LINKING TEACHER EDUCATION TO ADVANCES IN RESEARCH: THE ONLINE ACADEMY

FINAL REPORT

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Chapter 1

Introduction to Final Report: Overview of Online Academy and Structure of Report

Edward L. Meyen

Abstract

The Online Academy was funded at a time when comparatively little development of online courses was being done. Only a few faculty members were creating online courses and non-traditional cyber institutions were just evolving. Most institutions of higher education were beginning to explore the implications of the WWW and the Internet for instruction. Academic policies to address the many issues raised by the offering of online courses and/or degrees were yet to be developed. This chapter provides an overview of the processes employed by the Online Academy in achieving the stated outcomes for Project # H029K73002. The outcomes of the project included the development and validation of twenty-two fully online, content-rich and interactive modules in the areas of Reading, Positive Behavior Support, and Technology in Education.

The chapter is designed to serve as a framework for reading the final report and as a context for understanding the challenges inherent in carrying out a development project of this scope and taking it to scale nationally. It presents the rationale for organizing the chapters of the final report around major functions carried out fulfilling the obligations of the project.

Introduction

While technology may not be the answer to all challenges facing American education, it clearly represents an unprecedented opportunity for accessing and distributing information. If we are smart enough to know what information we want to share and are willing to invest the effort to configure the information in a manner that capitalizes on the capabilities of available technologies, we can get the information to our target audiences. This does not mean that the tasks associated with taking advantage of this opportunity are simple or require little investment.

Special education, despite its rapid growth and its commitment to research, has not been successful in getting new knowledge about teaching interventions translated to practice at the rate needed or in a form that has proven to be as effective as the profession would prefer. This has been a serious limitation in a field committed to improving instruction for the most challenged of all learners--students with disabilities.

The Office of Special Education Programs (OSEP) and the organizations that have preceded it have provided leadership in supporting programs to prepare specially trained teachers and teacher educators. There has also been a history of funding research on instructional interventions designed to address the unique needs of students with disabilities. Paralleling this effort have been initiatives to identify best practices, create dissemination models, and to implement technical assistance programs. IDEA is but one example of legislation in the history of special education to shape public policy in ways

that create conditions aimed at bringing equity to education and ensuring quality instruction for students with disabilities.

This history has resulted in improved educational opportunities for all students. However, there continues to be an excessive delay in making new information available to teachers and teacher educators. Despite efforts to create dissemination models, teachers are often left to their own resources to keep up with new knowledge on teaching interventions. They are dependent upon their own professional initiatives and on professional development programs to alert them to new information.

This also means that teacher educators are faced with the task of monitoring contributions to the literature about how best to teach students with disabilities. This is an almost impossible task given that most teacher educators in special education are responsible for preparing teachers to teach students from a wide array of disability groups. Added to this responsibility are the instructional demands of preparing teachers for teaching in inclusion settings. While teacher educators share the commitment of OSEP to shorten the time from research to practice, there is the reality of time and energy. Improvement in this situation will require a concerted effort by the profession. Researchers must assume responsibility for reporting their research results in a form that is understandable to those concerned with instructional practices and conditions must be created to facilitate dissemination. Funding agencies must make good decisions about the research they fund. Technology is not the solution for making those decisions, but it is a solution for disseminating them.

The Online Academy Concept

The Online Academy was funded by OSEP as an initiative to help instructors in teacher education bridge the gap between research and practice. It represented a response to the needs of teacher educators and, we believe, to in-service trainers. The charge to the Academy was to review the literature, to identify research-based interventions that have been validated for teaching students with disabilities or that have been established as effective teaching practices, and to transform those interventions into instructional modules for use in the preparation of teachers. Available technologies allow for broad and immediate national dissemination, thus the modules were designed for delivery online using the capabilities of the Internet and the WWW. The Academy represents one of the first national efforts to disseminate instruction to teacher education programs on a national level utilizing online instruction. It was one of the first major efforts to take online instruction to scale.

Our approach to the mission of the Online Academy has been to first involve colleagues from the field in identifying the research-based interventions that warrant being transformed into instructional modules and made available to teacher education programs nationally. We then designed a prototype module with the necessary technical features for dissemination online in preparation for writing and field-testing the modules. The Academy was guided in its development decisions by a commitment to create instructional resources that would be helpful to instructors with responsibilities for preparing teachers to teach students with disabilities in the context of academically and socially diverse settings.

The content areas were specified by OSEP included reading, positive behavioral support, and technology in education. In each content area, the task was to identify major examples of research-based interventions that have been validated as effective in teaching students with disabilities. The modules were designed for preservice students in a format that makes them available online. They are also appropriate for practicing teachers with a "need to know" the content of the instructional programs on research-based interventions. We knew that instructors have varied experiences in using technology and in how they structure their courses. We were also sensitive to the differences in how teacher education programs are organized and how their curricula are designed. We knew that in most programs the responsibility for preparing teachers in the areas of reading, positive behavioral support, and technology would vary. Some programs would offer courses in these content areas. Others would integrate instruction from the content areas into a course with a broader focus and some may even teach the content as part of the student teaching experience.

The modules can be used as courses, but this was not the original intention. Instructors may review the content maps and make a decision about which modules they wish their students to complete. They can also assign selected lessons within modules. We have approached the development of the modules as instructional units with the assumption that most instructors will use the modules fully online as instructional programs. They could be combined into a course if desired. By designing the instruction in a module format with lessons for each module, we have maximized flexibility for instructors to incorporate the online instruction developed by the Academy into their curriculum.

Content maps for each module were developed following the identification of research-based interventions in each content area. The process followed by the Academy in the selection of research-based interventions in the three content areas was very systematic. We approached the process of selecting interventions by applying a model with four major components. The components included creating standards for research-based interventions, conducting literature reviews, engaging experts from the field in a juror process, and finally selecting the interventions. We needed a research selection process because the amount of research in instructional interventions in the three content areas far exceeded what could be included in instructional modules or even taught in courses in teacher education programs. We also wanted to ensure that the interventions selected were ones that teacher educators and teachers had found to be successful in teaching students with disabilities.

Validating Research-Based Interventions

The first step was to develop standards to guide the selection of research to be considered as a basis for instructional modules. The standards took the form of criteria. Once a research study on an intervention was identified, it was subjected to assessments against the standards before being considered further. As is always true, there are exceptions, and on occasion, a study was considered that did not meet all criteria. But these were clearly exceptions. The standards were drafted by the Academy staff and subjected to extensive review by representatives from the field. Suggested revisions were considered and a revised draft was submitted to the Board of Governors and the Content

Area Jurors for review. The Board of Governors included representatives from the national educational organizations and a representative from private business. The jurors represented an external team of experts in each of the content areas and were selected nationally. They advised the writing teams for the Online Academy on the selection of research-based interventions and the content for the instructional modules. The underlying goal was to create criteria that would guide us in reducing the number of research-based interventions to be considered in the selection process.

The second step involved Academy staff conducting literature reviews. Two strategies were followed. One centered on analyzing the research synthesis products funded by OSEP and other organizations related to the three content areas. The second strategy entailed carrying out a traditional literature search.

The third step was the juror process. The reason for calling this group jurors was that their first task was to jury the research studies to select the research-based interventions. As we selected the jurors, we sought those who were doing research in the specified content areas. In reviewing the roster of jurors and governors on the Academy web page, you will note that they represent a wide array of institutions and come from various parts of the country.

The final step in the intervention selection process was to decide on which interventions to focus in the development of instructional modules. The standards, literature reviews, and the work of the jurors proved to be very effective, but did not result in the selection of a small enough number of interventions. We were able to narrow the selection of interventions, but as we developed modules some interventions overlapped with others. Clearly, the selection of interventions to include was one of the most difficult decisions in the development of content for the modules.

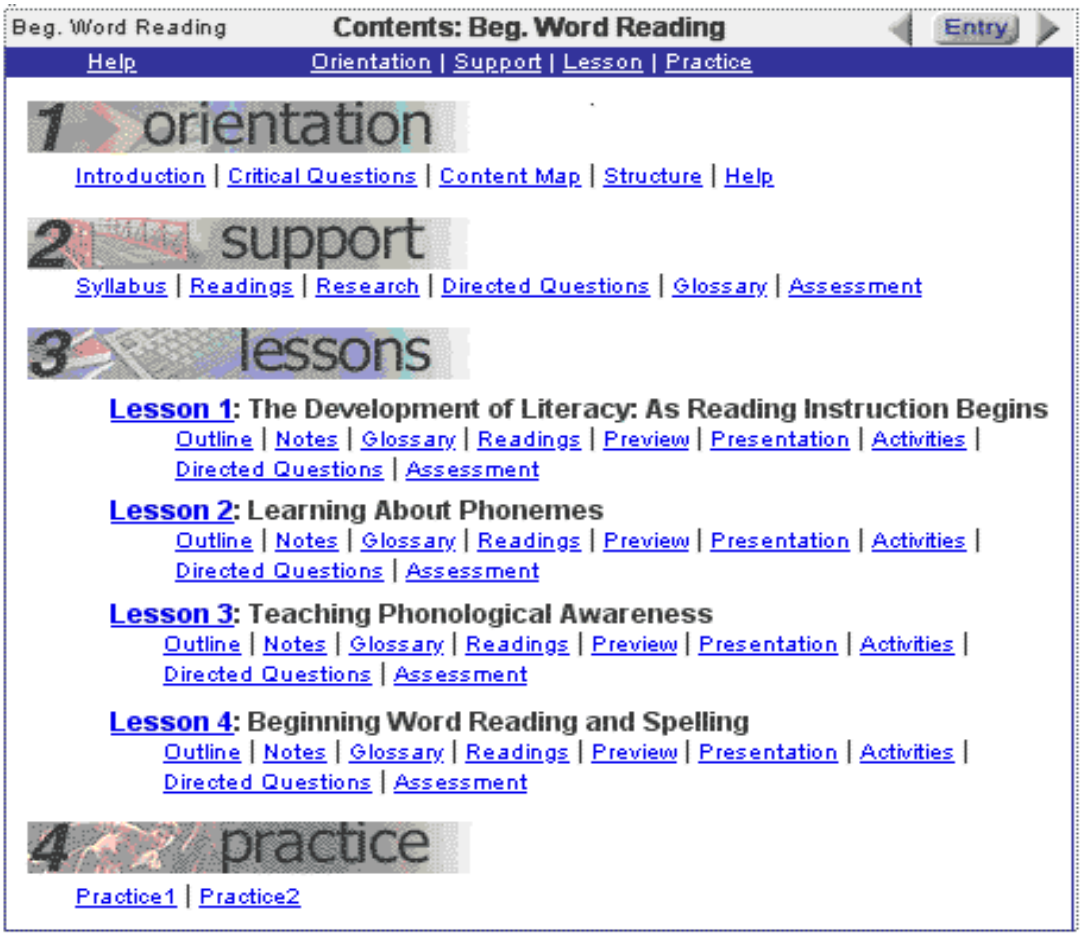
The process we used in moving research to practice worked very well. The juror function was particularly effective. The jurors not only assumed a leadership role in the selection of interventions, but in the process they became familiar with the mission of the Academy and were effective in advising us during module development and implementation. Some also became involved in writing modules.

The Development Process

Writing teams in each content area were responsible for preparing the content in a format that met the requirements of the module design and the technical features. A Technical Assistance Group (TAG) was responsible for developing the technical features and incorporating the content into those features. All modules were multimedia and interactive. Streaming media was used to present all lessons. An alternative presentation in a text format is also included. The content in the text version is identical to the multimedia lesson presentation. A special effort was made to design a friendly and intuitive navigation system. The modules are content-intense and operate across platforms. Each module represents a self-contained instructional program and the lessons within each module have integrity as instructional units. In examining the content maps, the comprehensiveness of the content becomes evident. The maps also illustrate the inter-relatedness of the lessons and modules. All modules are based on the same design, but may vary in their reliance on different features for instructional purposes.

Figure 1.1 represents the Table of Contents (ToC) for a module and illustrates the four levels of the module design and the instructional features. The four levels of the design include orientation, support, lesson, and practice. The navigation system allows any feature to be accessed from the Table of Contents (ToC) and from each page. Arrows also appear on the upper right -hand corner of each page allowing further ease of navigation.

Figure 1.1: Table of Contents Levels in Module Design



Status of the Online Academy

The Online Academy drew on talent from several disciplines. Most participants came from special education, general education, instructional technology and engineering. This collaborative experience built on several years of cooperative work between a small cadre of faculty members from engineering and education. Work on the Academy served as the catalyst to formalize this relationship. The faculty members from engineering were affiliated with the Information and Telecommunications Technology Center (ITTC) and the faculty from education with the Center for Research on Learning (CRL). These two centers formed a partnership to create the e-Learning Design

Laboratory (eDL). See Appendix B for a copy of the Mission Statement for the e-Learning Design Lab. The lab continues to support the implementation of the Online Academy and has expanded its work to include a focus on professional development, research, tool development, and online evaluation. It is a self-supporting unit that is governed by a national board and is administratively responsibility to the directors of the CRL and the ITTC. It is administered by co-directors representing engineering and education.

Structure of the Final Report

We have approached the design of the final report from the perspective of identifying the major components of the work carried out by the Online Academy. Having done this we tried to systematically structure each section as an independent paper. The following topics reflect our analysis of the major components.

- Content Validation Through a Juror Process
- Designing and Evaluating User Interfaces for e-Learning Modules
- Dynamic e-Learning Production
- Extendible Tools and Architecture for Developing e-Learning Modules
- Formative Evaluation Approach to Evaluating Online Instruction
- An Extranet Approach to Virtual Implementation
- A National Assessment of Staff Development Needs Related to the Education of Students with Disabilities

Where appropriate, each component was described by adhering to a standard model addressing background, methodology, results, and lessons learned. The goal was to prepare a report that has merit as a single document, but at the same time, to write each component in a style that would be appropriate for submission to professional journals as independent manuscripts. The rationale for this decision was that if the lessons learned from a project of this scope are disseminated to professionals, this would be achieved most effectively by targeting appropriate descriptions of components to specific professional journals where the readership is most interested in the particular component. See Appendix C for a listing of the manuscripts that have been accepted for publication today relating to the Online Academy project. Others are in the process of being prepared for submission.

In many ways, the modules, themselves, constitute the final product of the project. The modules will be maintained on the web site of the e-Learning Design Lab and can be accessed at the following URL, http://www.elearndesign.org. Because the modules were designed in a manner that allows every element of a module to be printed by the user, hard copies of each module have been printed and submitted as Appendix A to this Final Report.

Following is the listing of the module topics for the three content areas:

Reading

Module 0: Overview of Learning Disabilities and Reading Disabilities
Module 1: Beginning Word Reading
Module 2: Advanced Word and Developing Reading Fluency

Module 3: Basic Principles in Readings Comprehension
Module 4: Building Background Knowledge for Reading Comprehension
Module 5: Analyzing Text to Enable Comprehension
Module 6: Goal Specific Comprehension Strategies
Module 7: Putting It All Together

Positive Behavioral Support

Module 1: Foundations of PBS
Module 2: Functional Assessment
Module 3: Development & Implementation of PBS Plans
Module 4: Intervention Strategies (Part I)
Module 5: Intervention Strategies (Part II)
Module 6: Redesigning Environmental Systems
Module 7: Creating Positive Lifestyles

Technology in Education

Module 1: Learning and Technology
Module 2: Writing and Technology
Module 3: Reading and Technology
Module 4: Language and Technology
Module 5: Mathematics and Technology
Module 6: Data-Driven Instructional Decision Making
Module 7: Exceptionality and Technology

Chapter 2

Online Academy: Content Validation through A Juror Process

Edward L. Meyen and Yvonne N. Bui

Abstract

The Online Academy (HO29K73002) was funded by the Office of Special Education Programs (OSEP) to develop research-based online instructional modules in the content areas of reading, positive behavior support and technology across the curriculum. Targeted to preservice teacher education programs in Institutions of Higher Education (IHE), but also applicable to staff development, the modules were adopted for implementation by over 170 institutions. This paper describes the juror process employed by the Academy to identify the research base, frame the content maps, and to validate the content. Eighteen national content experts served as jurors. A total of 72 lessons in 22 content rich online modules were developed, each approximately equivalent to a two-semester credit course.

Background

The Office of Special Education Programs (OSEP) funded the Online Academy (onlineacademy.org) in 1997 to develop online modules for teacher education. The intent was to take advantage of the emerging Internet technology as a way of distributing instructional resources in teacher education. Access to resources via the Internet meant that the resources in the form of online modules would be made available anytime, anywhere. It also allowed for the modules to be developed for students' use while at the same time providing resources for instructors. The modules developed by the Academy were designed for use in an interactive mode with instructors or as self-contained instructional units. The modules were structured to be used as independent instructional resources or used in part as supplemental resources in courses. The modules can also be printed as hard copies.

OSEP required the modules be in the three content areas [i.e., reading, positive behavior supports (PBS), and technology in education] and be research-based. This presented a serious challenge due to the variability of the research base across the content areas and the difficulty in validating content. In examining the content areas to be covered by the Academy, it was apparent that reading had a significant research base characterized by differing philosophical perspectives. PBS represented a much smaller, but significant research base cutting across several disciplines. Finally, technology in education is a relatively new area of research that can best described as a literature base of best practices rather than a research base.

While literature review procedures were available for identifying the research, models were not available for validating the content once it was developed for the online delivery. Developing the content for each module was viewed as a major undertaking due to the breadth of the content. Thus, it was decided to combine the generation of content with the selection of research and the validation of content. A juror model involving content experts knowledgeable about research in the content areas was adopted.

Specifically, the juror model, combined with staff writing teams, was employed to validate the content.

The adoption of a content expert juror model to facilitate this research to practice process and the validation of content employed elements of the model employed in other settings. Gruber (1994) used a juror model to identify and validate content and indicators of quality in international education programming. Vrasidas and Harris (1995) involved jurors in reviewing prototypes of hypermedia CD-ROM products. Jurors included instructional designers, multimedia developers, graphic artists and content experts. Hoover and Abhaya (1995) in applying the juror model in the development of computer-based instruction, found that it is important to clarify how much faith content experts have in instructional design. While we did not directly involve the jurors with instructional designers, we did engage them in expanding the design for the online modules with particular attention being given to how the content would interface with the design. Maple (1994) examined the relationship of instructional designers and content experts and recommended simplifying language to eliminate jargon and focus on interpersonal skills. Because of the emphasis in online instruction and the lack of experience at that time with technology on the part of those who served as jurors, we clearly diminished the use of language relative to technology and focused on the content research and the functionality of the technology.

Methodology

The methodology for moving research to practice represented the development of processes for selecting research to be integrated into the online instructional modules and for validating content. This involved two primary strategies. The first strategy was to use content experts in the selection of research related to practice and validation of content for each content area. The second strategy was to use staff writers to prepare the content according to the specifications of the jurors and the production system used to transform content into operational modules for online delivery. These strategies were adopted to ensure that the most appropriate research was selected as the basis for the content and that the content written for inclusion in the modules was externally validated. It was also essential that the content be written in a form that met the format requirements of the production tool for online delivery. Each of the strategies will be described in more detail below.

Strategy I: The Juror Process

The juror process involved engaging nationally recognized experts in the respective content areas. Nominations were sought from colleagues nationally. Literature reviews were also conducted by Academy staff to identify individuals doing research in the content areas. In addition, consultation was sought from teacher education faculty nationally in the content areas and from other individuals considered to be knowledgeable in the field. An effort was made to achieve a representative group of jurors within each content area; however, priority was placed on expertise in the content and knowledge of related research. Personal involvement in research was also considered. Membership on the juror teams included 18 individuals as illustrated in Table 2.1.

Table 2.1 Composition of Juror Teams	N
Professors	13
Researchers (non faculty)	2
Teachers	2
Other	1
Female	7
Male	11

The input of the jurors was central to the role of the writing teams. For most content areas, juror meetings were held twice a year during the term of the project. The initial meeting included an orientation to the Online Academy project, followed by an explanation of participants' role as jurors. The three juror teams (one for each content area) met as a group for the first session. In subsequent sessions an attempt was made for teams to meet individually, but at the same time. However, this did not always work as the priority was placed on full attendance within juror teams versus getting the teams to meet on the same date.

The typical meeting involved a brief update on the work of the Academy, with most of the time committed to the work of the jurors in their respective content areas. Initially, the work focused on identifying research applicable to the respective content areas. The agenda then moved to providing input on content maps for module development and later to a review of the content for individual modules. As content was written and entered into the design tool, jurors had an opportunity to review it in the online module format. Finally, jurors were available on call and for on-site consultations.

Juror Responsibilities

Following is a listing of the major responsibilities assigned to the jurors to ensure selection of the most appropriate research and validation of the content.

1. Reviewing and advising on the research and content standards developed by the staff.
2. Setting criteria for selecting research and advising on implementation of the criteria for selecting research studies or validated practices to be considered for inclusion in instructional modules.
3. Providing leadership in developing content maps for each module.
4. Reviewing module content during the development process.
5. Participating in the Alpha testing of the module design. (This was done mainly to orient the jurors to the design of the modules and demonstrate how students would use them.)
6. Problem solving with writers as needed.
7. Participating in deciding when modules were to be considered in final form.
8. Providing input on beta testing procedures and sites.

Strategy II: The Team Writing Process

For each content area a writing team was appointed to the Online Academy, comprised of at least one professional staff member and a varying number of graduate

research assistants with experience in the specific content area. In addition, individuals nationally, with content expertise were also contracted as writers when needed.

The writing team was the primary point of contact with the jurors. Specifically, the writing team's responsibilities, in terms of the research and content validation, were to work closely with the juror team for the respective content area in the development of content. The staff set the agenda for each meeting and worked directly with the jurors as needed. In addition, the staff conducted traditional literature reviews to supplement the work of the jurors. Their primary responsibility was to translate the recommendations of the jurors on research and validated practices along with the findings from the literature reviews into first-draft content maps. They subsequently worked with the jurors to refine the content maps that served as the initial blue print for developing content for each module. Because the relationship between the writing teams and the jurors was an iterative one, the content maps were a work in progress during the early writing stages in each content area.

Following the development of content maps, the first step in writing was to be certain that all partners understood the instructional design and the specifications for writing content. This was quickly followed by the development of detailed outlines based on the content maps. When questions or problems arose relative to either the research or validated practice based of content, the teams consulted the respective jurors. Although an effort was made to write the content for each module sequentially, in reality, two or three modules typically were being worked on at any given time during the writing stage.

Results

The juror approach to content validation and development resulted in the development of 72 lessons and 22 modules, each including over 2000 text and 500 graphic files. Each module involved approximately 12-14 clock hours of instruction. Because the juror model was so central to the Academy approach to module development, the process was integral to the outcomes of the Academy, and therefore the roles of most staff.

