistent						
hyperlinks and buttons work						
scripts and functions work in multiple browsers and on multiple platforms						
animations, audio, and video run in multiple browsers and on multiple platforms						
plug-ins, software, and platform requirements are specified						
Comments:						

III. Potential Effectiveness as a Teaching Tool **The Module...**	Strongly Agree **1**	Agree **2**	Neither Agree Nor Disagree **3**	Disagree **4**	Strongly Disagree **5**	Not Appli-cable **6**
has clear and concise learning objectives						
identifies prerequisite knowledge						
has activities, practices, or quizzes that reinforce the content						
offers timely and relevant feedback						
builds on prior concepts						
demonstrates relationships between concepts						
is very efficient (one can learn a lot in a short period of time)						
overall, is very effective as a teaching tool						
Comments:						

What type of browser and operating system did you use to review the module?

What did you like LEAST about the module?

What did you like MOST about the module?

What changes would you recommend to make this module more effective?

Would you use this module as a teaching tool? Yes___ No___

Would you recommend this module as an effective teaching tool? Yes___ No___

Appendix B

Teaching with Technology Developers' Interview Questions

1. How would you rate the quality of your online module?

   Excellent *Good* *Satisfactory* *Poor*

2. To what do you contribute its quality?

3. How would you rate the usability of your online module?

   Excellent *Good* *Satisfactory* *Poor*

4. To what do you contribute its usability?

5. How would you rate the effectiveness of your online module?

   Excellent *Good* *Satisfactory* *Poor*

6. To what do you contribute its effectiveness?

7. Describe any previous experience with online learning.

8. Describe any previous experience with online teaching.

9. What computer skills/knowledge did you possess to complete your module?

10. What additional computer skills/knowledge did you require to complete your module? How did you obtain the additional computer skills/knowledge?

11. What type of support did you receive in your module development (training, technical, departmental, etc.) and from whom?

12. Did you change your module from what you originally proposed? If so, in what way(s)?

13. How did the change(s) contribute to the module's quality and effectiveness?

Appendix C

Reviewer's Letter

Dr. John Doe
123 Claxton Annex
University of Tennessee
Knoxville, TN 37996-1234

4/6/03

Dear Dr. Doe,

Thanks for your willingness to participate in my dissertation research. Attached are copies of the Module Evaluation Criteria checklist to be used in evaluating each of the modules submitted to the Innovative Technology Center (ITC) by the 2001 Teaching With Technology (TWT) grant recipients. The modules are available online at http://edtech.tennessee.edu/modules.html.

I need you to review each module by Friday March 28, 2003. When you have completed your reviews, place them in the sealed envelope and leave the envelope with your department's receptionist. Please notify me by email (cgoode@utk.edu) or phone 687-2752 and I will pick it up. Try to be as honest in your responses as possible. If more space is needed for comments, feel free to use the back of the first page or the blank space on the second page. Again, thank you for your assistance.

Sincerely,

Christina M. Goode

Appendix D

Developer's Letter

Dr. John Doe
123 Claxton Annex
University of Tennessee
Knoxville, TN 37996-1234

4/6/03

Dear Dr. Doe,

My name is Christina Goode and I am a doctoral candidate in Instructional Technology within the College of Education, Health, and Human Sciences. My research interests include online learning. I'm writing you because I need your assistance to conclude my dissertation research titled "Evaluating the Quality, Usability, and Effectiveness of Online Learning Modules: A Case Study of Teaching with Technology Grant Recipients at the University of Tennessee, Knoxville." I am specifically interested in interviewing the 2001 Teaching with Technology (TwT) grant recipients, a group to which you belong.

My dissertation research features quantitative and qualitative research methods for evaluating the quality, usability, and effectiveness of the 2001 TWT online learning modules. The quantitative analysis features a module evaluation checklist using various criteria to measure each module's quality, usability, and effectiveness as a teaching tool. The qualitative analysis features a phenomenological interview with each module developer to address your experience in teaching and learning in the online environment, your skill set in developing online learning modules, and the developmental support (if any) you required.