The following discussion focuses on the juror model based on observations from staff and jurors relative to the process over two and a half years of content development. The section concludes with a look at the writing team strategy.

Staff Observations

1. The strength of the juror strategy was the knowledge and insight the jurors brought to the process about the research base and its implications for the respective content areas.
2. Each group of jurors took its responsibilities seriously. Rarely was anyone absent from a meeting, as evidenced in a 90% percent rate of attendance at all meetings across the three teams of jurors. In addition, all jurors completed the three-year assignment with the project.
3. The two-day sessions held during the process of developing the content maps proved extremely important. It took a while for the jurors to develop a perspective of the scope of the content to be covered by the modules before they could focus

on the content for individual modules. In part, the extended sessions served to create a culture for the jurors and allowed them to learn each other's perspectives.

4. The content development process yielded content maps in a timely manner. However, it soon became apparent that it was necessary to view the development of content maps as works-in-progress, as the research review and content development process resulted in changes as content was written. Posting the content maps on a web site allowed jurors to provide feedback to writing teams on a continuous basis.
5. This juror model allowed for maximum input in the content development process. Consultation with individual jurors greatly enhanced decisions on content changes and shifts in the number of lessons within a module and the number and titles of modules.
6. Some jurors elected to personally write modules, lessons or parts of lessons. This was not required or anticipated. However, it reflected the level of interest in the content and desire to be part of the writing process. When a juror assumed a writing responsibility, a member of the respective writing team took on the role of a content manager, working closely with the juror (writer) to ensure that the content specifications of the design tool were met.
7. Jurors varied in their knowledge of and interest in technology (except for those in the technology in education content area). However, their interest in the content and in moving research to practice was uniform. When modules were made available for review on the web site, several jurors preferred the online format, whereas others preferred to review the content in hard copy.
8. Individual consultations occurring outside of juror meetings were more frequent with jurors electing to participate in the writing process. Consultations resulted from the initiative of jurors as well as in response to requests from writing team members. The value of the individual consultations was on par with the juror sessions. The difference was that the consultation input tended to relate to very specific topics, module features, selected resources or the presentation of content, whereas the group sessions were oriented more toward determining content and integrating research.
9. Jurors were very open and candid in their interactions and consultation. At times they disagreed among themselves, but were always able to reach consensus to fulfill their roles.

Juror Observations

Jurors' observations were solicited on the effectiveness of the juror model in moving research to practice and validating content for online modules. Each juror had an opportunity to respond to specific queries and to offer comments. Responses were anonymous and aggregated across content areas; as a result, they reflect on the process, not the work of specific juror teams.

Following is the list of items in rank order, with the highest ranked first. (There was no difference in how the first four items were ranked.)

1. The Academy staff was responsive to my inquiries and/or suggestions.
2. The juror process is effective as employed by the Academy.
3. I had a positive influence on the content area.

4. The meetings were well planned and productive.
5. My input was respected.
6. There was sufficient opportunity for me to provide input to the writing teams.
7. My responsibility as a juror was sufficiently clear.
8. There was a good balance of expertise among the jurors on my team.
9. If asked to serve in a similar role in the future, I would be willing to do so if my schedule permitted.
10. The juror method is an effective way to select research for transfer to practice.
11. The juror board of which I was a member worked well together.
12. Jurors were also allowed to submit anonymous comments in response to the survey.

The following comments are representative of those received.

1. This was a monumental project that broke new ground.
2. This is an effective way to engage experts in a process that results in product development.
3. Need to actively solicit involvement of culturally and linguistically diverse participants.
4. More communication outside of meetings, including a listserv and more meetings, would have been helpful.
5. The strength was in the wide variety of expertise and perspectives brought to bear on the issues.
6. More clarity on roles and relationships with writing teams would be beneficial.
7. More input from stakeholders to supplement the input from jurors would help.
8. Once writing began there could have been more emphasis on the nuts and bold of developing the modules.

Writing Team Strategy

The strength of the writing team strategy in the research/validation process was the consistency of staffing across the three years of the project. That is, while there were changes among staff, the lead staff person on each writing team remained consistent during both the writing and the production phases of the Academy.

The structure of the teams included a coordinator, lead writer and writing team. Many of the writing staff were graduate research assistants experienced in the content area. Most members of the writing staff at some time were involved in a review of research on some module topic. Staff interacted with jurors during onsite meetings. However, the lead writer was the key person who routinely communicated with jurors.

While the research-to-practice literature review by the staff was an iterative process with the jurors, the teams also pursued independent literature search initiatives. This was essential to maximize efficient use of time. The sequencing and time required for module development allowed for effective communication between the content area staff and the jurors during the research review stages. Due to the number of modules involved for each content area, the research review process was a constant activity throughout the three years of the project.

Summary of Lessons Learned

The core staff, including coordinators and lead writers, met weekly to coordinate the activities of the Academy. This provided an effective mechanism for monitoring the jury process. Particular attention was given to sharing anecdotal experiences and observations to improve the process.

Lessons learned that should be considered in modifying the process for future applications of the juror model include:

1. Centralize coordination of juror teams in one person to capitalize on the experiences of each team and to ensure that processes and communications are similar across teams.
2. Increase opportunities for communications among jurors (e.g., more frequent meetings, use of a listserv, teleconferences and more precise guidelines for how they can communicate with team leaders and staff).
3. Engage jurors from all teams in an orientation/training session at the beginning to share the Academy process and the lessons learned--at the beginning.
4. Be more aggressive in seeking diversity among jurors.
5. Create links with input from stakeholders, where appropriate, and ensure access to the perspectives of the stakeholders and jurors.
6. Provide jurors early access to the internal web site where modules are posted during the formative process.
7. Be more assertive in exploring jurors' interest in assuming responsibilities for writing modules or parts of modules.
8. Encourage jurors to view content in the online version.

The use of jurors was considered critical to meeting the commitment of developing research-based modules with validated content. The richness of the content can also be attributed to the input of the jurors and their collaborative work with the writing teams. The juror process was viewed as one of the central elements of the Academy along with the tool design, content generation, production, Beta testing and implementation processes. The intent is to continue refining the juror process in subsequent projects where the output is research-based and content-rich online instruction.

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Chapter 3

Designing and Evaluating User Interfaces for e-Learning Modules

Ronald J. Aust, Robert E. Isaacson, Edward L. Meyen, and Brian Newberry

Abstract

The growth of e-Learning is fostering a wide variety of new designs for presenting instructional content. This article describes the design and evaluation of the user interface for 22 online modules encompassing 72 lessons, and over 100 hours of mediated instruction for the Online Academy. In 1997, the Office of Special Education Programs (OSEP) funded the Online Academy to develop a series of online instructional modules for teacher education in the content areas of reading, positive behavior support and technology. We employed rapid prototyping, multiple focus groups, alpha and beta test evaluations in developing a consistent, effective, reliable and scaleable user interface. The user interface elements used to describe the structure and functioning of the modules' content employ multiple navigation strategies with page arrows and position indicators, a main table of contents and sub-menus that support a modular design allowing lessons to be used independently. Interactive elements include context sensitive glossary items, multiple choice and free text assessments with tailored remediation and email response forms for instructors. The primary instructional components are the lesson previews and presentations that are available in a text format and streaming media versions with segmented play lists. Proactive requirements, rapid prototyping, and a user-centered evaluation, contributed to the development of content rich modules which are easy to use and highly reliable across a broad range of platforms. The modules can also be easily mirrored on remote servers using commonly available web and streaming media software.

Background

With the global expansion of the Internet, there has been a considerable increase in the quantity and diversity of user interfaces for e-Learning content. Following is a description of the factors that influenced the design of the user interface developed for the Online Academy's instructional modules to inform teacher educators in the content areas of reading, positive behavior support and technology. As part of this major development effort, the Online Academy's Technical Applications Group (TAG) produced 22 content rich short courses in the form of online accessible modules. These modules include 72 lessons, 300 hours of streaming media, 13,800 graphics and over 50,000 files. The instructional design allows for the modules to be used as self-contained interactive units or as part of an instructor led course. The modules have been adopted by over 170 universities using a phased distribution model where the universities install (mirror) the modules on their local servers.

There were many processes and experts involved in developing the Online Academy modules. The Online Academy engaged three writing teams and national boards of jurors in the initial conception and writing of the content. The written content became e-Learning modules through a series of production processes that transformed the text into interactive mediated instruction. Scaling and sustaining this level of production

required software tools and systems designed to maintain high quality and consistency across a large amount of information. Finally, a reliable distribution architecture was used by system administrators to move the modules to a variety of technical settings.

This discussion focuses on one important aspect of the larger e-Learning module development; the design and evaluation of the general user interface characteristics that apply across all modules and influence the users' experience with the content. According to Neilson (2000) the page layout is the most immediately visible part of an online design that sets the stage for how users will interact with the content. We use the term general user interface in referring to major design characteristics, such as page layout, that are used consistently across modules to describe the structure of the content, make it easy to use, improve interaction and contribute to understanding. The general user interface characteristics include: the page layout, graphics, navigational aids, help messages, cues, highlighting, interactive elements and media.

Method: Requirements and Rapid-Prototyping

Our interface development process began with a recommended strategy (Andriole & Adelman, 1995; Kovitz, 1999) of analyzing the instructional goals, the needs of the user community, the implementation plan and the criteria for evaluating success. This information served as the foundation for establishing the requirements and specifications. We refined the requirement drafts through internal reviews and early meetings with the content team jurors and the Academy's board of governors.

User Interface Requirements

As noted by Gardiner and Christie (1987), the user interface functions as a type of *dialogue* with the user. In this era of rapid technological innovation, there is a risk that the quest for novelty will result in user interface designs that overshadow the intended message or simply confuse the users. The key is to keep the dialogue clear and understated so the interface becomes transparent (Mandel, 1997) allowing the users to focus on the intended learning.

User interfaces that model transparency adhere to a consistent look and feel using a standardized naming scheme, graphics, orientation, navigation and other user interface elements (Shneiderman, 1998). Language use must be consistent and at the appropriate reading level. Terms must be clearly defined, highlighted, punctuated and used consistently within modules. The modules must adhere to national and international standards including relevant tagging procedures established by the World Wide Web Consortium (W3C), Advanced Distributed Learning Group (ADL SCORM), IEEE Learning Technology Group (P1484) and CAST's Bobby guidelines.

The Online Academy modules adhere to pre-determined and consistent instructional components and organizational structure. There are four main levels (Orientation, Support, Lessons and Practice) in all modules (see Figure 1.1). The instructional components for each level are consistent across all modules. A modular design that conforms to current trends in reusable learning objects (Wiley, 2000) was required with cohesive components at the collection, content area, module and lesson levels. Each of these levels can be used independently or integrated into locally developed online courses.

The modules were required to be accessible to a wide variety of learners, in various settings, using a broad range of equipment and network connection speeds. Initial minimum requirements include Windows and Macintosh computer platforms using Internet Explorer 4.0+ or Netscape 3.0+ browsers with 14-inch monitors. We anticipated that many universities would provide students with faster connectivity (T1 or greater). We also knew that other users would have slower speed dial up connections (28.8 K modems). All module content was required to be accessible to a wide variety of users including those with special needs who use text-readers and/or other adaptive devises.

The Online modules primary instructional components (preview and presentation) are available in two forms, text transcript with graphics and streamed media slide show with audio narration. The design of the streaming media was subject to the bandwidth constraints of dial up modem speeds (28.8 Kbps) thus limiting the presentations to an audio slide show. We required technologies capable of delivering moderately high quality audio with minimal interruptions using 28.8 Kbps modems.

Rapid-Prototyping

When we developed the initial requirements in 1997, we drew on previous experience in developing educational resources that were broadly accessible on the Internet (Aust, 1994). We knew that the Internet would continue to expand at a rapid pace and that some aspects of Internet's evolution would be unpredictable. We recognized that bandwidth and access to Internet would continue to increase and that the rate of adoption by schools and teacher education institutions would vary considerably with their investments in technical support infrastructure. Given the rapid growth of the Internet, our approach was to design a scaleable and sustainable method that would quickly adapt to change.

Our design decisions were also influenced by the highly fluid nature of networking technologies. The modules require use of primary applications in the form of various computer operating systems and secondary applications (e.g., web browsers, media players, browser helper applications and plug-ins) that change frequently. The interface elements in each of these application levels are unique. In this context, optimal usability must be balanced by considering feasibility, reliability, and compatibility across multiple operating systems, browsers, hardware platforms and network capacities.

With the understanding that the end result was required to remain reliable and widely compatible in a rapidly changing environment, we adopted a rapid-prototyping approach to design and evaluation (Tripp & Bichelmeyer, 1990). Our rapid-prototyping benefited from customized software tools that separated the content from the user interface. This approach allowed for design improvements to be consistently and universally applied across content in all modules. By using the content rendering tools we were able to refine the interface throughout the rapid-prototyping phase.

A central recommendation from an early Academy board of governors meeting was to develop an Instructor's Module describing strategies for teaching with the modules. While the content for the Instructor's Module was being written, we began developing the software architecture and early prototype for various interface elements (navigation, menus, organization, graphics, etc.). During the spring of 1998 we evaluated, refined and reevaluated the early versions of the user interface in undergraduate and graduate education courses. We also conducted several focus group sessions with

students and staff to discuss the effectiveness of the interface elements. We based many of our decisions on observations of how the users interacted with the interface. Did the users navigate using the forward and backward arrows? Could they find the table of contents? Did they click on glossary terms? Did the users refer to only one or both of the text and media versions of the presentation? Did they understand how to mail the free response and multiple choice assessment items to instructors? As Nielsen (2000, p. 16) argues, "don't listen to users...watch what they do." The user interface was established by the end of the semester and became the design for the first generation of modules.

Results: The User Interface

The strategies used in refining the prototype followed a user-centered approach that draws from knowledge learned in interacting with the natural world and standard conventions of computer use. Upon completion of the Instructor's Module the components and structural organization were finalized. As is true for most bodies of knowledge, the structure of the Online Academy content can be expressed in a taxonomy.

We began by creating a simple outline (see Figure 3.1) of the content that served as a site map for developing the navigation interface. Although an outline seems an obvious first step in the design process, it is sometimes overlooked or avoided because of concerns that it may constrain users on a linear path. A more likely outcome is that an outline provides a consistent and easily understood structure that facilitates personalization.

Figure 3.1: Simple Outline of the Academy Content Structure

I. Orientation
- A) Introduction
- B) Critical Questions
- C) Content Map
- D) Structure
- E) Help

II. Support
- A) Syllabus
- B) Readings
- C) Research
- D) Directed Questions
- E) Glossary
- F) Assessment

III. Lessons

A) Lesson 1: *Lesson One Title*
- a) Outline
- b) Notes
- c) Glossary
- d) Readings
- e) Preview
- f) Presentation
- g) Activities
- h) Directed Questions
- i) Assessment

B) Lesson 2: *Lesson Two Title*
- a) Outline
- b) ...

IV. Practice
- A) Practice 1
- B) Practice 2
- C) ...

Although the linear structure and navigation describe a specific path through the module, the primary intent is to aid users in knowing where they are, not to constrain users on a prescribed path. As long as the navigation interface allows multiple and direct paths to any content, the users are free to choose their own linear or nonlinear path. The multiple navigation approaches are designed to allow users quick and easy access to all information. For example, if users choose to use the Table of Contents (TOC) navigation they are only two or three clicks away from all information in the module.

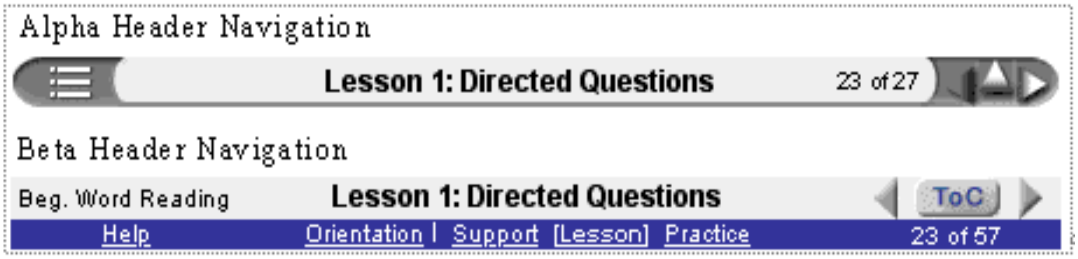
We selected a horizontal top navigation bar to minimize use of valuable screen real estate. This is an effective approach used by many sites with linear or hierarchical content (Rosenfeld & Morville, 1998). The use of horizontal navigation accommodates integration of the modules in comprehensive learning environments such as Blackboard or Web CT. These systems often use vertical navigation that would compete if the modules also used a vertical navigation scheme.

Features of the Alpha and Beta Navigation

The first navigation header bar (see Figure 3.2) was designed for the alpha test. It appeared at the top of all pages of the module. During the Alpha testing we learned that the users easily understood the function of the Next and Previous arrows but they did not readily understand the function of the up arrow as a means of navigating up through sub-menus. They also did not readily understand the meaning of the TOC icon. Some users said that they would like to see the title of the module on every page.

We designed the second navigation bar in Figure 3.2 in response to lessons learned from the Alpha evaluation phase. This modified navigation bar then became part of the Beta test and was ultimately used in the modules. It appears at the top of all pages of the module except for the entry page. A simple footer bar was also added for the Beta evaluation. It appears at the bottom of most pages. Features of the footer navigation include Next and Previous linear navigation arrows and an Up arrow to the top of the page.

Figure 3.2: Alpha and Beta Navigation Headers



Alpha Navigation features (left to right)
- Table of Contents link (left icon)
- Page Title
- Page numbers (23 of 27)
- Next and Previous navigation arrows
- Up navigation arrow

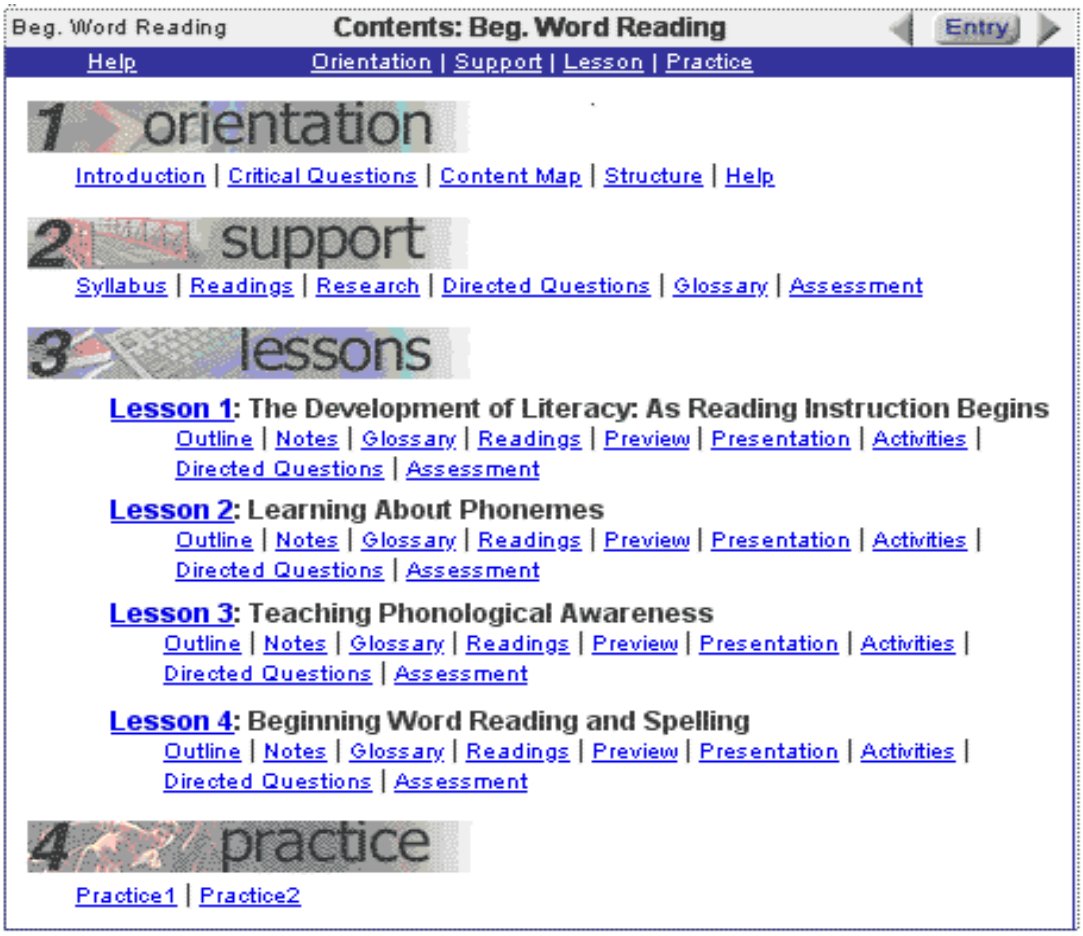
Beta Navigation features (left to right)
- Module Title
- Help Page Link
- Page Title
- Link to the Sub--Menus
- Next and Previous navigation arrows
- Table of Contents link

Page numbers (23 of 27)

Table of Contents

An improved ToC (see Figure 3.3) was designed for the Beta evaluation. Titles for the main levels incorporate illustrative graphics that are repeated in the sub-menus. Because all main components are in the ToC, and a link to the ToC is on all main pages, users can use this spoke and wheel navigation to get from any main page to any other main page in only two clicks.

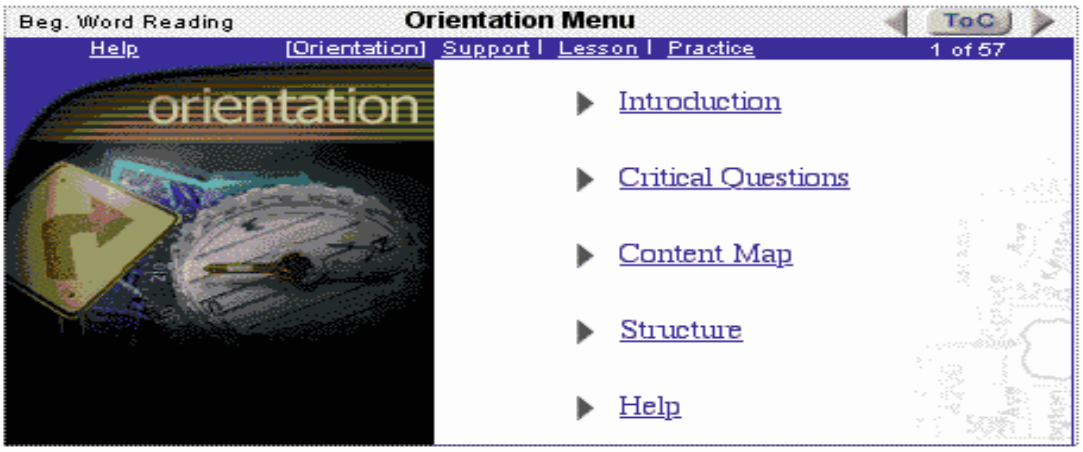
Figure 3.3: Table of Contents Levels in Module Design



Sub-Menus Organize Smaller Chunks of Information

Navigation features also include sub-menus for each of the main levels. The sub-menu offers navigation within a shorter list of links than the ToC. The use of sub-menus is an effective strategy for dividing content into smaller cohesive chunks of information (Lynch & Horton, 1999). Users who prefer to work with smaller chunks can use the sub-menu links in the navigation bar to go directly to any sub-menu (see Figure 3.4).

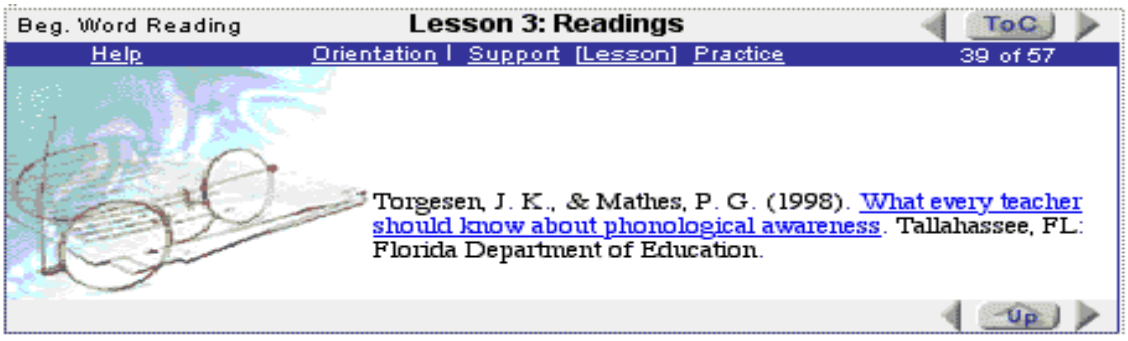
Figure 3.4: Sub-Menu Navigation



Illustrative Graphics

Graphic illustrations are used consistently across the modules to identify the major instructional components (see Figure 3.5). Graphics were developed for each of the four main levels (Orientation, Support, Lessons and Practice) and they appear in both the ToC and each of the sub-menus. Icons were also developed for several of the instructional components. We understood that some users would read information directly on the screen while other would print the pages. Whenever feasible we designed the pages to maximize use of screen real estate and minimize scrolling. For some pages, such as the transcripts and readings, scrolling is required because the content is logically connected as a unit and because it can be printed as a coherent chunk of information.

Figure 3.5: Readings Page with Illustrative Graphic

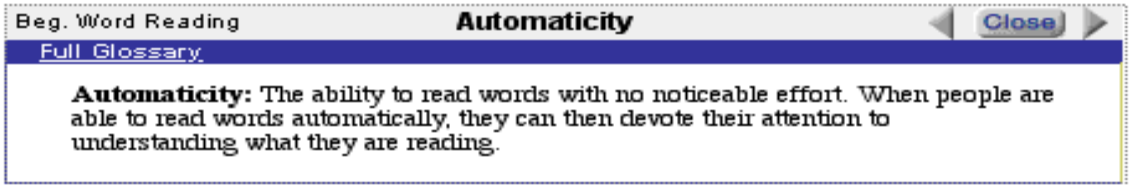


Glossary Features

The glossary included a comprehensive master glossary at the Support level, context sensitive glossaries at each lesson level and interactive glossary terms across the modules. Glossary terms that appear in the body of the text are underlined. The interface employs a hyper-reference design (Aust, Kelly, & Roby, 1993) with the term's definition

appearing in a pop-up window (see Figure 3.6) that maintains the context within the document. Users may then click the Full Glossary to see a list of all glossary terms.

Figure 3.6: Pop Up Glossary Term



Interactive Free Response and Multiple Choice Assessment

To minimize server installation challenges, interactive assessment components are embedded in the web pages. Thus, no special server software is required and the modules can be saved to CD with interactive components intact. There are two forms of interactive assessments: free response and multiple choice.

The free response items allow users to write a response, compare their response to an exemplary response and mail the response to an instructor. Authors of free response items have the option of including a exemplary response for any item. The exemplary responses are seen by the user after they have entered their response but before they mail the responses. Free response items are used in the modules for such items as the Directed Questions, Activities and Practice Items.

The multiple choice items provide users with forced choice options for each item. Users respond to each item by clicking their "correct response" for a list of items. The scored multiple choice responses may then be mailed to an instructor. Authors of the multiple choice items have the option to provide comments (remediation or extension) for each of the items. The scored responses are seen by the user after they have entered their response but before they mail their response to an instructor. Multiple choice items are used in the modules as assessment components at the Support and Lesson levels.

Design Requirements and Specifications for Streaming Media Software

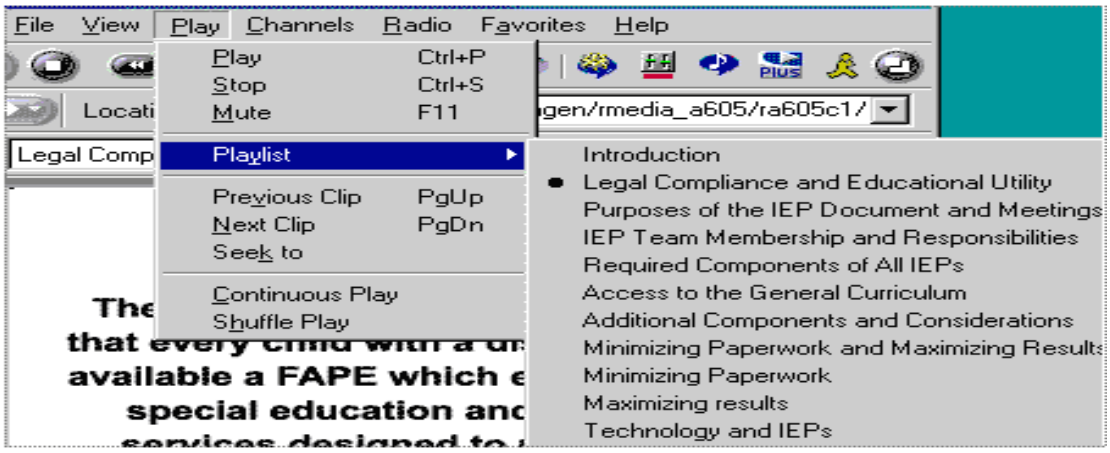
The Online Academy modules' primary instructional components are the lesson preview and presentations. These components are available in two forms, text transcript with graphics and streamed multimedia slide show with audio narration. The term streaming media is derived from the fact that audio and video files are played on the client computer while the data is being received in a constant flow or stream of information from the server. This “stream” of information is buffered and viewing can proceed as additional data continues to download from the server. The multimedia slide show included the integration, of text, graphic illustrations, photography, and audio in a format that allowed the user to control, and manipulate the presentation. There are a number of advantages that multimedia provides for users. These advantages include the accommodation of multiple learning styles and special learning needs such as audio for visually impaired users and text versions for hearing impaired users. Additionally, important research on the effectiveness of multimedia has been based upon theories of multiple-channel communication which assert that learning will increase when the

number and types of cue stimuli that cover similar semantic content are increased and presented together in a reinforcing manner (Moore, Burton, & Myer, 1996, pp. 851-875).

The design of the streaming multimedia media component was subject to the bandwidth constraints of dial up modem speeds (28.8 kpbs) thus limiting the media presentation options to an audio narrated slide show. The use of Flash as a media delivery option was considered, however, due to the length of the lecture presentations, and relative complexity of this authoring environment it was not selected as the primary media delivery option for the modules. The use of video clips was considered as a media option but due to production costs and bandwidth constraints that users are subject to over dial up modems it was determined to not be feasible. The development of streaming media technologies provided a partial solution to this problem. Streaming can be used for both audio and video files.

A review of various streaming media technologies conducted in spring of 1998 revealed that Real Network's RealPlayer was the acknowledged leader in terms of the streaming media technology and installed user base with an estimated 85% of market share. The user installation base of the RealPlayer was the most widely distributed and preferred version of streaming media players. The key feature related to usability that set the RealPlayer (see Real Systems Authoring Kit) apart from other streaming media players at the time of our technology review was the support for synchronized multimedia integration language (SMIL) a version of extended markup language (XML) designed specifically for the integration of various types of media such as animation, audio, graphics, photographs, and video. Both QuickTime and Windows Media Player lacked the same level of support for SMIL at the time of our review of each of the three streaming media technologies. Another important feature of the RealPlayer was the playlist indexing capability (see Figure 3.7). This allows the slide show presentations to be indexed so that users could select specific sections of the lesson presentations for review.

Figure 3.7: RealPlayer Playlist Index Feature



Summary of Lessons Learned

Proactive Requirements and Specifications

The effort spent developing clear specifications and requirements saved time in development efforts and minimized the need for later revisions. Common reference points in the form of requirements and specifications were beneficial in creating a universal understanding among a diverse group of team members engaged in a collaborative design process.

User-Centered Design

Focus group interviews conducted during alpha testing encouraged a collaborative approach to development and engaged users in the early phases of the design process. User feedback increased the likelihood of success in creating a user interface that matched the needs of the targeted audience. The processes of developing effective user-centered designs benefit from:

- A collaborative team effort;
- Clearly identified requirements and specifications at the early conceptual stages of the design process;
- Rapid-prototyping incorporating focus group alpha testing to determine proof of concept prior to final implementation;
- Development environments that are capable of separating the content from the user interface so as to allow for rapid refinement;
- Alpha and beta testing of user interface that is extended to all phases of production from the initial prototyping to final distribution.

Addressing the Accessibility Challenge

The Technical Application Group was committed to developing modules that were accessible and easy-to-use for a diverse group of users. The modules needed to be reliable and ease-to-use across a broad range of hardware and software platforms. Over the past five years, the Internet and computer hardware and software have changed exponentially. We learned that developing a user-interface that works reliably across most hardware, software and network configurations was substantially more challenging than designing software that only works on the latest configurations. Maintaining broad accessibility requires:

- A multi-platform development environment with a broad range of hardware and software configuration covering the past 5 years of use. Many users will stay with the configuration that was on their machine when they purchased it.
- A realistic balance between features and reliability. Expanding features must be tempered by a rational comparison of need, impact on accessibility and available resources.

Rapid-Prototyping and Evaluation

We adopted a rapid-prototyping approach to design and development. The prototypes advanced through Alpha (features are evolving), and Beta (features are fixed and bugs are addressed) phases before they achieved release status.

- Rapid-prototyping methods that incorporate focus group during the alpha testing phase are effective in establishing consensus for proof of concept prior to final implementation;
- Development environments that separate content from the user interface allow for rapid refinement of the interface while maintaining contextual perspective for the designers and content developers.
- Alpha and Beta testing of user interface should be extended to all phases of production from the initial prototyping through final distribution.

Communication and Coordination

We learned the importance of consistent communication with all members of our design and development team as well as with our constituent groups. Factors that contribute to effective and consistent communications include:

- A collaborative team effort;
- Regular weekly meetings of the Technical Applications Group
- An internal web site for internal communications including: project goals, guidelines, internal and external standards, personnel schedules and meeting minutes.

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Online Resources

Real System Authoring Kit
http://www.realnetworks.com/resources/smil/downloads/authkit/
QuickTime
http://www.apple.com/quicktime/
Windows Media Player
http://www.microsoft.com/windows/windowsmedia/default.asp
Macromedia Flash
http://www.macromedia.com/software/flash/

Chapter 4

Dynamic e-Learning Production

Ronald J. Aust, Cherrie Noble, Edward L. Meyen, Robert E. Isaacson, and Brian Newberry

Abstract

The rapid growth of e-Learning (Lewis, Snow, Farris, Levin, & Green, 1999) is fostering a vast array of designs and methods to produce educational content for online delivery. Following is a discussion of a production system that was used to create instructional modules for the Online Academy. The Office of Special Education Programs (OSEP) funded the Online Academy to produce 22 content-rich, online-accessible modules with 72 lessons and over 300 hours of streaming media. This management and development of this content engaged a number of people including: writers, editors, jurors, instructional designers, graphics artists, media developers, software engineers, systems architects, and evaluators.

The initial content production methods emerged during the early management planning sessions and evolved throughout the project. The writing procedures, derived from early meetings with the jurors and writers, encompassed *pre-writing, content generation*, *content review, content revision* and the *final edit.* When writers completed final edits, the content entered the first production phase called co*ntent delivery*. The delivered content was then *processed* with custom software checked in *technical editing*, enriched with audio and graphics in *media production*, checked during a comprehensive *final proof* and finally bundled for *distribution* to remote servers.

State management, action items and status reports were employed to track and monitor the flow of content throughout the production of e-Learning modules. These established procedures coupled with consistent communications through multiple channels, and a collaborative team development effort assisted in maintaining a consistent workflow and ultimately in the quality of the online products.

Background

Uses of Maturing Internet Technologies Changing Higher Education

During the past decade the Internet has grown from a test bed for exchanging ideas among researchers to a global communication medium that is transforming many aspects of society. One of these changes has been the rapid development of new systems for creating and delivering educational content. The ability to develop and deliver educational content is dynamically altering higher education. There is increased competition in the higher education market and at least one for-profit institution. The University of Phoenix is leveraging its ability to create and serve online classes into increased market penetration and increased enrollment (Farrell, 2002; Shea, 2002;). Mainstream education institutions are also working to deliver online education with the percentage of institutions doing so jumping from 22% in 1995 to 60% in 1997-1998 (Lewis et al., 1999, p. vi). Accordingly, there is increased interest on the part of those working in higher education seeking to understand how to create systems to effectively

develop and deliver large quantities of educational material online. This paper contributes to the evolving body of knowledge and practice in this area by describing the system and procedures that were developed to produce instructional modules for the Online Academy for the Office of Special Education Programs (OSEP). This production system described in this paper is the result of much planning, thought and above all, practice. The production system that is described is not the production system that was first developed. Rather, the system that is presented here has been fine-tuned through many lessons learned. While describing the various attempts along the way would be just as informative, this paper will tend to describe the final system.

OSEP

The Office of Special Education Programs (OSEP) funded the Online Academy (H029K73002) to develop online content for translating research to practice in the areas of reading, positive behavior support and technology. During its operational phase, the Online Academy's Technical Applications Group (TAG) developed a production system that delivered 22 content-rich online instructional modules. For the purposes of this paper, the term "module" refers to a self-contained instructional unit, which combines text-based content, media, navigation systems, organization elements, and interactive assessment components. A module generally consists of 3-5 lessons covering a single topic, such as a module on Individualized Education Programs (Banathy, 1995; Richie, 1994). These modules were designed to be used in a number of ways consistent with what was known about the nature of effective e-Learning.

Factors Associated with the Development of Effective e-Learning

Factors relating to effective e-Learning, including principles of instructional design, providing a consistent user interface, reliability of the resources, flexibility for users, and lowering technology barriers influenced the development of the Online Academy's module design. Other publications address the design of the resulting modules while the focus here is on the development and evaluation of the processes that were developed to manage the production of a large quantity of content. The resulting production system evolved to be efficient and effective with key features that others wishing to develop a similar system should consider. These features, that will be discussed in this paper include:

- conceptualizing the production process as having three distinct phases, content development, materials development, and distribution
- shared understanding of explicit procedures belonging to each phase
- identification of key roles at each phase
- clear and consistent points of interface between the phases
- clear and consistent tracking of content as it flowed through the system
- procedures for ensuring quality control at each phase.

The development of this system drew on some individuals' previous experiences related to the design and delivery of online education and was modeled on a multimedia model of online education (Lewis, Snow, Farris, Levin, & Green, 1995).

Designing a Dynamic System for Producing e-Learning Content

Previous Experiences

As the production system was being first conceptualized, previous experiences of key personnel proved instrumental in the development efforts (see Aust, 1994; Meyen, Lian, & Tangen, 1997; Meyen, Tangen & Lian, 1999). These included experiences associated with a large-scale distributed resource development project that used online submission systems and quality control assurance procedures as well as experiences with a collaborative system for the design and delivery of online classes (Tangen, & Lian. 1999). The development of these classes followed what is sometimes identified as the multimedia model of distance learning materials development.

Multimedia Model

The multimedia model of distance learning, sometimes called the factory model (Lewis et al., 1995) features a division of labor in the production of content and materials for distance and/or online education. This division of labor allows for a certain level of efficiency in a large-scale production system because it allows experts in certain aspects of production to concentrate their efforts on the most difficult or time-consuming tasks. Of course, such a system requires a clear understanding of the scope of work, a conceptualization about the proper division of tasks, and a means to coordinate and control all of the parts of production. This was ensured through effective management strategy and planning.

Management Strategy and Planning

Management strategy and planning sessions were an important part of developing the production process. Instructional development researchers (Dick & Carey, 2000; Narayanan, 2001; Prestera & Moller, 2001) have noted that it is important that these sessions occur early in the project cycle. It was out of these early management strategy and planning sessions that the divisions of labor for the production system emerged. The structure of a module was developed which specified the content to be produced for each module. Once these were conceptualized, the planning sessions focused on developing requirements and specifications for the content such as topics, initial outlines, and guidelines for the length and depth of the content. These helped form a writer's guide that reflected the module structure, the subject of each lesson, and other support material that is helpful to writers. Requirements for the final product were also developed which helped guide the functioning of the various phases of the production system that emerged.

Guiding Principles and Requirements

The guiding principles and requirements help shape the production system. It is rarely possible to design and implement a complex production system such as the one created for this project without modification and adjustments to the system. The establishment of guiding principles and requirements helped ensure that modifications to the production system to needed accommodate unforeseen circumstances that arose were consistent with the intent of the project. The production system that was developed can be thought of as having three phases. These are the content development phase, the materials development phase, and the distribution phase. Each phase has specific

responsibilities and there are specific roles in each of the phases. In addition there is a unique role in between the content development and materials development phases that is critical in the success of the production system. Each of the three phases with its purposes, lines of accountability and various roles will be described below.

Description of the Stages and Procedures of the Resulting System

The Content Development Phase

The first phase of the production system is the content development phase. The purpose of this phase is to develop the instructional content for each module according to the writer's guide that was developed according to the specifications and requirements. According to Reid (1999), writer's guides function as a useful reference tool and tutorial for content developers. The writer's guide that was developed explained guidelines, and technical specifications in both condensed and detailed formats. The writer's guide also covered how to write to an online audience, technical requirements, samples content, as well as a description of the module structure including all content items that were to be produced and by whom.

The primary role in this phase of the production system is that of the writer. In some cases, content development groups chose to have a lead writer with support personnel to assist with research and other tasks that are associated with producing educational content. Typically one person in the writer's group is responsible for ensuring that the content that is produced is aligned with the description of the module in the writer's guide. The writing process in this phase typically follows a structure of pre-writing, content generation, content review, content revision and final edit.

Writing begins with *pre-writing* activities in which the writers reviewed and discussed the writer's guide and developed an outline and notes that aided content development. Pre-writing was followed by *content generation* during which the initial draft was produced. The initial draft was then submitted for *content review,* in which the draft was reviewed by a single outside reviewer and/or through a jury process. The writing then proceeded through *content revision* and a *final edit*, often conducted by an outside editor, before being forwarded to the content production stage. While the writing process generally passed through these five stages, writing is a highly individual process that varied somewhat across the writing teams.

Once the content was prepared and proofed, it was ready to be delivered to the production unit. The content was delivered through a web-based system with password protection. This content delivery system contained the table of contents from the module, with entry forms for all content items. The delivery system also included links to the writer's guide. Writers had the option to save content that is still in development or select the *Final Delivery* button when the content was ready to deliver. All final delivery content items were backed up and the time and date of delivery were registered. The content delivery system served as a useful communication and organizational tool for the content developers during the draft period and later for the production staff in monitoring workflow.

The Materials Development Phase

We defined the materials development phase as the set of processes used to transform the final text draft into a feature-rich mediated e-Learning product. The primary function or purpose of this phase of the production system were to: (1) enter content into the production environment, (2) coordinate and track production, (3) audio media creation, (4) ensure quality control, and (5) conduct alpha testing and beta testing. The primary roles in this phase of production included that of the production manager, instructional materials developers, graphic designers and audio developers.

The production manager role is critical to the successful development of e-Learning resources using a multimedia model of production. This is because the materials development unit, through the production manager, provided oversight and coordination for the entire content production process. In many respects, materials development unit functioned as a hub during the content production process (Laaser, 1993). The production manager initially served as the primary liaison between the people working in the materials development phase and the content developers. This worked well until the volume of production increased to a certain point at which time the role of a writer liaison was created. The writer liaison role is discussed in more detail below.

Instructional material developers work to translate the content as produced by writers into materials suited for delivery via online technologies. People in this role need to be extremely detail oriented, as they are responsible for transforming the instructional content into its online form without introducing error.

Graphic designers work in the materials development phase of production to create instructional graphics from graphic descriptions provided by content developers or by the production manager or writer liaison. Development of graphics is a high skill endeavor; fortunately we had access to students in the art and design program to take on these tasks.

Audio developers are responsible for the recording and editing of audio resources for the module such as presentations. The audio developers are also responsible for scripting the control files that cause graphics to be displayed during the playing of the audio resources. Audio production is also a high-skill process.

This production system functioned by having materials flow from the content development group, into the materials development unit to be processed, reconfigured or transformed.

Production began with the *content delivery* when the final draft of the content was delivered and registered with the production unit. During the *processing* phase, the proofed text was inserted into the production environment, which integrated the technical structure, organizational scheme, and navigational features. Any additional markup tags in the Hypertext Markup Language (HTML) and extended markup language (XML) were also added for rendering unique features. Once the text was processed, all elements were viewed in a browser as they will appear to the end user. The initial processing was followed by *technical editing* to ensure that all technical components (e.g., navigation, interactive questions, and glossary terms) had been accurately rendered and were functioning properly in the browser.

During *media production*, the text transcripts as well as the completed graphics were converted to an audio-narrated slide show presentation. This phase often occurred simultaneously or overlapped with other processing phases. Voice actors read and recorded the transcripts. The audio recording was then digitized, edited, and converted to

RealMedia format for streaming. The synchronized multimedia integration language (SMIL) was used to integrate the audio and graphics into a media slide show. The slide shows were posted to a streaming media server, reviewed and edited prior to release from media production.