The purpose of the interview will be to discover what factors you encountered in developing your online module and examine any patterns or relationships between specific variables that may have contributed positively or negatively to the module development. The interview is also an attempt to substantiate the findings of the module evaluation. The combination of research methods (triangulation) is meant to confirm or substantiate the data derived from the quantitative method. The data gathered from each method will combine to address the following research questions:

1. What factors constitute a quality online learning module?
2. What factors constitute a usable online learning module?
3. What factors constitute an effective online learning module?
4. W hat types of support and resources do faculty need to develop quality online learning modules that are usable and effective?

Your participation in this study is completely voluntary. You will not be penalized if you chose not to participate, and you may withdraw your participation at any time. If you agree to participate, I would like to meet with you for approximately 1 hour during the week of April 21-25, 2003 to conduct the interview. Please complete the attached consent form and mail to me via the enclosed envelope. All responses will remain confidential and I will be the sole transcriber. Upon completion of the dissertation, each developer will receive a copy of the statistical results. If you have any questions or concerns, feel free to contact me at 687-2752 or via email at cgoode@utk.edu. Thank you in advance for your participation.

Sincerely,

Christina M. Goode

Appendix E

Multivariate Tests of Reviewers' Means

Without Interrater Reliability

	Value	F	Hypothesis	Error	Sig.
Pillai's	.453	2.633	6.000	54.000	.026
Wilks'	.597	2.554[a]	6.000	52.000	.030
Hotelling's	.594	2.473	6.000	50.000	.036
Roy's largest	.371	3.339[b]	3.000	27.000	.034

Each F tests the multivariate effect of RATER. These tests are based on the linearly pairwise comparisons among the estimated marginal

a. Exact

b. The statistic is an upper bound on F that yields a lower bound on the

With Interrater Reliability

	Valu	F	Hypothesi	Error	Si
Pillai's	.35	2.87[a]	3.00	16.0	.06
Wilks'	.65	2.87[a]	3.00	16.0	.06
Hotelling's	.53	2.87[a]	3.00	16.0	.06
Roy's largest	.53	2.87[a]	3.00	16.0	.06

Each F tests the multivariate effect of RATER. These tests are based pairwise comparisons among the estimated

a. Exact

Appendix F

Pairwise Comparisons of Reviewers' Means

Dependent	(I)	(J)	Me Difference	Std.	Si [a]	95% Confidence Differe [a] Lower	Upper
QUALI	1	2	.48*	.23	.04	.00	.96
		3	-	.24	.32	-	.25
	2	1	- *	.23	.04	-	-
		3	- *	.24	.00	-	-
	3	1	.24	.24	.32	-	.75
		2	.73*	.24	.00	.22	1.2
USAB	1	2	.71*	.28	.01	.13	1.2
		3	.40	.29	.18	-	1.0
	2	1	- *	.28	.01	-	-
		3	-	.29	.32	-	.30
	3	1	-	.29	.18	-	.20
		2	.30	.29	.32	-	.91
EFFE	1	2	.44	.28	.12	-	1.0
		3	-	.29	.50	-	.41
	2	1	-	.28	.12	-	.13
		3	- *	.29	.04	-	-
	3	1	.20	.29	.50	-	.81
		2	.64*	.29	.04	.03	1.2

Based on estimated

*. The mean difference is significant at

a. Adjustment for multiple comparisons: Least Significant Difference

Appendix G

Tests of Between-Subjects Effects

Sourc	Dependent	Type III of	df	Mean	F	Sig
Corrected	QUALIT	.30 [a]	1	.30	.92	.34
	USABL	.82 [b]	1	.82	1.51	.23
	EFFEC	.19 [c]	1	.19	.37	.54
	OVERA	.00 [d]	1	.00	.00	.96
Interce	QUALIT	318.1	1	318.1	959.5	.00
	USABL	293.5	1	293.5	534.5	.00
	EFFEC	239.1	1	239.1	449.2	.00
	OVERA	282.6	1	282.6	789.5	.00
RAT	QUALIT	.30	1	.30	.92	.34
	USABL	.82	1	.82	1.51	.23
	EFFEC	.19	1	.19	.37	.54
	OVERA	.00	1	.00	.00	.96
Erro	QUALIT	5.96	1	.33		
	USABL	9.88	1	.54		
	EFFEC	9.58	1	.53		
	OVERA	6.44	1	.35		
Tot	QUALIT	325.6	2			
	USABL	310.3	2			
	EFFEC	249.9	2			
	OVERA	291.8	2			
Corrected	QUALIT	6.27	1			
	USABL	10.7	1			
	EFFEC	9.78	1			
	OVERA	6.44	1			