Media production also involved the graphics development team in creating graphics, which supported and sometimes further explained the lesson transcript (text) material. Early in this process, the graphics team reviewed the text transcript and met with the writer or writer's liaison, who explained the graphics descriptions to the designer. After this initial meeting, the designer created the lesson graphics using a photograph, illustration, or text diagram. After the lesson graphics were completed, they were reviewed prior to merging with text (lesson transcripts) and streaming media (audio recording). Once all text and media components passed technical editing, the module moved to the distribution phase of production.

The Distribution Phase

The purpose of the distribution phase of the production system is to conduct final quality assurance testing, to prepare the module for downloading to servers where it would ultimately be used, and to record who downloaded modules for use in case notification was to be made upon the re-release of a particular module.

The primary roles during the distribution phase of production are those of the distribution manager, the quality control tester and the packaging technician. The distribution manager coordinates the processes of distribution and serves as the contact point between the materials development and the distribution phases of the production system. The production manager has the responsibility for ensuring that quality control testing is done, that the module is packaged for distribution and for maintaining records on the status of modules and downloads of the modules. The quality control tester carefully examines each module in it as-released form to ensure technical quality control. It should be stressed that this is not content quality control, rather, the testing proTOCols at this phase of production concentrate on ensuring that all links work, all graphics display, all navigation works etc. The final proof testing proTOCols included an automated link validation process and a manual review of every page. If, in the rare circumstance, a module failed this proTOCol, the module returned to processing with a description of the problem(s). Upon passing all quality control testing proTOCols the module was released for distribution. The packaging technician handles the copying of the module from the materials development environment to the testing location and ultimately compresses the module, packages it for download and posts it on the download site. In practice the same person can handle these three roles but it is important to ensure that all functions are addressed.

There were three release and distributions methods that were executed independently or simultaneously depending on the release requirements. First, the proofed module was placed on a centralized server for widespread accessibility. The second release option was to make the module available for download. The download system bundled the module and its associated media into a compressed (tar.gz and/or .zip) package. The download package was then placed into an automated download system with password verification and usage tracking. This system made the modules available for installation on a wide variety of server systems in as many locations as

needed. The third distribution option was CD development. CDs were created in limited numbers for circumstances where Internet connections were unavailable. Once a module is in its release state, periodic quality assurance protocols were applied to ensure the continued integrity of the released module.

Managing the Processes and the Communication between Phases

Communication and Coordination between Content Development and Materials Development

Communication and coordination between the various phases of production are essential in any production system and especially so in a large-scale project. The level of complexity in this project required ongoing communication and coordination of content flow throughout production (Levin, 2001; Phillips, 2001). When the production system originated, coordination and communication occurred through meetings and ad hoc relationships. Members from the content development groups and the materials development groups met to discuss process and procedures at regular intervals and there was a great deal of informal communication between various members of the production phases. As the scope of work grew, the content and materials development phases diverged and became more specialized and complex.

As this occurred it became more difficult to sustain these types of one-to-one and group relationships. It became unlikely that members of the increasingly diverse writer's groups could continue to understand the materials development system. An understanding of this system is needed because the complexities and the demands of a factory model materials development process has an impact on the writing of content for the system. At this time in the development of the production system a more formal and procedural relationship between content development and materials development was required. At this point the role of a writer liaison was created. The writer liaison is an individual who understands the materials development phase of production and who is able to help writers create content that conforms to the standards.

Managing Production Stages

The two processes of content writing and materials development are often highly interdependent. For example, the order of priority that was followed in the content writing stages directly affected the content production process. This point was illustrated by the lesson preview and presentation transcripts, which constituted the core instructional content and presented the greatest challenge for the writing teams and media production. All other content items, such as required readings, glossary, notes, and outline, were usually based on the lesson transcripts. In most cases, the lesson transcripts were developed during the early stages of the writing process.

Front-end development of the lesson transcripts also facilitated the content production workflow. Lesson transcripts required extensive text formatting, graphics, and audio production. Once the content developer completed a transcript of a lesson and delivered it to production, three content production sub-processes occurred simultaneously. These sub-processes included formatting the text, creating the graphics supporting the text transcript, and recording and editing the audio version of the lesson preview and presentation. While the transcript was in production, the content

development teams created the supporting instructional components, such as glossary, notes, outlines, and readings. In this way, content development occurred simultaneously with other stages of content production.

We found, as others have (Whitten, Bentley, & Dittman, 2001), that successful production management requires an explicit understanding of the production status for all components. For e-Learning content, this requires the ability to track, monitor, document, and archive the flow of content. The proTOCols we established to manage content flow involved a clear description of content states, action items, and status reports.

Throughout the development and production processes, the content passed through at several states (see Table 4.1). A module can be in only one state at a time. At each state, the content changed in specific ways. During some states, the formatting of the content changed, or the content was modified as the result of an edit or revision. Each state was documented with a data archive.

Table 4.1: Content Stages

State	Explanation	Archive
Content Delivery	Automated delivery of content (1 or more versions)	Content Delivery Template
Module Source	Source files of final delivery documents (final version)	Module Source
Rendered "Gold" Text	HTML formatted copy of source documents	Design template
Module Text Backups	Backup files of all "gold" content from design template	Module Text Backups
Graphics Source Documents	Source folder for copies of all graphics files and graphics descriptions	Graphics Archive and Module Source
Rendered "Gold" Graphics	Folders for all rendered graphics and slides	Graphics Archive/Server
	Folders for media content	Media Archive/Server
Rendered "Gold" Merged	Integrated text and multimedia	Module Archive/Server
Distribution Copy	Module "bundled" for download	Distribution Archive/Server
Server and CD Backups	Backups of all content	CD Archive/Server

Action Items

In order to maintain the integrity of the module, and to ensure efficiency in a distributed environment, a module changed state only through a formalized procedure called an action item. Action items functioned as work orders between units to manage the flow of content to different states in the production system. For example, an action item was initiated from the production unit to move graphics descriptions, which were ready to render, to the graphics development team. The graphics development team initiated a separate action item to move completed graphics back to the production unit for entry into the design template.

Each action item consisted of a classification scheme, which included the initiating unit (usually production unit), action item, year (yyyy), month (mm), day (dd), action number for that day, and module identity number. To further explain, the module identity number (a605), which appeared at the end of the action item, included the structure (a), the series number (6), and the module number within the series (05). Thus a production action item title might read: *Production action item 2002.06.29.01.a605*. The action item would continue to describe the exact process that was to occur because of the action item. For example an action item that moved a module into final release would stipulate that the module (1) be packaged for download, (2) placed in a named download directory, (3) be added to the list of downloadable modules. By being so explicit, tacit knowledge about the state of the module was made explicit within the group.

Status Systems and Reports

In addition to action items to manage and track the status of material and modules, the development unit created an internal web site to track each module through content production. The web site included all action items and completion dates for each module during each sub-process, and documented any delays, inefficiencies, or difficulties during content production. This status system evolved to track each individual content item, such as a lesson outline or lesson glossary, and to document changes in state within the design template. In addition, this tracking system generated dynamic color-coded status reports for each content item, so that we were able to more easily track production and produce highly visual status reports. This tracking system consisted of five content states for each content item. Each content item was automatically date stamped as it changed content states. In addition, each content item had a *notes* box, which allowed detailed documentation of state changes for each content item.

The six states in the content tracking report were: (1) Manuscript Writing -- the content is still being written; (2) Manuscript Delivered -- the content has been fully edited and delivered to the production unit; (3) Manuscript Reviewed -- the content is being evaluated against a quality control standard; (4) Manuscript Approved -- all review procedures are completed, and the content has been approved for processing; (5) Content Processed -- the content has been accurately rendered and in the final product; (6) Content Released -- the content has been packaged and is prepared for shipping to the end clients.

Quality Control

Several approaches were applied to ensure that quality standards, such as reliability, scalability and consistency, were maintained throughout the production process. These quality control procedures occurred at different stages of production and included procedures for both product and process. Process quality control refers to those mechanisms that facilitated our ability to (a) maintain standards for the reliability and consistency of the production process and to (b) make incremental changes and improvements to the production process. (Narayanan, 2001; Richie, 1994). Product quality control refers to those mechanisms that facilitated our ability to maintain standards for the reliability and consistency of the product throughout production and as a finished product.

For quality control we used the internal tracking site and status reports to identify delays, inefficiencies, or difficulties in the module production cycle. The phases of the production cycle included: (1) content quality control, (2) technical editing, (3) media editing, (4) final proof and (5) distribution testing. Content quality control had two dimensions: a) copy editing, which included basic editing, adding sub-headings for the media playlists and finalizing graphic descriptions and b) the content review procedures, which entailed sending content to outside reviewers. The technical editing phase occurred after text had been proofed and entered into the design template. Technical editing ensured that all text had been rendered accurately. The media production edits and graphics development editing occurred throughout production to ensure that all narrated audio and graphics had been rendered accurately. The final proof editing occurred once all audio, graphics, and text had been merged. Final proof editing ensured that all text and media were properly integrated and had been rendered accurately. Finally the distribution testing occurred once the module was bundled and just prior to distribution of the module to remote servers.

Conclusion and Summary of Lessons Learned

Creating an e-Learning production system for the development of a large number of high quality online education resources proved to be a challenging yet worthwhile endeavor. Success required an understanding of the task, a great deal of planning, teamwork and excellent communication. Understanding the task, and guiding the development of the production system based on this understanding led to the adoption of a factory or multimedia model of development that helped ensure standardization and allowed an economy of scale. Planning the production of materials helped to develop criteria relating to the scope of work for the production system, which facilitated staffing decisions and workflow. Teamwork was required within each phase of production as well as between phases of production to ensure smooth transition of content through the system and efficient production. Communication proved to be the critical factor in the success of the production system. Communication channels, both formal and informal made sure that there was a shared understanding of the state of each module as it progressed through production. This explicit knowledge allowed for considered adjustments to be made in the production system to alleviate bottlenecks when they occurred. The development of a production system presented the opportunity to learn a number of key lessons about the endeavor that are presented below.

Conduct Explicit Quality Control

An important outcome of a successful production system is the ability to build a reliable and scaleable product of high quality. A comprehensive e-Learning content production system requires mechanisms which are implemented at different points and which ensure the quality, consistency, and reliability of the final products. Key lessons included: the need for maintaining an explicit institution wide respect and focus on quality control across all constituents, the need for assuring ubiquitous quality control at every production stage, and the need for developing rapidly adaptable quality control that continuously monitored and adapted to changes in the production system.

Promote Consistent Communication and Coordination

The production unit used verbal and written formal reports, face-to-face meetings, telephone, electronic mail, web sites, and computer-mediated threaded discussions. Robust communication, must also be complimented by clear mechanisms that continually relay production status to various constituents. For this reason we implemented diverse mechanisms to report production status including a production web site, which tracked the progress of each module, the content delivery template, and the writer's guide.

Status reports, which used color-coded visual representation to indicate content states, clearly benefited communications and the ability to manage production. This color-coded summary created a highly visual representation of module status and efficiently summarized key production data at two levels: the module level and individual content items for each module. This system also incorporated useful monitoring information at the content development stage. In addition to their usefulness as a communication tool, these tracking mechanisms provided current and archival information, facilitated the identification of problems during content development and production, and helped in forecasting module production schedules.

We have learned that it is important to be responsive to our constituents, who may use a variety of communication modes, including phone, email, threaded discussions and more traditional face-to-face modes. The production unit interacted regularly with the content manager for each content group, representative members in TAG, and core staff. Feedback from these constituent groups indicated the need for two kinds of information: (a) specific just-in-time information concerning module production as a way of mobilizing different groups, as needed, when the module enters different production stages, and (b) broader information that extended beyond functional boundaries, so that all groups can follow the progress of content through the entire production cycle.

Maintain a Consistent Work Flow

The production of online modules benefited from consistent workflow. Content production involved a diverse group of experts including jurors, writers, editors, graphic designers, software engineers, media engineers and system administrators. Each of these groups had unique responsibilities and a schedule to keep. If groups missed their schedule early in the development, the workload at the end of the production became uneven, resulting in a significant balloon effect near the delivery deadlines. Maintaining a level workflow significantly improved both the work environment and the quality of the final products.

Build Collaborative Teams and Shared Vision

The creation of interactive e-Learning modules is a complex process that requires a collaborative team approach to project management and workflow. Each team member must have clearly defined responsibilities within their area of expertise. They also must have an extended view of the project goals and a willingness to contribute ideas at all levels. Encouraging all individual team members to contribute whatever and whenever they have valuable ideas is fundamental to an effective collaborative design and development process.

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Chapter 5

Extendible Tools and Architecture for Developing e-Learning Modules

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Abstract

With the rapid growth in e-Learning an increasing number of public and private institutions are seeking to expand their capacity to provide online content. Such large scale efforts require reliable and extendible systems to manage content development. This paper describes the requirements and processes that led to the creation of software tools and procedures used in developing 22 online modules encompassing 72 lessons and 300 hours of mediated instruction for preservice and practicing teachers. These included professional development activities that were supported by the Office of Special Education Programs (OSEP), the Office of Education Research (OERI) and the Office of Indian Education Programs (OIEP). Rapid prototyping development and iterative formative analysis were used to create an effective, reliable and scaleable system for producing these online interactive modules. Extendible software tools were developed to separate content from design templates used to render the modules. These tools were designed to develop content that would: (a) be highly reliable across a wide variety of Internet browsers and hardware platforms, (b) be easy to use and easily updated with features and modifications based on field testing, (c) be installed on up to 200 remote sites, and (d) rapidly adjust to the changes in the nation's technical infrastructure. Early requirements, specifications and alpha and beta field testing were instrumental in developing an architecture that resulted in highly reliable online modules that are easily installed on remote servers using commonly available web and streaming media software.

Background

In 1993, when we designed our first system for producing large collections of resources on the Internet, the worldwide web was an experiment focusing more on technical innovations in communication than content development. Most users connected to the internet using low speed dial-up modems. Innovations that demanded higher speed connectivity, such as streaming media, were just beginning to emerge. We knew then that the web and digital media would continue to advance rapidly and we designed a system and affiliated software tools that would support content development under the current capabilities and constraints while maintaining the flexibility to quickly adapt to advances in the technology and methods of instruction.

This paper describes the software tools developed to produce online instructional modules for practicing and preservice teachers. We describe the process of developing online content in four distinct stages or steps. These stages include content development, content delivery, module production and module distribution. Each stage includes software, operations and processes specific to the stage. Managing the entire process requires a set of procedures, quality control measures, tracking systems and communications systems. This paper focuses on the software created for the module production system to manage and facilitate content delivery, module production and

module distribution, which are the final three stages in the four stages of module production. The content production procedures and the overall production system that manages content through the module development process are discussed in other publications.

Four factors necessitated the use of software to automate and facilitate the production of the e-Learning modules. These factors were the large scope of the project, the complexity of a module, the importance of absolute reliability and the need for design flexibility so that we could refine the user interface and instructional design. Table 5.1 demonstrates the size of the project and gives a sense for the complexity of the modules and the associated development tasks.

Table 5.1: Scope of Academy Modules Production	N
Modules	22
Lessons	72
Interactive Open Response Items*	1,200
Unique Glossary Terms*	1,380
Interactive Multiple Choice Items*	1,400
Interactive Glossary Links*	3,600
Streaming Media Files*	4,600
Graphics*	13,800
Unique Files*	50,000
Words*	1,600,000
Total Size of All Modules (zip. compressed)*	1 Gigabyte

** represents estimates based on samples*

Each of the modules was released and installed on hundreds of servers located at Colleges and Universities across the United States. Knowing this, a commitment was made to ensure absolute reliability and trouble-free operation. We also understood that there would be a need to continually refine the user interface to meet the needs of the writers and users of the modules. The development of this software was influenced by instructional design factors, user interface considerations, and the procedures used to manage content through the production process. These influences were captured at the outset of software development in a set of operating principles and specifications that informed developers about the characteristics and capabilities needed in both the modules and the software used to produce the modules.

Software Development

Operating Principles and Specifications

Operating principles express qualities that are identified as being essential to the functioning of the end product. Specifications describe capabilities or features that must exist in the end product or must be programmed into the software to meet the operating principles. Operational principles were captured in the form of objectives arising from the original proposals, the early meetings of governing organizations and reviews of the initial production specification. Specifications were developed according to a heuristic

development model (Inmon, 1999) where each operational principle created a cascading set of interrelated requirements that were evaluated and refined in an iterative manner.

Some key operating principles for this project included the commitment to an extranet model, guidelines about how the modules were to be used in different instructional settings, adherence to proven instructional design principles, and steps taken to ensure accessibility of the modules to individuals with disabilities. The extranet model committed the group to produce modules that would be distributed to many remote sites and served to end-users. This meant developing the capability to deliver content rich modules to numerous higher education institutions where they would be installed on a wide variety of server platforms. Because we could not predict the type of server that the modules would ultimately be served from, we were required to develop modules that would work with software that was commonly available for a wide range of server types. These requirements contributed to decisions on how technical issues such as addressing the links to media presentations were resolved.

Another set of operational principles came from the guidelines that were established regarding how the modules would ultimately be used in different instructional settings. According to these guidelines the modules would be used with or without an active instructor. The modules were required to easily integrate into existing face-to-face and traditional courses, as well as with other modules and materials to create an online course. These requirements were important to the technological implementation of the modules, and thus the software tools used to create the modules. The modules were required to be completely portable across browsers and computer platforms and be compatible with common course management software. Additionally, the module design was required to be flexible enough to accommodate independent use of each lesson.

The instructional design principles called for all modules to have similar and consistent navigation, have assessments that would not necessarily require instructor evaluation, provide information about other modules, and make it easy for students to monitor what they had and had not completed. Many of these requirements, such as the need for common navigation, played an important part in the development of software that would automate these features. The commitment to principles that would ensure accessibility required that modules have both multimedia and text versions of the primary instruction components and that accessibility guidelines established by W3C and CAST be followed. These required certain technical provisions including standardized data about images and other features of the modules.

Because of the need for accessibility, reliability across many server platforms, and for use on a wide range of end-user operating systems and software environments, the specifications called for a production system that would allow systemic testing (Toleman & Welsh, 1998) that adhered to standardized procedures (Nielsen, 1989). Integrating the resulting findings of this testing was only possible because the software that was created allowed the production team to apply changes in the technical coding of the modules across an entire set of modules in the most efficient manner. The production tools were also required to be capable of reliably managing and processing large quantities of information, incorporating a wide variety of formats including: HTML text, Gif and JPEG graphics, interactive JavaScript and various media files. The module production tools helped ensure that the content would be reusable (Maly, Liu, Nelson, & Zeil, 1999),

reformatable (Nelson, 1997; Nelson, Marchionini, Geisler, & Yang, 2001), and thereby achieve economy of scale and efficiency.

Drawing upon our experience in developing educational tools for the web (Aust, 1994), we knew that the technology, instructional components and interface elements would continue to evolve during the rapid prototyping phase of development (Tripp & Bichelmeyer, 1990). This necessitated a production system that could accommodate these changes while simultaneously addressing all requirements of the production system specifications. A production system was created that adopted a learning object approach (Wiley, 2000) that allows components of the modules to be used independently from the entire module through the use of templates that are dynamically applied to the content. These templates provide the user interface or look and feel of a module and conform to our specifications about consistency in the user interface. These templates are dependent on the content specifications but independent of the content. This allows the content to be recast with evolving user interfaces while maintaining reliability of the final product and achieving a consistent look and feel across all modules. Consistency in the user interface increases ease of use and user satisfaction (Nielsen, 1989).

The module production system manages and maintains content while the module-rendering tool applies the design templates to all content. This process allows the user interface to be changed consistently across all aspects of the module while maintaining the integrity and independence of the content. Because the module rendering tools applies the template's technical coding across all modules, it offers more consistency and reliability than would be accomplished with an approach where each module was individually hand coded. A typical module has well over 100 separate but interconnected pages and over 2000 files of various formats. A design change resulting from user testing might necessitate modification to the header navigation on all pages in the module. Other changes might necessitate modification to only a few pages. Human error is introduced when these numerous, and essentially, repetitive tasks are applied independently by hand. Using our production tools, changes are made on a template in one location that are in turn applied in all cases where that template is used. Thus, the production tools improve the quality and reliability of the resulting modules. The tools are scalable and robust, having been evaluated and refined in an iterative development process (Boehm, 1988; Kruchten, 2000) that employed significant alpha and beta testing (Hoffman & Margerum-Leys, 1996; Lewis & Rieman, 1994).

The process of ongoing refinement and feature development has benefited from a multidisciplinary team approach where programmers work closely with the users and testers of the system to respond to technical implementation, practical use, and reliability issues as they arise. Ongoing software requirements meetings were held to compare the software with the specifications. Participants in the design, use, testing, and programming groups employed e-mail, online threaded discussions, instant messaging and “all-hands” face-to-face “alpha” sessions to communicate about the effectiveness of the production tools and system.

The following three sections provide more detail about the software created to develop the e-Learning modules. These three sections explain the content delivery, content rendering and distribution management software.

Content Delivery Software

The content delivery software consists of a web-page interface that mimics the planned structure of the module. This software, largely CGI scripting, is extendible and flexible, making it possible to easily modify the number and type of input fields or content containers. Writers or managers of writing groups deliver content into unique containers for each separate content piece. The containers are conveniently structured around the module Table of Contents that provides one-to-one mapping of the content for efficient communication and tracking. The container's structure makes it easy for the content developer to quickly assess if all content they are responsible for has been entered into the system. All containers are access controlled and password protected.

The delivery system includes content containers for text that describes global aspects of the modules such as the introduction, syllabus, outline, glossary, critical questions, directed questions and practice activities. Additionally, the delivery system permits submission of instructional content components such as transcripts, media description and graphics used in developing streaming media content. Guides for writing each component's content are integrated in the delivery interfaces.

Module Rendering Tools

The module rendering tools are a suite of software that perform a number of functions relating to the production of modules. These include managing the state of the content for processing, combining the content with the design templates, creating a consistent and flexible navigation system, and implementing interactive functions. Once the content is designated as being in the final delivery state it is imported into the module processing tools. Once there it is tagged as needed and processing software marries the original text content with the user interface design template to publish the module in a format that is viewable using commonly available web browsers. The design templates are created using standard HTML and customized markup tags. The rendering tools interpret these custom markup tags and apply processes that install such items as the navigation elements, interactive glossary and assessment items. Each unique tag represents a content marker or defines the boundaries for a particular set of functions that are used to marry the content with the design templates to produce the completed module.

The template design allows for rapid global modification of the user interface. Modification can be made within template suites in response to field-testing that suggest user interface improvements. This approach also provides the opportunity to develop multiple user interfaces that reflect alternative instructional models tailored for different applications and/or audiences.

Constructing a Module

Module creation begins with a standard set of default pages that represent a generic module structure. These default pages form the structure upon which all other content connects to the module. The module structure as defined by the default pages serves as the foundation for the navigation interface. Additional pages are added to the module as needed and in practice each module has a different number of these optional pages. These optional pages are configurable in a variety of ways. Optional pages may be inserted or deleted as needed at any point in the module creation. For example, an author might initially identify seven readings for a lesson and later change the number of

readings to nine. The module rendering tools permit this flexibility while at the same time ensuring accurate, stable and similar navigation features for all modules with a unique navigation interface dynamically generated for each module.

Once the structure of the modules is established, content is entered into the individual pages in the content processing web site. Entering content data into the pages is achieved through a text box in a standard web browser. For ease of use, instructions and samples of the pages are provided and the editable fields are labeled with HTML comments such as “add content here.” The custom tags used by the module rendering tools may be entered with the content or the tags may be entered at a later time. When the document is saved, the template tags are automatically rendered to "rebuild" a preview version of the page.

The internal tags are added to the content control and support unique functions and processing by the module rendering tools. Specific functions supported through internal tags include: Glossary, Open Ended Questions, Multiple Choice Questions, Outline and Transcript Storyboard. The module rendering tools interpret these internal tags and then produce the standard HTML coding for the web-ready modules. Examples of the internal tags appear in Figure 5.1.

Figure 5.1: Internal Tag Samples

```
<OPENQUESTIONS>
<QUESTION VALUE="question 1 stem goes here.">
<ANSWER VALUE="sample 1 response goes here">
</QUESTION>
<QUESTION VALUE="question 2 stem goes here.">
<ANSWER VALUE="sample 2 response goes here">
</QUESTION>
…
</OPENQUESTIONS>

<MULTIQUESTION>
<QUESTION VALUE="question 1 stem goes here.">
<ANSWER TYPE="W" VALUE="distractor comment goes here.">
<ANSWER TYPE="C" VALUE="correct response comment goes here.">
<ANSWER TYPE="W" VALUE="distractor comment goes here.">
<ANSWER TYPE="W" VALUE="distractor comment goes here.">
<ANSWER TYPE="W" VALUE="distractor comment goes here.">
</QUESTION>
…
</MULTIQUESTION>

<STORYBOARD>
<SCENE NUMBER="1" IMAGETYPE="JPG">
scene narrative goes here
</SCENE>
<SCENE NUMBER="2" IMAGETYPE="JPG">
scene narrative goes here
</SCENE>
…
</STORYBOARD>

<GLOSSARY>
<GLOSSARYWORD VALUE="term 1 goes here">
term definition goes here.
</GLOSSARYWORD>
<GLOSSARYWORD VALUE="term 2 goes here">
term definition goes here.
</GLOSSARYWORD>
</GLOSSARY>
```

Note: This figure shows samples of the mark-up tags that we developed for Open Ended Questions, Multiple Choice Questions, Storyboards and Glossary Items. These internal tags were designed prior to the availability of the Extendible Markup Language XML tags.

Distribution Management System

The distribution management system uses a PostgreSQL database back-end interacting with PHP scripts. It was developed to ensure the reliability and availability of module downloads. The system enables authorized users to access the download site and to maintain accurate records of contact information. Additionally, the system keeps a record of downloaded modules by institution. Combining contact information and module download information permits notification of interested users regarding module updates. The content packaging is made available in both .zip and .tar.gz formats. This permits data compression to optimize efficiency of download and at the same time maintain the ability to install the modules on the widest range of servers possible. The remote server package includes instructions for installing the modules on standard UNIX or Windows NT servers that use commonly available Web HTTP and streaming media software.

Summary of Lessons Learned

Creating a production system that integrates commercial software, custom software and numerous procedures to facilitate the production of e-Learning modules was both a significant task and opportunity. Following are some of the notable lessons learned in this process.

Establish Clear Communication and Specifications

Specifications and requirements are essential to the success of the system. Some of these specifications and requirements were conceptualized at the onset of the project. There were also many situations where specifications or requirements were developed as the need became known. Occasionally, it seemed expedient to begin working on the implementation prior to the development and/or clear communication of specifications and requirements. However, delays in developing or communicating specifications only hampered production, while the initial development of clear specifications ultimately saved time in developing the production tools and technical infrastructure.

Group Diversity and Collaboration Contribute to Innovation

Creating a dynamic multidisciplinary team requires effort and consideration. The development of interactive media is a complex process that requires a collaborative team approach where team members are actively engaged in establishing project management and workflow systems. We followed a project organization model (Narayanan, 2001) that brought together individuals from diverse disciplines to form a highly functional team. Development of clear specifications contributes to that collaborative team spirit and assists the integration of new members to the team. The organization process, where responsibilities and procedures are continually evaluated and communicated, helps to more clearly define team member responsibilities in an atmosphere that draws on and respects individual skills and expertise. The process of encouraging each team member to offer their best ideas involved them in the project and contributed to a productive design and development environment.

Maintain Version Control and Standardization

Standardization of file handling procedures and naming systems helped the group keep track of changes needed to create the complex e-Learning modules. One of the most challenging aspects of any large-scale development process is maintaining a common group understanding of the status of all design components and processes. Each module includes about 125 system graphics (those used across all modules), 500 unique graphic files for each module and about 2000 total files including files in the GIF, HTML, JPEG, JS, RM, RP, SMIL, TXT, and WAV formats. During the alpha design phase, many of the files changed on a regular basis. This required the development group to maintain a common understanding of the most current version of all files. We eventually automated much of the version control process in our module rendering tools. We also developed standard procedures for naming, dating and storing files. The graphics files were created in formats (e.g., .ai, .psd) that are different from the display formats. Because the creator files are the most time consuming to recreate, maintaining current status of the creator files is a critical aspect of a comprehensive version control system.

Separate the Content from the Functional Design

Separating the content from the user interface, navigation and design allowed for more flexibility in refining the user interface as well as ensured the stability of the final product. The module rendering tools evolved through three major revisions. Each version became more reliable, easier to use and more flexible. A significant advance to the module rendering tools has been the system that cleanly separates the content from how the content is rendered. This approach allowed us to apply more robust rapid-prototyping to the refinement of the navigation and other design features during the alpha phase of development. By separating the content from the design elements we were also able to improve reliability during the beta testing while maintaining consistency across all modules.

Automate Repetitive Processes to Improve Reliability

Simplifying the download and installation procedures through automation helped to ensure ease of installation of the e-Learning resource at the end users' site. The distribution packaging software was revised and field-tested with server administrators at remote sites. After assessing the platforms and capacity at the implementation sites, the packaging was made available in both .zip and .tar.gz formats. These compressed files can be downloaded and mounted on a wide range of server configurations using UNIX and NT based server software. The download system is automated and the installation procedures have been simplified as much as possible through automation to ensure that the module can be installed on the widest possible server infrastructure by system administrators with varying levels of expertise.

Preserve Use and Distribution Options

Because the modules require no special server interaction, they can be distributed in a CD-ROM format or readily integrated into a wide variety of server-based learning architectures such as WebCT or Blackboard. While the CD delivery option was not an initial requirement of the project, the use of flexible tools, adherence to the specification that called for no server interaction, and the insistence on having the modules be accessible through standard end-user software meant that when called upon to produce a

CD ROM-based version of modules we were able to do so rapidly and with complete confidence in the quality of the result.

Conclusion

Developing a significant number of high quality e-Learning resources requires planning, commonly understood guidelines, clear specifications, and effective communication. Large-scale projects should consider development and use of software that systemizes major portions of the task to ensure quality and reliability. Such software is best developed after careful creation of guidelines and specifications to ensure that the software is responsive to the project vision. Large-scale production projects face several challenges that must be overcome. These include ensuring that the final product is maximally usable and reliable. Often it will be necessary to modify user interface even while continuing the production of the resources. These factors also favor the development of software to automate repetitive procedures, to ensure compliance with technical specifications and to make modification of the underlying coding as well as the user interface possible.

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Chapter 6

The Online Academy Formative Evaluation Approach to Evaluating Online Instruction

Edward L. Meyen, Ronald J. Aust, Yvonne N. Bui, Eugene Ramp, and Sean J. Smith

Abstract

The Online Academy (HO29K73002) was funded by the Office of Special Education Programs (OSEP) to develop online instructional modules in the content areas of reading, positive behavior support and technology across the curriculum. Targeted to preservice teacher education programs in institutions of higher education (IHE), to date, the modules have been adopted for implementation by over 170 institutions. A requirement of the funding agency was that the content of the modules be research-based. A total of 72 lessons in 22 online modules and an authoring software tool were developed. Each module is approximately equivalent to a one-semester credit course. This paper describes the formative evaluation processes that were employed in creating the instructional design, design and production processes, content development, usability and navigational features of the modules, and the national implementation process.

Background

The Online Academy was funded in 1997 as a three-year project to develop online instructional modules for preservice teacher education programs. This represented a major development effort as few commercially available development tools were available for web-based instruction at that time, and existing ones were geared primarily for institutional use, where the fee structure was mainly passed on to the institution on the basis of student use. Additionally, streaming media was still in its infancy, with minimal use of streaming media in online instruction. Besides, the status of online instruction in higher education institutions was in an early stage, with few institutions engaged in creating or offering online instruction. Consequently, there was little experience or literature to draw upon in the development of online instruction of the magnitude included in the scope of work for the Online Academy.

The development tasks facing the Academy included creating an instructional design applicable to the proposed content and target audience, developing systematic processes and authoring software to automate the module production process and to facilitate writing content, and implementing the modules as instructional resources in preservice teacher education programs nationally. Each development task introduced the need for a major emphasis on formative evaluation to enhance the decisions to be made relative to each of the tasks. The formative evaluation process was further complicated by (a) the commitment to scalability nationally not knowing the changes in technology that would occur over the life of the project; (b) the integration of streaming media as a central mode for presentation of lessons; and (c) the requirement that the content be research-based. The decision was made early in the project to disseminate the modules to institutions of higher education via an extranet model that would require each institution

to manage the modules on their own servers. This eliminated the dependency on the Academy during implementation and ensured continued access to the modules following the end of the grant.

The development effort involved creating and field-testing 22 online modules that contained 13,800 graphics, 4,600 streaming media files and 50,000 unique files. Each module was designed to be taught in either an interactive mode with an instructor or as a self-contained unit. The modules were also designed to be Bobby compliant for access by persons with disabilities.

Formative Evaluation Procedures

The scope of the development effort, combined with the limited time period, dictated that a formative evaluation model be adopted. The challenge faced by the Online Academy in designing a formative evaluation model was not the lack of traditional evaluative strategies. Rather, it was an almost total absence of literature on evaluation of online instruction when the project was funded in 1997. This was especially true of development projects of the magnitude of the Academy. The evaluation efforts were concerned with the effectiveness of the technology as well as the instructional design and content. The model drew heavily from the evaluation of traditional forms of distance education or curriculum development (Beyer, 1995). For example, a body of literature focused on course development and the utilization of instructional television (Price & Repman, 1995). There was also an emerging literature base on the evaluation of teaching (Nelson & Smith, 1994). Dodge (1994) offered direction on the formative evaluation of a computer-based tool in the development of lessons. In 1997 Bodily and Mitchell published a source book on the evaluation of Challenge Grants funded by the U.S. Department of Education. Subsequently, resources began to appear in the literature on the formative evaluation of web-based courses (Maslowski, Visscher, Collies, & Bloemen, 2000; Youngman, Gotcher, Vafa, Dinsmore, & Goucher, 2000). Thus, in addition to drawing heavily from the traditional literature on formative evaluation in the design of evaluation procedures, the Academy sought consultation from individuals engaged in the development of online instruction at the time for input on evaluation of technology related features of online instruction.

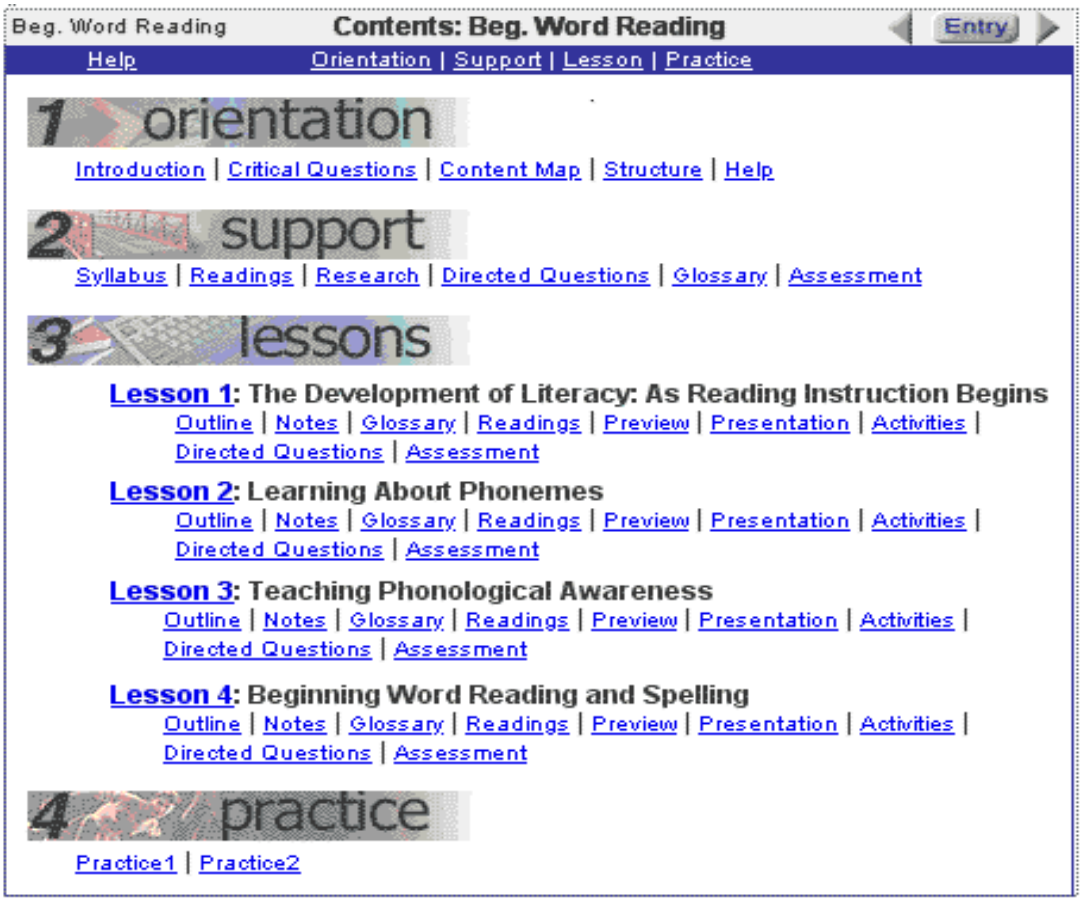
The formative evaluation process needed to minimize the time required to translate evaluation results into indicators for revising or refining the modules and the major elements of the project. While formative procedures were integral to all aspects of the project, five processes served as the main foci. These included:

- *Instructional design of the online modules:* As mentioned, literature on the status of online instructional design was very limited in 1997. However, online courses were being developed at the University of Kansas that were fully online, employed multimedia including streaming media and incorporated a wide array of instructional features characteristic of face-to- face instruction (Meyen, Lian, & Tangen, 1997). These instructional design features became an early focus of evaluation as they served as the basis for the foundation for module content development.
- *The production system*: Two early decisions set the framework for evaluation strategies related to production systems. The first was that a production system

would be created to allow content to be written according to prescribed specifications to meet the requirements of the production tool. Once the content met the requirements of the specifications, it would be processed in the production system and the operational online modules created. This meant that the instructional design had to be validated prior to creation of the tool, i.e., the production system, and the tool had to be completed prior to the development of specifications for content writers.

- *Content development:* Online design delivery required that the content be in final form and in compliance with all design features prior to being delivered (see Figure 6.1). This added a level of precision in the creation of content that is not essential in face-to-face instruction. In addition, the funding agency requirement that the content be research-based added a dimension of content validation more rigorous than is typical of course development. Two primary strategies were employed in the development of content. The first involved the use of content experts as jurors to identify applicable research and validate the content to be incorporated into the modules. The second was the use of writing teams knowledgeable of the content areas that worked with the jurors in the validation process and in writing the content to meet the specifications of the instructional design and production system.

Figure 6.1: Table of Contents Levels in Module Design



- *Usability and navigation:* In contrast to face-to-face instruction where the instructor manages the students' progress through the content and has real-time options to modify the presentation, if necessary, during online instruction all instructional features have to be developed in advance and thus are not subject to "on the spot" revision. Further, online instruction requires that the instructional features be integrated into an electronic form and managed by the students as they progress through the program. Thus, it is important that the features and the process (navigation) for moving through the instructional program be consistent. They must also be somewhat intuitive so the students can easily learn how to navigate through the instruction and thereby focus their attention on the instruction and not the technology features. The user interface design adopted standards of information organization that are widely applied and understood, including a page structure, table of contents, nested menus, chapter headers and way-finding markers that indicate the current location and scope of information (e.g., page 14 of 76). The flexible navigation design accommodates the preferred styles of diverse learners, including a linear navigation from first to last page, spoke-and-wheel navigation using the table of contents and chapter menu navigation.
- *Implementation:* The goal of the project was to make the online modules available to any preservice teacher education program nationally. This requirement meant that it was essential to design the technology so that the modules would be maximally accessible regardless of the institution from which students might take the modules. It was also essential to develop the modules so that they could be installed on local servers of participating institutions within the context of the extranet model. The latter was considered essential for ensuring access to the modules following completion of the project.

A mixture of formative methodologies was employed depending on the purpose of the function or process being evaluated. Both internal and external strategies were used. The external strategies involved a third-party evaluation firm that was contracted to carry out specific evaluation tasks. Their involvement was primarily related to evaluation of the usability/navigation and implementation processes. Additionally, because the Academy project was carried out in an academic environment, student research studies were encouraged and, when appropriate, the results were utilized in the formative evaluation process.

The five evaluation targets listed above were addressed sequentially; however, each was also part of a continuous process. For example, the instructional design was the first to be addressed as the design had to be in place prior to beginning work on the development tool and production system. Likewise, the tool had to be completed before content generation could begin. The focus of each evaluation effort was on the targeted functions, but if data supported changes in other target functions, they were made. The exception was in the instructional design and the tool during the third year of the project where module production was heavy. At that time, a policy of "no feature creep" was adopted (i.e., no new features). Any change in the design required a change in the tool and in the development of all modules. Thus, even if a feature change was found to be beneficial, it was not cost effective to make it at that stage in the project. Only one design

change was made in the third year of the project and that was the indexing feature made available through its Real Player. This feature simplified the task of the learner moving from one place to another in the multimedia presentation.

In the following discussion each of the five evaluation areas will be addressed in terms of methodology and results.

Instructional Design

Methodology. The instructional design for the Academy modules derived from the online instructional design developed by Meyen for graduate-level courses at the University of Kansas (Meyen et al., 1996). Meyen had developed two online instructional models. One was designed for graduate level courses (this model received Honorable Mention in the international Paul Allen Virtual Education competition for online courses), the other approximated a graduate seminar. Each had been taught at least once under normal conditions and subjected to Alpha testing in the design process. Focus sessions had been conducted with students unfamiliar with online instruction engaged in working through lessons and evaluative data on each lesson were collected on student satisfaction and performance. A study was also carried out using the standard course evaluation system employed by the University of Kansas and the results were compared with other web-based courses and with similar traditional face-to-face courses. Also, the Meyen model was deconstructed to analyze the individual elements as the initial process for creating the instructional design to be employed by the Academy. This design, in turn, served as the framework against which other online instructional models nationally were compared.

The process for comparison with other models was carried out in two steps. First, a series of standards were developed to guide in the selection of research studies for the content of the modules as the basic OSEP requirement for research-based content. The second set of standards was in the form of pedagogical statements that served as design standards. The latter were principles that were viewed as important to the final design and content to characterize the modules. The evaluation of design features was carried out by initially identifying online courses that were operational in 1997. In addition, emerging technologies were also reviewed. For purposes of review, courses from the fields of education, medicine, nursing and engineering were screened for the features that appeared to be unique or of sound pedagogy. The requirements of the funding agency (OSEP) were also reviewed for instructional design implications. This process was completed via group sessions during the first three months of the project by the core staff, along with the technology and writing staffs that had been hired at that time.

Additionally, it was necessary to finalize the design so that development could proceed with the confidence that the format would not change. However, the aesthetics design (i.e., the look and feel of the interface) continued to remain fluid until near the end of the second year of the project. The look and feel, as well as the navigation, became the focus on the Beta testing once modules were completed in draft form. (See section on usability and navigation.)

Once the features in were agreed upon, an instructional design in the form of a Table of Contents (ToC) for a module was configured. Each feature in the ToC was structured to reflect the instructional design and defined to minimize misinterpretation. This instructional design was then refined as the basis for the prototype tool that would

be created to automate the production process of producing the modules once the content had been created and validated. It was essential to achieve consensus on the instructional design features so the development of the tool could proceed and so specifications could be written on each element as a guide for the development of content. Ultimately, the content had to be crafted in a format that matched the requirements of the tool. As mentioned, given the amount of content and the number of modules to be developed, a decision was made that once the instructional design was agreed upon, no changes would be made in the format or instructional design.

Results. Three levels of results in the evaluation process were directed toward creating the instructional design. These included (a) the identification of features to be included in the instructional design, (b) the nomenclature used to label the features, and (c) the nature of the interactivity and the configuration of the features. Of the 21 features selected, only four were not part of the original Meyen model. These included the addition of critical questions, research summaries, a separate practice level and a text version of the multimedia presentation (see Figure 6.1). In the Meyen model the text version served as the script for the multimedia version of the presentation. The most significant change was the configuration of the features into four levels (i.e., orientation, support, lessons and practice). The results of the instructional design evaluation contributed significantly to the usability and navigation design. The aesthetic design also gave the modules their own branding. That is, it was determined that the modules should all have the same look and feel, as well as features. This enabled students to quickly acclimate to the instructional design and technology, allowed them to focus on the instruction and not the features or the technology.