a. R Squared = .049 (Adjusted R Squared

b. R Squared = .077 (Adjusted R Squared

c. R Squared = .020 (Adjusted R Squared

d. R Squared = .000 (Adjusted R Squared

Appendix H

Descriptive Statistics

Dependent Variable	MODULE	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
QUALITY2	a	3.647	.406	2.728	4.566
	b	4.313	.287	3.663	4.962
	c	4.112	.287	3.462	4.762
	d	4.912	.287	4.262	5.562
	e	3.604	.287	2.954	4.254
	f	3.718	.287	3.068	4.368
	g	4.412	.287	3.762	5.062
	h	3.837	.287	3.187	4.487
	i	2.875	.406	1.956	3.794
	j	4.289	.287	3.639	4.939
	k	3.507	.287	2.857	4.157
USABLE2	a	3.222	.740	1.548	4.896
	b	4.393	.523	3.209	5.576
	c	4.702	.523	3.519	5.886
	d	3.881	.523	2.697	5.065
	e	3.246	.523	2.062	4.430
	f	3.992	.523	2.809	5.176
	g	4.071	.523	2.888	5.255
	h	3.833	.523	2.650	5.017
	i	3.000	.740	1.326	4.674
	j	4.393	.523	3.209	5.576
	k	3.083	.523	1.900	4.267
EFFECT2	a	3.375	.582	2.059	4.691
	b	4.313	.411	3.382	5.243
	c	3.063	.411	2.132	3.993
	d	4.250	.411	3.319	5.181
	e	3.000	.411	2.069	3.931
	f	3.295	.411	2.364	4.225
	g	4.250	.411	3.319	5.181
	h	3.000	.411	2.069	3.931
	i	2.500	.582	1.184	3.816
	j	3.625	.411	2.694	4.556
	k	2.920	.411	1.989	3.850
OVERALL	a	3.415	.471	2.349	4.481
	b	4.339	.333	3.585	5.093
	c	3.959	.333	3.205	4.713
	d	4.348	.333	3.594	5.102
	e	3.283	.333	2.529	4.037
	f	3.668	.333	2.914	4.422
	g	4.244	.333	3.490	4.998
	h	3.557	.333	2.803	4.311
	i	2.792	.471	1.725	3.858
	j	4.102	.333	3.348	4.856
	k	3.170	.333	2.416	3.924

VITA

Christina Marie Goode has a varied background in technical writing and editing, training and documentation, and instructional technology. In May, 1981 she earned a Bachelor of Arts degree in Journalism from the University of South Carolina, Columbia. In 1982, she enrolled in the Master of Science program in Urban Planning at the University of Tennessee, Knoxville, where she completed all course requirements. She has over 15 years experience in technical writing, editing, desktop publishing, self-paced print instruction, and traditional classroom instruction, and five years experience in designing, developing, and delivering Web-based training and instruction.

She has worked as a writer and publication specialist for the Division of Information Infrastructure at the University of Tennessee, Knoxville, and as a freelance writer and desktop publisher.

She is a member of the Association for Educational Communications and Technology and the East Tennessee Chapter of the Society for Technical Communication (STC). She has taught instructional technology to undergraduate pre-service teachers in the College of Education at the University of Tennessee, Knoxville. She has also taught Web design and served as Technology Resource Coordinator for Project GRAD, Knoxville.

She has given presentations on teaching with technology and online documentation at conferences for the Society for Information Technology and Teacher Education (SITE), the Department of Defense Education Symposium, and for STC.

She is currently employed as a Graduate Assistant in the Instructional Technology Center at the University of Tennessee, Knoxville where she provides professional development and support to faculty, staff, and graduate teaching assistants in enhancing their curriculum with technology, and co-manages GTA@itc, a graduate mentoring program for graduate teaching associates and assistants interested in using technology for teaching and learning.

Her research interests include engaging the learner through online teaching and learning and faculty development.

3444 1896 18
03/31/04 MAB