Production System

Methodology. The module production system is a complex series of procedures, protocols, and software that transforms content, initially developed as text, into interactive media for online delivery. The production software includes:

1. *The content delivery forms*, which are used by content developers to enter text-based content such as the outline, glossary, critical questions, presentations and graphic descriptions.
2. *The source management structure*, which is used to control the state and security of the original text and media data. When prepared for distribution on the Internet, modules typically include over 500 graphic and 2000 text files.
3. *The user interface template,* which describe the look and feel of the modules and are designed for rapid global modification of the user interface.
4. *The content rendering engine*, which marries the harvested content with the user interface templates to publish web-ready data.
5. *The distribution system,* which prepares the web-ready data produced by the content transformation engines for downloading to remote servers.

The evaluation of the production software system was ongoing throughout the project. The initial evaluation focused on developing high-quality, reliable and consistent modules that adhered to the Academy design. The user interface templates progressed through several iterations prior to the release of the first module. Formative evaluation of the initial template designs was primarily conducted internally using faculty and graduate

students. Reviews employed email, online threaded discussions and “all-hands” face-to-face sessions. Each of these “Alpha” sessions was followed by design revisions and follow-up review sessions that progressively involved broader audiences, including diverse settings, undergraduate students, preservice teacher educators, the Academy jurors and the board of governors.

The alpha evaluations of the user interface templates were followed by three Beta evaluations during which the designs were fixed and the focus shifted to uncovering bugs or incompatibilities. The initial requirements called for modules that were accessible to a wide variety of learners, technology and network connectivity options. These requirements demanded extensive Beta evaluation using various versions of computer platforms, operating systems, browsers, streaming media players and connectivity options.

Results. Once the initial modules were released the user interface templates were stamped as golden and the evaluation of the production system turned from improving the module template design to improving efficiency. Formative evaluation of the content delivery component involved email communications and several face-to-face meetings with the writers. Revisions to both the procedures and the software were made to streamline the content entry process. The source management and security system was evaluated regularly during the weekly meetings, through email and the internal production web site. These evaluations resulted in greatly improved version control and a system for managing and backing up the source files.

The evaluation of the content rendering engine also took place during the weekly meetings of the Technical Applications Group (TAG), email and the internal production web site. The content rendering engine evolved through three major revisions. Each version has become more reliable, easier to use and more flexible.

Content Development

Methodology. The parameters of the content were set by OSEP. That is, the content areas, which were to be research-based, included instruction for preservice teacher education in reading, positive behavior supports and technology across the curriculum. The evaluation methodology for content centered on identifying the research to underlie the content of the modules, developing content according to the specifications of the tool and production system, validating the content to ensure accuracy and currency, and integrating the content into a pedagogy that worked effectively with the online design.

The approach taken by the Academy in the evaluation of content was closely aligned with OSEP's research-to-practice requirement, combined with the validation of content for each component in the instructional design (see Figure 6.1). A writing team was appointed for each content area, and a board of jurors comprised of national experts in the respective content areas was appointed. The jurors' roles were to provide leadership in the identification of research to be incorporated into the modules, participate in building content maps for each module, and to review the content as developed by the writing teams. Paralleling the work of the jurors in the identification of research, writing teams also generated a review of the literature.

Detailed directions were developed as a writer's guide for each element in the instructional design to facilitate the writing of content to meet the specification

requirements of the template. Modules were written by each team, so several team members were involved in writing each module. They were responsible for generating the content to meet the specifications of the development tool and the editing process carried out by a third party. Once content was drafted, it was subjected to internal review for accuracy, completeness and compliance with the template specifications prior to being edited by a copy editor. Evaluation continued into the production process where the production staff applied their criteria to the content to ensure compliance with the development tool specifications. Once completed, the modules were Beta tested with a focus on usability and navigation.

The most formal approach to the evaluation of content from a validation perspective occurred at the Board of Jurors level. While the writing teams were experienced and knowledgeable in their respective content areas the jurors were selected nationally for their expertise. The jurors served as the external source of evaluation and validation of content. This occurred in several forms. Group meetings were held involving the jurors and writing teams in each content area. Individual jurors were consulted via telephone and some were engaged to participate in the writing. The content maps resulted from collaborative efforts and were collective decisions. Each content map was equivalent to a brief outline of the content.

The content for each module was developed to meet the specifications of the template. Four features within each module were specific to the content of the lessons. For example, lists of 10-15 key points were generated to reflect the intent of the modules, based on the content maps. Subsequently, outlines were developed from which the presentation of content for each lesson was written. This provided four levels of content detail that could be evaluated, each serving as an independent element in the instructional design. The content for each of these features was subjected to internal review.

The four content elements were combined with the remaining features of the module design (see Figure 6.1). When this was done, the content was expanded to include elements such as critical questions, directed questions, activities, assessments, glossaries, and readings. The content-based features were derived from the process of generating the content for the presentation element of lessons. It was the presentation element that comprised the majority of the content from each lesson. A presentation was equivalent to a comprehensive multimedia lecture with audio support and represented the focus of each lesson.

Results. The formative procedures applied to the content development process to ensure appropriate content within the research-to-practice model are reflected in the richness of content and quality of the final modules. The evaluation steps included the involvement or national experts as jurors in the selection of research, the generation of content maps, reviews of the different features of content, and the modules in final form. The role of the jurors varied, in that some became more extensively involved as individuals. The role of the jurors was complemented by the functions of the writing teams within each content area.

The major results from the evaluation of the content generation process included: (a) the need to refine the specifications used as guidelines for writers to a more formal manual to minimize the probability of any variance from the specifications; (b) greater reliance on contracting with nationally recognized experts as writers; (c) infusion of a content manager in the content development process to serve as the quality control liaison

between the jurors, the contracted writer(s), and between the writer and the production team; and (d) refinement of procedures for moving content from the writing stage to the production stage.

Usability and Navigation

Methodology. Throughout the development of the instructional design, user interface templates and content, attention was given to those features that would enhance usability and navigation. Two major evaluation targets related to scalability and meeting the goals of the Academy were: (a) producing online modules that had a high level of usability for the students and (b) designing modules that were easy to navigate and that provided flexibility in navigating through the instructional experience. Both targets were considered critical due to the newness of the online mode of instruction at the time the modules were developed. Even though most universities were offering some courses online and some were offering degrees online, most students at that time had no prior experience with online instruction. This also applied to instructors. Evaluation of usability and navigation could not occur until the instructional design was finalized, the user interface template was operational and content had been produced to meet the specifications of the template.

A series of rigorous formative evaluation procedures were employed in the development of the e-learning instructional modules in an effort to release modules to the public with maximum assurance that they would meet state of the art expectations.

The evaluation of usability and navigation was carried out in four stages: (a) Alpha testing was carried out within the Online Academy; (b) Beta 1 testing, conducted with the assistance of 32 colleges and universities nationwide, involved subjecting the online modules to actual use conditions in teacher education programs; (c) Beta 2 testing took place at the University of Kansas as part of a summer course (40 teachers from two states were enrolled in a module taught by the staff under conditions approximating typical enrollment conditions); and (d) Beta 3 testing, which involved seven institutions and was designed to specifically test the extranet model that involved downloading modules to local servers at participating institutions. While the first stage was conducted internally, the last three were carried out with the assistance of University of Kansas and other institutions of higher education, and a third party evaluator. The four stages combined to provide a very high degree of assurance that the modules would meet the highest standards of usability and navigation feasible.

Alpha testing was the first level of evaluation. Much of this testing involved observing individuals using modules and procedures involving individuals self-reporting on their personal experiences with the modules at different stages of development. Nearly everyone who used the modules while in development, including, but not limited to, the Technical Applications Group (TAG), communicated with TAG about any usability or navigation problems observed during the development process. The TAG team focused predominantly on the technical design and navigation tools of the modules, while program managers closely at both during the first year of the project. All data were given to the TAG team, who in turn oversaw changes to the modules often in conjunction with the writing teams. The result was the development of a set of modules ready for Beta testing.

Beta 1 testing began after revisions dictated by the results of Alpha testing were made. Beta 1 involved a formal set of procedures for peers outside of the Academy to use in testing the modules. This phase of testing was limited to a small, but representative, sample of 32 institutions of higher education. Beta 1 testing was conducted in 1998. Few institutions or students had prior experience with online instruction. Extensive research was done to determine what would constitute a representative sample of institutions. The first step was to determine the 25 largest teacher-producing preservice programs in the United States and then develop a list of potential institutions representing different demographic profiles. It was determined that a sample should be between 20 and 30 test sites, representing the various types and sizes of teacher education programs. Once this was done, invitations to participate in Beta testing were sent to the 750 education deans, directors and department heads, who constituted the entire membership of the American Association of Colleges of Teacher Education (AACTE).

The invitation consisted of a letter describing the mission of the Online Academy and detailed information about module content and design (see Appendix D). Anybody interested in participating as a Beta test site for evaluation of the modules was asked to register online. The registration page was detailed regarding the names of key individuals at the institution that would be using the modules, deans' and directors' names, and many other items. The form also requested information on the size of the institution, the department that would be involved, the number of students enrolled each year and the number graduated, as well as other demographic details of the applicant (see Appendix D). Within one month more than 200 institutions had registered at the Academy web site, indicating a desire to participate. After applying the selection criteria and negotiating with potential applicants, 32 preservice programs were selected to become Beta 1 test sites. Of these, 10 were rural, 12 urban, and 10 were suburban/mixed. Twenty-one states were represented. Four institutions were private, while 28 were public institutions.

A total of 230 students were selected as module users. Of those, 182 were women and 48 were men. 165 used PCs and 64 used Macs. Modules were accessed on desktop computers by 210 students; 20 worked on laptops. They connected to the Internet via modems (151) and LAN connections (49). Students were primarily first-year graduate students or seniors in college. More than 100 were between 21 and 30 years of age with nearly 100 being 30 years or older. Nearly 150 students were special education majors, with the rest distributed among early childhood, elementary, secondary, and other majors. Most students reported they worked on modules from home (119), with the rest working in labs, classrooms or other locations.

Beta 1 testing lasted two semesters, and was carried out through a series of formal and informal evaluation methods. The formal measures were recorded online as part of the module completion process. Each module and lesson within the module included an evaluation form to be completed by students online as they finished each part of the module. Students completed a demographic information form before they could begin a module. Finally, there was a form for instructors to complete online. The informal part of the evaluation took the form of phone calls and email messages largely from faculty using the modules in their classes.

Beta 1 testing focused primarily on module structure, navigation system, feedback on special features, the technology capacity of the participants, departments, the attributes of the faculty and students involved in the test, and the instructional environment in

which the modules were deployed. Modifications in the module design, usability features, and navigation options were made as a result of feedback from this stage.

Academy personnel conducted Beta 2 testing with 40 teachers enrolled for credit under conditions anticipated during implementation. While the teachers were not enrolled in preservice programs, they were considered typical of teachers who enroll in masters degree programs where the modules might be used. The Online Academy worked with directors of special education in Kansas and Missouri in recruiting teachers to participate. A total of 118 applications from K-12 special education teachers, administrators, and students preparing to teach were received. The final sample consisted of 40 subjects pulled from this applicant pool in a stratified, intentional (nonrandom) procedure based on prioritized features (gender, age, and technology experience). If students dropped, replacements were selected from those remaining in the subject pool. Over the course of Beta test 2, 58 individuals were drawn from the residual pool to maintain the continuous enrollment at a minimum of 40 subjects.

The subjects' age ranged evenly from 22 to 55 years of age, with a mean of 38.5 years. Although an equal number of each would have been preferred, the ratio of men to women was unbalanced with 3 males and 37 females even though all males who applied to participate were included. When technology experience was defined as "comfort using e-mail and World Wide Web on a daily basis," the subjects balanced, with 48% claiming to be comfortable using telecommunications and the remaining 52% claiming to be novices. By contrast, when technology experience was defined as "experience with online courses," only 6 of the 40 subjects declared experience, meaning 85% had not taken courses online. Because Academy staff conducted the Beta 2 testing, a variety of options were employed to pursue in-depth interviews on any concerns identified. Phone interviews with subjects were conducted to ascertain problems experienced by subjects and the implications of those problems.

Beta 3, the fourth and final phase of the module formative evaluation program, began with the identification of colleagues that were engaged in online instruction and willing to help in this process. Beta 1 testing had involved institutions with little online experience. The review then moved to institutions that were known to have the technological capabilities and demonstrated interest in working with the Academy in this final Beta test phase. This search also included Beta 1 test sites that had been especially knowledgeable and helpful. Approximately 20 sites were considered, and after initial contacts and discussions, the list was narrowed to 10 possible institutions. Following further discussions about schedule conflicts, department requirements, and several other matters, seven institutions were finally selected to participate in Beta 3 testing. Most were familiar with Academy modules, and one was a former Beta 1 test site. This was important because this stage of testing was carried out using modules that were accessed exclusively from servers located at the Online Academy, rather than from local servers at individual institutions. This was done so the Academy could monitor access and technology problems.

The Academy did not intervene in how the institutions used the modules. The intent was to observe their experience in the installation process under normal conditions to ascertain any modification required in the final version. Detailed instructions were developed for Beta 3 test sites. Special Help files, FAQs, and a Getting Started Tutorial were developed, and made available online. Special help lines for both phone and email

communications were set up, and the entire process lasted approximately two semesters. The goal was to take one last, hard look at the modules and their use by institutions under typical implementation conditions.

Results. The following discussion of results is broken down by testing stage as above.

Alpha testing. During this phase, changes were made in the module design. Specifically, navigation and design elements were modified to minimize user error and to maximize the users effective and appropriate interaction with the content of the module(s). Because of the complexity and size of modules, additional help features and navigation aides were included. The Orientation section was reworked to better explain how the modules were supposed to be used and what results should be expected. Also, module assessments had to be changed in order to present the look and feel of professional software and quality content.

Beta 1 testing. Experience with various levels of technology usage varied among all students. On a scale from 1 to 5, with 5 being the highest level of experience, students ranked themselves 4.1 on use of word processing, 3.6 on use of e-mail, 3.2 on use of the Internet, and only 2.2 on knowledge of online instruction. While students had experience in using technology, students in the sample had very little prior knowledge of online instruction. This was to be expected, since online instruction was very new at the time Beta test 1 occurred in 1998.

Students were asked to rate the modules on several dimensions, using a rating scale of 1 to 5, with 1 being most negative and 5 being most positive. They report having the most difficulty in controlling the RealNetworks audio player with an average ranking of 1.9 (see Table 6.1). This was anticipated, as streaming media was new and few had experienced using RealNetworks audio player. In subsequent testing and in implementation that problem disappeared.

Table 6.1: Student Evaluation of Modules (n = 32)

Module Dimensions	Ranking
Controlling audio player	1.9
Easy access to features	3.4
Effective glossary	3.8
Module review features	3.6
Quality of screen design	3.9
Usefulness of screen design	3.7
Response time of features	3.5
(1=negative and 5= positive)	

They were also asked to comment on the lessons within each module (see Table 6.2). Most students (120) did not use the audio player, probably because of the difficulty they had in controlling it. However, all 141 of the students indicated that the instructional goals, as presented in the modules, were clear. About half felt the technology helped in learning the content. Most (125) said instructions were clear, and 103 thought that the layout of the module design helped them learn. Most (135) believed that the lessons were well integrated, and 103 felt that they were engaging and interactive. This was a reasonable response considering that this was a Beta test version.

Table 6.2: Student Evaluation of Lessons (n = 141)

	Yes	No
Use of audio player?	21	120
Instructional goals clear?	141	0
Does technology help learning?	71	70
Clear instructions?	125	16
Did layout help?	103	38
Appropriate lesson integration?	135	6
Interactive and engaging?	103	38

The students' rating for use of the audio player was 1.9 on a 5-point scale and, as might be expected, only 21 of the 141 students used it. At the time of this test, RealNetworks audio player was unstable on the Mac platform and almost none of the students had it installed on their PCs, even though it was available. It was cutting-edge technology at the time, and too new for most to know about let alone understand how to download and use. It was known that by the time implementation would occur, the technology would be stable across platforms. This is now considered old technology and students are using audio players such as Napster to download and play audio in increasingly large numbers. Being a little ahead of the cutting edge can be problematic when Beta testing. However, emerging technologies must be considered in the development of online instruction.

Students and faculty were provided open-ended opportunities to comment on the lessons and modules. The following contains a representative sample of comments by students.

Student Feedback Comments

1. It was definitely a new approach to learning for me. I liked it.
2. The lesson was ok if listened to on audio. However, when reading, it was too long.
3. Thanks for providing the interview forms!
4. The lesson is hard to navigate when you wish to go forward or back several pages.
5. I learned a lot of valuable information from these modules that I will apply to my teaching situation.
6. Lessons need to be shorter and more help needs to be provided.
7. I enjoyed the activities and discussion with an immediate response.
8. The glossary was great, but after Lesson 1 I received a Javascript error message.

Although the focus of this Beta test was the student as user, unsolicited comments and questions were received from faculty over the two-semester testing period. A few representative comments include the following.

Faculty Feedback Comments

1. In the spring I will be a member of the teaching team, which includes this topic. I think it offers a really good "validation" of the techniques and procedures that

Arizona educators are following. So please continue to count me on the Beta test site team!

2. For me, I learned that I would make the use of the resource as part of an out of class assignment after I am sure students know how to use it. This would be explained on the syllabus - I particularly like the organization, literature from which you have drawn for functional assessment information.
3. A number of the students in my classes do not have access to e-mail. They have been attempting to complete the modules and send their responses through our open access labs here on campus. These open access labs are not configured for individuals and therefore, their responses have not been coming through … the students who have their own computers and e-mail accounts at home are having no difficulty. In fact yesterday one student announced she had even received a response back from [an Academy staff member]. She was impressed. I'm enjoying working with the modules, and plan to continue to use them.
4. That [module] is all I need and I am a happy camper. I appreciate all you are doing with the Online Academy.
5. I think that you folks have provided us with some of the best instructional materials that exist online right now.
6. Academy staff, in order to determine if an error or problem could be replicated, reconstructed very technical problem identified by students or faculty. This was essential to the revision process.

Beta 2 testing. Researchers collected and analyzed data with a variety of qualitative and quantitative methods. For example, one dissertation (Chang, 2000) compared the effect of the level of technological proficiency on variables such as performance, self-efficacy, and attitude toward instructional features. No significant differences in performance, self-efficacy, and attitude were found across the levels of technological proficiency. A second project took the form of an in-depth case study of module features. This work helped module developers understand "server-side" versus "user-side" features necessary for addressing co-mingled technical problems (e.g., when subjects used the module navigation and multimedia RealPlayer technology with different browsers and platforms during implementation). The primary finding was that the amount of experience with technology had no relationship to the level of success in the class.

Beta 3 testing. This stage of testing was important because it focused on the extranet model. It was found that system administrators at extranet sites had difficulty readdressing the links to audio content of modules to be delivered from their servers. The number of links that were necessary to change and the complex coding of Online Academy modules complicated the process of readdressing pointers to audio resources. Some system administrators also experienced difficulty properly configuring their Real Server. As a result, additional help resources were created, including several procedural guides about Real Server and installing Online Academy modules. Additionally, the Online Academy modules were reengineered to change the way audio resource readdressing was accomplished. This significantly decreased the time and effort system administrators had to expend to make the audio resources work from servers under their control, from as long as three hours to 30 minutes to permanently install on local servers.

Improvements to the download system were also implemented, which allowed for improved personalization by institutions.

Implementation/Distribution

Methodology. The requirements for the Academy module distribution system called for an-easy-to use extranet system that would permit authorized system administrators at participating institutions to access modules compressed in two formats (.tar.gz and .zip). This was to be done through a controlled environment that tracked the downloads of each module. The intent was to give institutions maximum control of the maintenance, use and administration of the modules. The Academy also wanted faculty members at participating institutions to be able to reconfigure the modules to use them in part or in total. Several solutions were discussed in weekly and special meetings of TAG.

A number of designs and systems were created and tested before development of the final system, which uses a database to store user information and download status. The download system was tested extensively in-house on multiple platforms before an external beta test was conducted. With assistance from system administrators at the University of Kansas campus computing center and the Edwards Campus of the University, several tests were conducted to determine the reliability and usability of the download system. Based on these tests, several changes were made to increase usability. The most substantial change was reworking the system to address media links in the module to reduce the workload of the system administrator related to making the module function in unique server environments. Certain refinements of the download interface and instruction set were also accomplished. Once full public release of Academy modules was underway, trouble reports were monitored to ensure usability and reliability of the system. Because of the small number of trouble reports, it was possible to contact most of the individuals reporting trouble with the download process to provide them assistance and to learn more about the trouble that they experienced. These contacts resulted in further refinements to the instruction set and Help Files provided to system administrators who downloaded and installed modules on servers under their control at participating institutions.

Results. The original system required the system administrator to make multiple changes on multiple pages. This was a laborious process, taking considerable time to locate each page, locate the links on the page and the change them. It is difficult to estimate the typical or average time for installation per module because of individual differences. Several system administrators were unable to perform an installation because their skills were inadequate. During the evaluation stage of implementation using the extranet model it was found that three hours was not a bad time in installing a single module. This was viewed as unsatisfactory both from the perspective of the Academy and the user. With the new system the links have been made and only one modification needs to be made to an easy-to- find file. This cut installation time to less than 30 minutes per module. Given that a typical module contains over 2000 data and five hundred graphic files, and employed streaming media, this seems very reasonable.

Summary of Lessons Learned

The primary purpose of the formative evaluation procedures was to improve the product, processes employed in development, effectiveness of the implementation and usability by students. Staff reviewed the results from the perspective of determining what changes needed to be made in the design of the online modules or the processes used to create the modules. Following is a summary of the lessons learned as a result of the evaluation processes.

Instructional Design

1. As instructional design features are created, it helps to define them to ensure a common understanding among the staff as to their function and the features impact on content and/or navigation.
2. The development of online instructional designs needs to be coordinated with the development of production systems.
3. In online development projects that produce significant amounts of online instruction design and production decisions must be made prior to initiating the content generation process.
4. Online instruction intended for national dissemination must be sensitive to the technology capacity of the target audience.
5. Participation of content writers and production process developers in decisions on instructional design is important in projects that create significant amounts of online instruction.
6. Setting standards to guide the development of instructional designs facilitates collaborative work in creating the actual design.
7. As production begins, new technologies will emerge that merit consideration. However, the value of adding new features must be weighed against the time and costs of retrofitting the production tools that have already been developed.
8. When creating the instructional design of online instruction, although aesthetics and navigation are important issues, those decisions can remain fluid while content development begins.
9. In developing instructional designs for online instruction, the focus should be on sound instructional principles and the nature of the content in contrast to focusing primarily on the capabilities of the technology.
10. Students value the ability to access any instructional resource in an online instructional program.
11. Many students prefer text resources as an option to multimedia presentations. For example, sometimes they are unable to access the multimedia resources, but can access the text resources or even print them.
12. Providing several levels of content to students for review is advantageous as it allows students to determine what they need to study and increases their efficiency.

Content Development

1. The use of national experts as jurors responsible for setting the content parameters and identifying supporting research was effective.

2. When focusing on research to practice, it is important to be sensitive to the variability in the amount and quality of research carried out relative to content areas.
3. Compliance with content specifications is closely related to the intensity and quality of training writers receive.
4. When a number of people are writing content for different features of a single module, coordination is essential to ensure that all parts come together on schedule.
5. Writing content against specific specifications with structure and length limitations is a new experience for many. It calls for close monitoring of work in progress so that corrections can be made in process if necessary.
6. Content writers must have an understanding of the ultimate product so that they appreciate the importance of adhering to specifications.
7. While there are some advantages in having writers on staff, since their work can be more easily monitored and communications are facilitated, there are also advantages in contracting for writing. For example, the latter allows for a larger pool of content experts.
8. Carefully defining each feature of the instructional design prior to beginning to create the production system enhanced the structuring of the content development process.
9. Placing a moratorium on new features once content development began proved to be a wise decision. Had this not occurred and new features were added, the task of retrofitting all completed modules would have been very costly in time and resources.

Production System

1. It is essential that agreement be reached on the instructional design and that the content parameters be well defined before the technical aspects of the production system are developed.
2. Responsibility for quality control needs to be vested and those responsible should be fully knowledgeable about the template requirements and capable of communicating the specifications to the content writers.
3. Once the design is final and the production system is in place, training must be provided to all writers to ensure compliance with the specifications.
4. Alpha testing involving naive participants is central to building a quality system. It needs to be carried out prior to finalizing the system.
5. Because the content validation model employed involved national content experts, the Beta testing focused on navigation and usability. This worked well as it allowed the staff to concentrate on the features that enhanced student progress through the online modules.
6. Creating our own production system and development tool proved to be a good decision, as it allowed us to control the features of the system without being dependent on an external source to maintain support for the system. Because we were committed to making the modules available to institutions of higher education without cost, we were not tied to a fee structure.

Usability and Navigation

1. Testing usability and navigation using staff members is of value even though they are familiar with the content and knowledgeable of the navigation options.
2. The involvement of individuals in Alpha testing who are naïve about the content and inexperienced in e-learning is essential to determining the effectiveness of navigation systems and the preferences of learners.
3. The level of interest on the part of institutions of higher education in e-learning was sufficient to generate a significant response among universities wanting to volunteer to participate in beta testing.
4. A common look and feel for the instructional design is important. Students value not having to learn a new design with each new course.
5. Multiple navigation systems are helpful. Students prefer having several options and quickly form a preference for a navigation pattern.
6. The level of computer skill possessed by students does not affect their performance in e-learning instruction.
7. Formative evaluation procedures can be designed to yield specific results that can be employed in the revision of e-learning content and design features.
8. Students can adequately describe problems they encounter or features that are missing.
9. If a problem is major, students will be consistent in identifying the problem and in offering proposals for changes.

Implementation/Distribution

1. The decision to use an extranet model for installing the online instruction on the participating institution's server needs to be made early in the development process.
2. The time required to install online instruction via the extranet model can be reduced to a few minutes per course.
3. The extranet model is valued by participating institutions as it allows them full control of the online instruction.
4. Having signed agreements with the participating institutions designating contact people and committing server space adds a level of accountability that facilitates installation.
5. Instructions for installing online instruction via an extranet model can be placed on online and effectively used in making installations.
6. Implementation is most effective when on-site systems administrators and faculty work as a team in the installation process.
7. Maintenance of a web site is an effective vehicle for communicating with participating institutions during the implementation process.

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Chapter 7

The Online Academy: An Extranet Approach to Virtual Implementation

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Abstract

The Online Academy (H029K73002) was funded by the Office of Special Education Programs (OSEP) to develop online instructional modules in the content areas of reading, positive behavior support and technology across the curriculum. Targeted for preservice teacher education programs in Institutions of Higher Education (IHEs), the modules have been implemented by over 170 institutions. This paper addresses the processes employed by the Academy in implementing the modules nationally and the results of that effort.

Background

The Office of Special Education Programs (OSEP) funded the Online Academy as a three-year project in 1997 to develop online instruction for preservice programs in teacher education. The content areas were reading, technology across the curriculum, and positive behavior supports with an emphasis on research to practice. A design tool and production process was created to automate the generation of online modules once content had been prepared according to prescribed specifications. Twenty-two modules were developed, evaluated, and disseminated through the implementation model to be described in this article. The modules were content-rich, interactive, utilized streaming media and were designed to be offered fully online. Each module includes over 2000 text and 500 graphic files. Each module involves approximately 12-14 clock hours of engaged instruction.

While use of Academy modules by university-based teacher education programs nationally was the ultimate goal of the Online Academy, many IHEs did not possess the needed technology infrastructure when the modules were first released. This added to the implementation challenge. To maximize implementation, the processes that were targeted for implementation were integrated into the project from the beginning. For example, early in conceptualizing the Academy model, two critical decisions were made that greatly impacted implementation. First, it was decided to base implementation on an extranet model. This involved designing the technologies for delivering the modules so that all modules could be downloaded locally and delivered from the participating institutions' server. Second, it was decided that the online technology to be developed must be scalable nationally and not dependent on advanced technologies that might only be available at some institutions. While adding to the complexity of the design and development tasks, these two decisions enhanced the probability of successful implementation.

For the Academy, implementation represented the culmination of all activities that took place in the design, development, production, and testing of the e-learning modules. Formative procedures were employed to ensure that the content and design were conducive to maximizing implementation. Specifically, prior to implementation, the modules were subjected to extensive evaluation carried out in five stages (Meyen, 2001).

Two stages of Alpha testing occurred in-house in a highly focused process. The emphasis in stage 1 was to assess the effectiveness of the user interface design. In the second stage of evaluation, emphasis was on assessing how the modules might be managed when offered to groups of students. To that end, the Academy enrolled teachers from two states under conditions similar to how they might ultimately be enrolled during implementation. The students completed a module and earned credit for their work. Data were collected on their performance, navigation preference, and problems encountered.

In addition to two stages of alpha testing, Beta testing was carried out with 32 institutions of higher education over a period of more than two years. This also included a controlled implementation phase following the second Beta test, but prior to full implementation. The intent of the controlled implementation was to test the installation process via the extranet model and to determine how long it took to download the modules and install them on the servers of institutions adopting the modules. The controlled implementation, involving seven institutions, revealed that the time required for downloading and installation was excessive. This was due to the streaming media features of the modules. After additional programming to accommodate the streaming media features of the modules, the time required to install a module locally was reduced from a minimum of three hours each to 20 minutes per module. The controlled implementation became Beta test 3.

A decision was made very early in the project not to use traditional forms of dissemination in implementation of the modules, but to employ a model that was more compatible with online instruction. It was decided that flexibility, access, revision, and immediacy of posting for use should characterize the implementation of the Academy online modules. However, in 1997 when the Academy was originally funded there was almost no literature on how to achieve this. Online instruction was just emerging. Universities were still debating the efficacy of online pedagogy and there was no comparable project of similar scope to the Academy to collaborate with in designing a national online implementation model. Technologies in place today were on the horizon, but they were not stable enough for the magnitude of implementation in which the Academy would ultimately engage. Because the Online Academy was a three-year project with no assurance of continuation, utilizing resources of the project for sustained implementation or technical support on a continuum was not an option.

Based on announcements from industry about emerging technologies, the Academy committed to an extranet model very early. If successful, distribution would be immediate. Participating institutions would be able to install the modules on their own servers and manage their use. As beta testing of modules progressed, projects employing online distribution systems began to be reported in the literature. Some were related to K-12 schools (Visscher, Wild, & Alex, 1999). While not directly applicable, they nevertheless provided useful information. Cohen and Hickman (1998) in reporting on large-scale implementation programs in science and math, emphasized the importance of matching the curriculum with district needs. Because OSEP had already ascertained the need for the three content areas being addressed by the Online Academy it was assumed that they matched the needs of teacher education programs nationally. Bronack and Riedl (1998) listed the conditions necessary for implementation in the context of pedagogy and various attributes of media technologies. During the history of the Academy sources

began to appear in the literature that addressed the capacity of the extranet model and its application to schools and universities (Littman, 1998; Preston & McCrohan, 1998).

Methodology

Implementation was built on a formative approach to assessing and modifying the design, development, production and testing procedures for the modules. The intent was to integrate into each process what we learned from evaluating the other processes in order to improve the product (i.e., the modules) and to enhance their implementation or distribution (Meyen, 2001).

Implementation took two forms. First, controlled implementation involved testing under normal implementation conditions. The intent was to identify and correct any problems associated with the installation of modules on the server of implementation sites. Second, full implementation consisted of the release of Academy modules for use by participating institutions. This involved operationalizing the extranet model on implementation sites with minimal technical support from the Academy. This process allowed instructors from participating institutions to access the Academy website and download the modules for installation on their campus servers.

Controlled Implementation

Recommended by OSEP, this stage was to be carried out with 5-10 technology-enhanced institutions using faculty and staff who were technology-competent and highly motivated to use the modules. During controlled implementation the Academy wanted to monitor access and technology problems associated with the use of the modules. In Beta tests 1 and 2, participating faculty and students were largely inexperienced in online instruction. Therefore, it was important during the controlled implementation to submit the modules to use by faculty who had some experience with online instruction. Since the extranet model was the only part of the module design that was not tested during Beta tests 1 and 2, it was essential that any problems in the procedure be resolved before full implementation began.

The controlled implementation was important for another reason. Once Beta tests 1 and 2 were completed and the modules were deemed stable, the goal was to move all modules and technology to servers located at, and maintained by, the individual preservice programs wishing to implement them through the extranet model.

Controlled implementation testing began with the identification of colleagues who were engaged in online instruction and were willing to participate. Attention then shifted to institutions that were known to have the technological capabilities as well as an interest in working with the Academy in this final testing phase. This search included Beta 1 test sites that had been especially helpful in providing evaluation feedback on the modules.

Approximately 20 sites were considered for controlled implementation. After initial contacts and discussions, the list was narrowed to 10 possible institutions. Following further discussions about course conflicts, department requirements, and several other matters, seven institutions were selected to participate. Most were familiar with, and some had used, Academy modules, and one was a former Beta 1 test site. Detailed instructions were developed for these sites including developing and making available online special Help files, FAQs, and a Getting Started Tutorial. Special help lines for both phone and email communications were also set up. The entire process

lasted approximately two semesters. The goal was to take one last hard look at the modules and their use by universities before beginning full implementation. It was especially important that the extranet downloading process go flawlessly for those institutions opting to implement the modules.

Full Implementation

Full implementation occurred as soon as the controlled implementation evaluation process was completed and the modules were in final form and stable. As previously mentioned, a requirement of the Online Academy was to employ the extranet model. The extranet model was made necessary by two factors. First, the Academy wanted to achieve the greatest dissemination possible, and it was felt that other institutions might want to brand the modules with their own names and course information. The extranet model would provide a greater sense of ownership than a model requiring use of modules from Academy servers. Second, the Academy had a limited lifespan governed by a three-year federal grant and could not provide any assurance of continued support after the grant ended. Therefore, once implementation started, all responsibility and control for maintaining and distributing the modules would have to reside with participating institutions, not the Online Academy. Although the extranet model added complexity to the design and distribution process, it was hoped that it would be seen as an asset and contribute to wider distribution of the modules.

One requirement for implementation via the extranet model was that each host institution must meet certain technical requirements necessary to download and utilize the modules. For example, each institution had to enter into a formal implementation agreement, which had to be signed by the dean or program director, attesting to their commitment to installing and using the modules as prescribed. A faculty member and a technology systems administrator were also required to be named. They also had to provide the necessary server hardware and software to run the modules locally and provide the technical assistance and server support needed to install and maintain the modules on an institution-based server. Specific requirements included a functioning Web server of any type with at least 50 MB of free storage space per module and a functioning Real Networks G2 server with at least 20 MB of free space per module. Furthermore, a system administrator with Web server and G2 skills had to be identified, along with a technical support person with whom instructors and students would work after classes began.

The final implementation process involved notifying preservice education programs nationally of the availability of Online Academy e-learning modules and the process they would need to follow to obtain them. To accomplish this, the Academy first produced a packet of information materials describing all the modules and their content, technical and system requirements for module setup, and various other features of online instruction. The packets, along with a cover letter, were mailed to the deans, directors and department heads of 750 teacher education programs that constituted the membership of the American Association of Colleges of Teacher Education (AACTE).

The cover letter explained that the modules were available, what an institution needed to do to obtain them at no cost, and specified a deadline for submitting a formal agreement (see Appendix D). The packet also included an agreement form, which included details about downloading the modules and the institution's responsibility for maintaining and supporting the modules once installed on local servers. Specifically,

participating institutions were required to register with the Academy to use the modules. They were also required to meet the following conditions for implementation and to accommodate specific implementation requirements.

Conditions of Implementation

1. The modules or lessons may be offered as independent courses or integrated into regularly offered courses in the preservice teacher education program.
2. The tuition pricing policies of the institution shall apply in the offering of the modules.
3. The modules shall not be offered for continuing education credit. (The Academy reserved this option.)
4. The institution may add its name and course identification to the modules in order to meet its enrollment needs; however, the OSEP and Academy identification credits for the development and design of the modules must remain as embedded in the modules.
5. No modifications shall be permitted to the content of the module. The modules, however, maybe used in total or in part.
6. The Online Academy and University of Kansas expressly disclaim any and all express or implied warranties and make no express or implied warranties or representations of any kind including but not limited to warranties of merchantability, of fitness for a particular purpose, and that the use of the Academy modules will not infringe on any patent, copyright, trademark or other rights. Further, the Online Academy and the University of Kansas make no representations whatsoever that the Academy modules are free from liability for patent infringement or may be used without infringing any other patent, except to the limited extent that the Online Academy and the University of Kansas represent that, as of the effective date of this agreement, neither the Online Academy nor the University of Kansas has actual knowledge that the Academy modules infringe any valid and enforceable patent held by a third party.

Institutional Requirements for Implementation

1. Adherence to the above "conditions for implementation."
2. Designate a faculty member and a technical support person as the contact people during the installation process.
3. Provide the technical assistance and server support needed to install and maintain the modules on an institution-based server. The Online Academy is not responsible for any installation, maintenance, or troubleshooting that may be required for installation and operation. A functioning Web server of any type is recommended with at least 50 MB of free storage space per module and a functioning Real Networks G2 server with at least 20 MB of free space per module.
4. Identify a system administrator with Web server and G2 skills, as well as a technical support person with whom instructors and students will work. (See #2 above.)
5. Require instructors to complete the instructor's module prior to teaching the modules.
6. Agree to make general technical assistance available to students as needed.

When the installation process began for implementation in the 2001 school year in May of 2000, the Online Academy set up a series of conference calls designed to answer questions and respond to needs for technical assistance during the installation process. A follow-up mailing to the same 750 institutions was made one month later in an effort to secure wider participation.

Results

The controlled implementation process revealed that system administrators at extranet sites initially had difficulty readdressing the links to the audio content of modules to be delivered. Because of the streaming media feature there were a number of links that had to be changed. The coding of the Online Academy modules was also complex and added to the time requirement. In addition, some system administrators experienced difficulty properly configuring their Real Server. To resolve this problem, additional help resources were created, including several procedural guides about Real Server and installation of Online Academy modules. Further, the Online Academy modules were reengineered to change the way audio resource was readdressed. This resulted in a significant decrease in the time and effort system administrators had to expend to make the audio resources work from servers under their control. Improvements to the download system were also implemented to allow for better personalization and performance. Following many weeks of testing and retesting of module download and setup designs, a successful combination of enriched help files and simplified module design produced the desired results.

As of July 1, 2001, 170 had signed the implementation agreement forms requesting to use the modules. Of the institutions submitting agreements (see Appendix E), 88 downloaded some of the modules to their own servers within a semester. Downloading occurs as modules are used for the first time. Figure 7.1 shows the geographic location of the sites with signed agreements. One important consideration

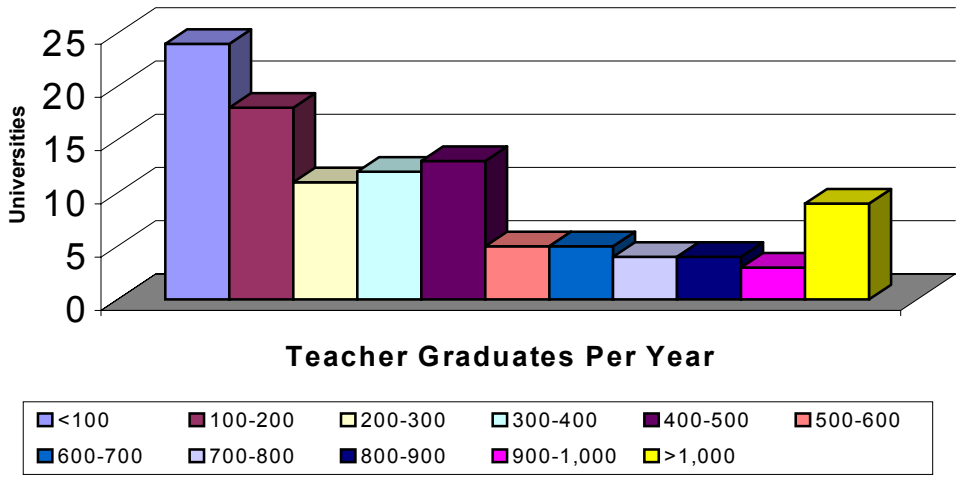
Figure 7.1: Geographic Location of Sites

regarding the success of implementation has to do with the types of institutions that have signed agreements to use Academy modules. Since the size of impact is, to some extent,

related to the number of teachers a university graduates each year, data on the size of institutions are presented in Figure 7.2. Of the 170 institutions that submitted signed agreements, 24 graduate fewer than 100 teachers per year, 18 graduate fewer than 200 teachers per year, 11 graduate up to 300 teachers per year, and nine institutions graduate over 1,000 teachers per year. (Note: The numbers of institutions reported in Figure 7.2 do not total 170 because no data were available for some institutions.). For institutions with graduation rates above 1,000, three graduated fewer than 1,100, four graduate less than 1,200 and two graduate between 1,400 and 1,500 students per year.

As illustrated in Figure 7.2, the numbers of institutions are skewed toward smaller schools and departments of education. However, the number of graduates annually by the initial group of participating institutions was approximately 17,000.

Figure 7.2: Teacher Production by Universities



Summary of Lessons Learned

1. The controlled implementation process proved valuable in uncovering problems related to the installation process via the extranet model. Since this was a new process, it was difficult to anticipate the problems that might be encountered at institutions nationally in implementing an online implementation process. Although the modules themselves were known to be stable and effective, the downloading process required for the extranet mode of implementation had not been tested.
2. National beta testing may contribute to interest in implementation. The very process of beta testing in numerous universities nationwide may have generated interest in using the modules by some institutions that had not otherwise expressed an interest.

3. Knowing that the modules had been thoroughly tested probably also contributed to the level of interest when it came time to implement the modules nationally.
4. It became apparent early that online instruction was a topic of major interest to deans and directors in schools of education nationally--both in terms of technology and the content. What began as an interest in new technology may have increased due to the richness of the module content?
5. The level of readiness for carrying out the extranet process of implementation, although not directly related to the size of institutions, varies greatly across the nation. Sometimes small institutions in rural settings had very advanced technology capabilities, whereas large metropolitan institutions needed much more technical support from the Online Academy.
6. The extranet model has merit in national online dissemination. Allowing institutions the independence of installing the modules on their own servers appears to encourage ownership and use. It also offers the advantage of eliminating dependence of a central source for future use.
7. Direct contact with faculty enhances implementation. That is, while communication with deans and/or directors is important in the adoption stage, direct and frequent communication with the faculty member who will be using the modules in instruction contributes to use.
8. Engaging the technical support staff at the institutional level facilitates installation at the institution level. Although some faculty members are fully capable of downloading and installing modules on a local server, when the online instruction being installed involves streaming media, technical skills beyond those typically possessed by faculty are required.
9. The installation process must be efficient and convenient: When institutions are installing the online instruction, their faculty may not have had an opportunity to experiment with the instruction and, therefore, are not likely to have a full appreciation of the value of the resources. If the installation process is time-consuming or unnecessarily complicated, they may not persevere. Also, technicians may form opinions about the quality of the instruction based on their perceptions of the effectiveness of the installation process.
10. When inviting institutions to participate in a project as comprehensive as the Online Academy, it is difficult to ensure that the invitations are received by the targeted person and that it is given the consideration warranted. First-class mail was used in all communications announcing the availability of the modules to deans and directors. They were encouraged to involve faculty in the decision to participate. While having 170 institutions sign implementation agreements was considered successful, 12 responses were received indicating that at this time they were not in a position to participate. Faculty also later informed the Academy that they did not think their dean had received the invitation materials. Given the positive responses from 170 out of 750 packets sent to deans and directors, it is not known whether (a) the non-responses represent negative decisions, (b) the packets were not received by the appropriate person, (c) the packets were received but failed to receive the needed attention, or (d) were not valued because of the online format.

11. Careful attention to detail when providing information online appears to reduce the need for technical assistance in the installation process: Once the installation process was refined, detailed information was posted and opportunities or conference calls to offer technical assistance were announced. Names of support personnel were also distributed. Of the 88 installations during the first semester following the announcement of the implementation process, nobody requested technical assistance on the need to participate in conference calls on the process.
12. Establishing requirements for implementation appear to facilitate adoptions. Prior to being approved for implementation, institutions were required to comply with specified requirements and to sign an agreement form. This included designating a faculty contact, naming a technical staff support person and ensuring that the technical capacity to accommodate the modules would be provided. We believe that this process contributed to the large number of implementation sites.

Although the implementation process is complete and the Online Academy no longer exists as a funded project, the e-learning Design Lab (eDL) continues to respond to universities requesting an opportunity to implement the modules. These requests are accommodated (See the eDL web site at www.elearndesign.org).

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Chapter 8

A National Assessment of Staff Development Needs Related to the Education of Students with Disabilities

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Abstract

The Online Academy (H029K73002) was funded by the Office of Special Education Programs (OSEP) to develop online instructional modules in the content areas of reading, positive behavior supports and technology across the curriculum. Targeted to teacher education programs in Institutions of Higher Education (IHE), the modules were implemented by over 172 institutions. A supplemental award was made by OSEP to develop five additional modules designed to meet the staff development needs of teachers. Focus groups combined with phone surveys and an online ranking system were employed to identify and prioritize national staff development topics representing needs of teachers in K-12 schools. Focus group participants included staff members from State Educational Agencies (SEA), Comprehensive System of Personnel Development (CSPD) programs, and staff members of State Improvement Grants (SIG), National Association of State Directors of Special Education (NASDSE), Regional Resource Centers (RRC) and OSEP. One hundred and thirteen topics were identified in four priority categories. Five topics were selected as meeting national criteria. They included (a) curriculum design and instructional accommodations for secondary students with mild disabilities, (b) relating instructional assessments to standards, (c) models for collaboration, (d) transition-focused secondary education for all students, and (d) developing standards-based IEPs. Online modules have been developed on these topics.

Background

IDEA compliance, curriculum standards, faculty turnover, high-stakes testing and increased expectations among policymakers and school patrons are among the many factors that contribute to staff development needs for experienced teachers. As teachers pursue personalized staff development plans, they seek opportunities to enhance their skills and to expand their knowledge. Typically, if they are engaged in a graduate degree program they are likely to depend on their home institution of higher education (IHE) as the source for their professional growth experiences. If they are not pursuing a degree program, they may look to their employer to provide staff development opportunities or, on their own, seek opportunities that best fit their needs and aspirations.

However, with the emergence of the Internet, access to professional development opportunities is increasing at an unprecedented rate. Offerings by IHEs on the Internet are increasing, professional associations are developing web sites to offer staff development, and e-learning in the commercial sector is evolving as a source for staff development. Thus, the Internet has dramatically changed the potential for accessing staff development anytime, anywhere.

The need for staff development among teachers to fully implement the Individuals with Disabilities Education Act (IDEA) is exacerbated by the growing shortage of trained

personnel and the tendency for states to allow emergency waivers for noncertified teachers to enter the field when the supply of certified teachers does not meet the demand. In particular, educators trained to work with students with disabilities continue to be in short supply (Brownell & Smith, 1993, 1997; Lauritzen & Freidman, 1993), a shortage that is expected to become even more acute in coming years for several reasons. First, the public school population, ages 5 through 13, rose to approximately 38.5 million in 1998 and continues to increase. Further, the U.S. Department of Education projects the need for an additional two million teachers over the next decade as veteran teachers retire (i.e., baby boom generation).

This critical personnel shortage is particularly significant when considering the chronic shortage of special education teachers over the past decade. For example, the Twentieth Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act (1998) reports that from 1987-1988 to 1995-1996, shortages for teaching positions nationally for students aged 6-21 with disabilities have averaged about 27,000 fully certified teachers per year. The production of new teachers is inadequate to meet projected personnel needs. This means that large numbers of teachers will enter the profession with significant staff development needs.

In response to the growing need for staff development among teachers, OSEP contracted with the Online Academy (http://onlineacademy.org) to develop a series of exemplary online modules for staff development on topics of high national concern. The online format would allow for experimentation with online instruction as a mode of delivering staff development. The modules would be designed using the production tool developed by the Online Academy to produce multimedia interactive online modules. The modules include the following features: be content-rich, self-paced, accessible 24-7, employ streaming media, be interactive and have a research-to-practice focus.

A prerequisite to developing online modules was to identify which topics were representative of nationally perceived needs. It was apparent that if only five online modules were to be developed (a limitation of resources), it was essential to select topics that were of national importance. While the five topics could have been selected by consulting with a few staff development specialists at the state and national levels, a decision was made to systematically examine the need for staff development nationwide. Not only would this result in better decisions on the topics, but having an inventory of assessed staff development needs would be useful to SEAs and LEAs as they plan staff development programs in the future. Additionally, such an inventory might have implications for preservice teacher education programs. Finally, professional organizations, publishers of teaching resources and individuals engaged in developing staff development programs would also find the inventory to be of interest.

Methodology

The first challenge was to determine an appropriate method for prioritizing staff development needs nationally as a basis for identifying the topics for the staff development modules to be developed. Several examples of needs assessment strategies have been employed at the state level. For example, Azin-Manley (1996) used a survey instrument to obtain input from all teachers and administrators in Wyoming schools. In another survey, the Illinois State Board of Education (1992) carried out a statewide needs

assessment for personnel associated with pre-kindergarten programs for children at risk of academic failure, prevention initiative programs for at-risk infants and toddlers and their families, and the model early childhood parental training programs.

A similar model could have been used to assess the staff development needs of teachers nationally in meeting the needs of students with disabilities. However, the problem in adopting this strategy for a national needs assessment was in determining the most representative sampling, as well as cost and time requirements.

Two other statewide strategies were considered. One was a model implemented by Black (1998), who surveyed all directors of technical and adult education within a state who were in attendance at a conference. The results were supplemented by a mail survey of all instructors statewide. Taking another approach, Hart (1995) reported on the use of focus groups to collect qualitative data on staff development needs. The advantages of focus groups are that data can be collected in a relatively short amount of time and the results can be combined with other measurement methods. Focus groups also serve to improve communication and allow for clarification to be obtained on recommended topics.

Based on these findings, we opted to develop a hybrid model that employed focus groups, engagement of key state agency staff attending a national conference and an online ranking system to build a set of national priorities in staff development to guide the initial development of online staff development modules.

Advisory Board

Working with the leadership of OSEP and the National Association of State Directors of Special Education (NASDSE), a national advisory board was assembled comprised of State Education Agencies (SEA), Comprehensive System of Personnel Development (CSPD), State Improvement Grants (SIG), Regional Resource Centers (RRC), and National Association of State Directors of Special Education (NASDSE) personnel. The advisory board included 10 carefully selected individuals with expertise in staff development, as well as professionals from the Monitoring and State Improvement Planning Division and the Research to Practice Division of OSEP. This board served a central role throughout the topic identification process and continued to provide significant input during the module development stages.

A qualitative approach, relying heavily on focus groups involving resource experts, was adopted, combined with an analysis of source documents containing information related to staff development needs, a phone survey and an online prioritization instrument.

Focus Groups

Four focus groups were held to generate staff development topics perceived by the participants as representing national concerns and warranting an investment at the national level. Each Focus Group session lasted approximately 60 minutes.

One group session consisted of 15 OSEP staff members from the divisions of Research to Practice and Monitoring and State Improvement Planning. Each participating staff member had responsibility for monitoring state implementation of IDEA, thus providing perspectives on staff development needs. This session was held in the Monitoring and State Improvement Plan Division (MSIPD) offices.

Two focus groups were held at the CSPD 2000 national conference. Participants recommended by the staffs of NASDSE and OSEP as individuals who were knowledgeable about national staff development needs were invited and assigned to focus groups in advance of the conference.

The fourth focus group was made up of the 10-member national advisory board. Since members of the board were selected because of their perspectives on staff development and knowledge of state needs, their input was considered important to have factored into the topic identification process.

Focus group procedures. The following procedures summarize the focus group process:

1. The number of participants per group averaged 13.
2. The focus groups were held in the OSEP offices and during the 2000 CSPD Conference sponsored by NASDSE.
3. The same facilitators and recorder (a three-person team from the Academy) were involved in each focus group. Two functioned as facilitators and assumed the role of stimulating discussion and keeping the discussion focused on generating and clarifying topics. The third person recorded the topics emerging from the discussion on which there was group consensus.
4. Immediately following each session, the three-person team refined the list of topics and sorted them into categories. Independent summary reports were prepared for each session, but the reports were not shared with participants in subsequent sessions prior to their session. This allowed each group to be independent in its generation of topics.
5. Following the first focus group, the team repeated the refinement process for each session. Specifically, the categories derived from the first session were reconstructed after each session as the topics generated in each session were factored into the sorting process. Consequently, as the number of topics grew, the categories changed depending on the emphasis of the topics added to the pool from the previous session.
6. An inventory of staff development topics was created based on the consensus topics emerging from the groups.
7. Following the last focus group, a final refinement and sorting process was employed. The last group was the 10-member advisory board, whose composition was similar in terms of expertise to that of the other focus groups. Having the advisory board serve as a focus group enhanced their later role in working with consultants and content writers.

Phone Survey and Review of Source Document

This component of the process consisted of the following:

1. A firm that provides evaluation studies was engaged to conduct a phone survey and to review SIG proposals and selected reports on staff development in the literature.
2. The phone survey consisted of a sample of over 25 individuals nationally, including regular education teachers and school administrators. The phone survey and literature review were carried out parallel to the focus groups and completed at the same time.

3. A series of stimulus questions was used to cause respondents to think about staff development needs.
4. The Study Group Inc. prepared a report independent of the focus group report process. The report results were not made known to the Academy team of facilitators until the results of the focus group and the validation process were completed. This allowed the survey data to be factored into the prioritization process as an independent source of input.

Validation Process

The validation process allowed all participants across the focus groups to respond to an instrument containing all topics generated via the focus group process. The specific steps of the process are outlined below.

1. The combined results of the focus groups were analyzed by the Academy team and redundancies were eliminated.
2. An instrument was developed containing nine subsets and 113 topics. A subset was defined as topics related to a theme or similar in terms of the training implied. No topic was assigned to more than one subset. The number of topics per subset ranged from four to 22.
3. The instrument was posted on the project web site and all responses were collected online. Respondents were notified of the URL, provided directions on the task that they were being asked to perform, that is, to prioritize each topic by placing them into one of four categories (see Table 8.1 in the Results section) and given a timeline for responding.
4. The data were analyzed by ranking the topics according to the categories in which the respondents placed them. Topics were then judged to be of national, state and local significance.
5. The results of the phone survey and the literature review were analyzed to determine the relationship between the topics identified through those processes and the focus groups. They were then crosschecked against the results of the categorizing process that was carried out online. For purposes of selecting the five topics to be developed into online staff development modules, these data were recorded along with the instrument categorizing results.
6. Anticipating that a substantial number of topics might be classified as being of national significance and warranting being addressed through a national effort, a set of decision rules for selecting topics for module development was developed by the Academy team in conjunction with the advisory board. These decision rules were used as criteria for selecting the topics for module development from among those judged to be of most importance nationally. The selection criteria were decided during an advisory board meeting.

Decision rules employed by the board included the following and the topics must:

1. Be research-based or highly validated. (This was consistent with the mission of the Online Academy.)
2. Entail content and instructional goals that can be incorporated effectively within the Academy module design. The Academy module design had been already validated. Thus, incorporation was important in order to capitalize on the

investment already made in the technology and to expedite the development process within the designated timeline.
3. Require content and activities to effectively cover the information and skills central to the topic within the limitations of a three- or four-lesson module (about 12 clock hours of instruction).
4. Accommodate a range of needs that transcend grade level, disability groups and that relate to the requirements of IDEA.
5. Have been proposed as a need area from several input sources rather than a single source.
6. Have a high probability of being successfully addressed through staff development efforts and be valued by the target group.

A major limitation of the study was that it focused on school-age programs and did not include early childhood staff development needs. Further, in the process of selecting topics, the board opted to orient the modules toward teachers at the secondary level. Comments throughout the forum sessions indicated that staff development was needed at the secondary level and there were fewer resources available. However, the topics were applicable for the K-12 programs unless specifically addressed to an age group.

Results

The results of the prioritization responses to the instrument are shown in Table 8.1. The number of responses per category are reported in the four columns on the right hand side of the table. In reviewing the results in Table 8.1, keep in mind that the purpose was to identify topics of national significance that warranted an investment into creating online development resources for national dissemination.

The categories were defined as follows:

Category 1: National Response (High Priority): Needs to be addressed nationally and in the immediate future. (Use this category for no more than 10 of the topics listed in the next pages.)

Category 2: National Response (Medium Priority): Very important, but if a choice had to be made to develop a priority the Category 1 topics would be selected.

Category 3: State Response: Important priority but a topic that could be addressed at the state level rather than through a national initiative.

Category 4: Local Response: An important topic warranting attention at the LEA level. May require SEA leadership but represents a topic that can and should be addressed at the LEA level.

Items with asterisks in Table 8.1 indicate the topics were selected for development into online modules after applying the decision rules previously mentioned. Because the topics were not all independent, that is, many overlapped when viewed from the perspective of how they might be dealt with through a staff development program, the framing of the topics selected for module development varied somewhat from the wording listed on the survey instrument. Clarification of the topics occurred through a two-day planning session involving the board, Academy team, and consultants with expertise in the skills and knowledge associated with the high-priority topics. The intent

here was to translate the selected topics into wording content maps that were more meaningful to teachers.

The process entailed a review of the ranked topics in the four categories to ensure that there were no topics in Categories 2, 3, or 4 that, when examined by the advisory board and consultants, might be viewed as warranting special consideration. Because the membership of the board and consultants included individuals with extensive knowledge of states, staff development programs, and IDEA, their perspectives provided a validation of the ranking system.

This review did not result in any topics being moved to Category 1. However, it did stimulate discussion on two issues. One related to the omission of early childhood in the needs assessment process; the other related to focusing on topics most important to middle and secondary schools. Participants agreed that should further staff development modules be developed in the future, preschool needs should be included in the assessment process. With reference to the middle and secondary school emphasis, it was decided in reviewing the Category 1 priority rankings that the general need for staff development was greater at those levels. This is not to suggest that the topics do not generalize to teachers at the elementary level. Consequently, once the priority topics were selected from Category 1, they were analyzed in terms of their application to the middle and secondary school levels.

Once the topics were selected, content maps in the form of outlines were developed as a way of operationally defining the topics. This was viewed as important prior to engaging writers to develop content for the modules.

Following are the topics selected for development in the form of online modules.

1. Curricular design and instructional accommodations for secondary students with mild disabilities.
2. Relating instructional assessments to standards.
3. Models for collaboration.
4. Transition-focused secondary education for all students.
5. Developing standards-based IEPs.

Table 8.1: Staff Development Topics Sorted by Priority Categories

Rank Order	Topic	Category 2	1+2	3	4
1	Best practices on curriculum/instructional accommodation*	6	15	3	0
2	Relating instructional assessments to standards*	6	15	3	0
3	Bilingual teaching practices that work	3	11	7	0
4	Modifying curriculum to the needs of students with mild to moderate disabilities	1	9	7	2
5	Models for collaboration*	7	14	4	0
6	What constitutes an effective transition plan?*	7	14	2	2
7	Accommodation...special and general education teachers working together	4	11	7	2
8	Developing standards based IEPs*	4	11	6	1
9	Understanding alternative assessments	4	11	6	1
10	Assessing progress of students with disabilities in the regular curriculum	3	10	8	0
11	The teacher's role in collaboration	3	10	5	3
12	Understanding national curriculum standards	9	15	2	1
13	Issues related to measuring student progress	6	12	4	2

*Topics selected for module development

Table 8.1: Staff Development Topics Sorted by Priority Categories, continued

Rank Order	Topic	Category 2	1+2	3	4
14	Defining outcomes for transition	6	12	6	0
15	Achieving accommodation in high stakes testing states	5	11	7	0
16	Collaboration skills and accessing the regular curriculum	5	11	6	1
17	Understanding cultural differences in teaching English	5	11	6	1
18	School-wide behavior management planning processes that work	4	10	5	3
19	Creating standards based IEPs	4	10	6	2
20	Collaborating with regular classroom teachers	2	8	3	6
21	Mentoring paraprofessionals	2	8	6	3
22	Sound pedagogical practices	7	12	4	2
23	Planning instructional systems that build from a philosophy of school improvement, curriculum frameworks, standards and IEP planning	7	12	2	1
24	Working with families of non-English speaking children	6	11	6	1
25	Techniques for monitoring student progress on IEPs	6	11	5	2
26	Measuring progress in achieving the IEP	6	11	3	4
27	Efficient and effective approaches to accommodation	5	10	6	2
28	Collaboration skills for teachers at the secondary level	5	10	3	3
29	Defining accommodation	4	9	7	2
30	Relating outcomes to student needs	4	9	4	5
31	Standards based reform strategies for special/B104general education teachers to work together	4	9	4	1
32	Setting outcomes for middle school students	3	8	4	6
33	Classroom discipline strategies	3	8	4	6
34	Developing behavior plans	2	7	7	4
35	Techniques applicable to instructional differentiation	8	12	1	5
36	The use of functional assessment in planning for IEP planning	8	12	5	2
37	Strategies for developing transition plans for students with mild disabilities	7	11	4	1
38	Understanding critical education in general education curriculum	6	10	6	2
39	How to design informal assessments that align with standards based testing	6	10	7	1
40	Coordinating services across agencies for families and children (target could be service coordinators across disciplines)	6	10	7	0
41	Knowing what accommodations to ask for in general education	5	9	3	5
42	Curriculum accommodation strategies that generalize cross content areas	5	9	3	3
43	Inclusion skills for beginning classroom teachers	5	9	8	1
44	Accommodation strategies	5	9	6	3
45	Collaborative strategies applicable focusing on sharing behavior management techniques	5	9	7	2
46	Relating national curriculum standards to state standards	5	9	9	0
47	Tracking assessments to IEP goals	5	9	6	2
48	Working with families of children 0-2 and 3-5 programs	5	9	3	5
49	Working with para-professionals	5	9	4	5
50	Adapting instructional plans	4	8	6	4
51	Collaborating with parents	4	8	1	2
52	Translating curriculum standards by subjects to meet the needs of student with disabilities	4	8	6	4
53	Co-teaching techniques applicable to achieving accommodations	3	7	7	4
54	Accommodating the needs of students with sensory disabilities in a standards-based curriculum	3	7	9	2
55	Teaming at the building level	3	7	7	7
56	Understanding the basics of bilingual Education and English as a Second Language	8	11	5	2

*Topics selected for module development

Table 8.1: Staff Development Topics Sorted by Priority Categories, continued

Rank Order	Topic	Category 2	1+2	3	4
57	Behavior management strategies applicable to 0 -3 and 3-5 year olds	7	10	6	2
58	Basic collaboration skills	6	9	6	3
59	Strategies beyond PBS	6	9	4	4
60	Aligning standards based curriculum with needs of students in inclusion settings	6	9	7	2
61	Creating assessments in forms that allow students with disabilities to gain routine experience with those formats and testing procedures used in statewide testing programs	6	9	5	4
62	Collaboration skills that work with paraprofessionals	5	8	7	3
63	Sources of data for improving instruction	5	8	8	2
64	Role of the general education teacher on the IEP team e.g., documentation	5	8	6	4
65	Conflict resolution strategies that work	4	7	3	2
66	Making effective use of adults in the instructional environment	3	6	5	6
67	Time management strategies for collaboration	3	6	6	6
68	Preparing 14 year olds as self-advocates in the IEP process	1	4	9	5
69	Assessment based instruction	9	11	7	2
70	Understanding age appropriate content in the general education curriculum	8	10	4	4
71	Using informal assessment as a basis for instructional planning	8	10	4	4
72	Getting a job is not enough	6	8	4	6
73	Communicating with parents of students with disabilities	5	7	6	5
74	Mediation skills for teachers	5	7	3	3
75	Engaging regular classroom teachers in the IEP process	5	7	8	3
76	Working with families and parents in supporting students in inclusion programs	5	7	6	3
77	Building community with colleagues	5	7	6	7
78	Curriculum planning for teachers: neither texts nor tests equal curriculum	5	7	7	4
79	Understanding transition requirements (0-2, 3-5, and secondary)	5	7	8	3
80	Teaming strategies in ESL	4	6	9	3
81	Developing behavior modification plans and strategies for measuring progress	4	6	4	8
82	Strategies for instructional planning based on curriculum standards	4	6	9	3
83	Teaching reading across the content fields	4	6	10	2
84	Teaching the language of the subject e.g., in science and math there is a critical vocabulary that must be known to participate in the regular curriculum	4	6	8	4
85	Effective ECH transition practices	4	6	6	5
86	Techniques for handling conflict resolution	3	5	7	5
87	Transitional opportunities in rural areas	3	5	8	4
88	Involving community agencies in transitioning for O-3 and 3-5 year olds	3	5	9	4
89	Developing collaboration between teachers and related service providers	3	5	8	5
90	Role of paraprofessional classrooms serving non-English speaking children	3	5	8	4
91	The basics of curriculum	2	4	13	1
92	Interpreting informal assessment results	8	9	4	4
93	Decision making in manifestation meetings	7	8	0	4
94	Self-advocacy for 14 year olds	7	8	6	4
95	How to help students participate effectively as self-advocates	7	8	4	6
96	The measuring of curriculum standards for classroom instructors	6	7	4	7

*Topics selected for module development

Table 8.1: Staff Development Topics Sorted by Priority Categories, continued

Rank Order	Topic	Category 2	1+2	3	4
97	Different ways to collaborate	5	6	5	5
98	Teaming skills	5	6	6	5
99	Transitional opportunities in urban settings	5	6	8	4
100	Informal assessments: design, application, and interpretation	5	6	7	4
101	Understanding the child's perspective in transitioning	5	6	7	3
102	Monitoring the work of paraprofessionals	4	5	6	7
103	Involving directors, counselors, teachers and other care providers	4	5	8	4
104	Teaming for solutions	3	4	6	7
105	Student procedures for paraprofessionals	3	4	7	6
106	Strategies for co-teaching with paraprofessionals	2	3	6	7
107	How to design teacher made tests	6	6	8	4
108	Communities for transition for school programs.	6	6	4	7
109	Integrating related services into the regular classroom instructional program	5	5	8	4
110	Family role needs to be strengthened in IEP/teaching literacy development for deaf and blind	5	5	4	3
111	Ensuring that paraprofessionals know their children understand their role	5	5	8	5
112	Transition strategies for hospital to home or to another care provider	5	5	10	2
113	Focusing on speech and language in the regular classroom	2	2	9	6

*Topics selected for module development

Summary of Lessons Learned

1. The use of focus groups proved to be an effective strategy for developing an item pool of staff development needs/topics of national importance. Considerable overlap occurred across focus groups. The topics that surfaced most frequently were the ones ultimately ranked in the national response category in the prioritization process via the online instrument.
2. The use of the Web to obtain responses to a validation and prioritizing instrument was effective with a sample of respondents with vested interests in the results. This was not a random sample. All respondents had been involved in some aspect of generating items or were participating in the project.
3. Consensus can be achieved on staff development topics warranting attention at the national level. While the language may vary for how best to describe each topic, groups with national perspectives share common views on staff development needs when judged by categories of priority needs.
4. Needs specific to curriculum content or subject matter fields did not receive significant attention in the needs assessment process because the Academy had already addressed may of them in previously developed online modules in reading, positive behavioral support (PSB), and technology in education. A process that engages teachers rather than staff development specialists and experts in national roles might result in more curriculum/instruction related topics.
5. The high priority topics derived largely from the consequences of reauthorization of IDEA.

6. There were serious concerns about staff development issues among focus group participants. The level of discourse was consistent and each session could have gone beyond the scheduled time frame.
7. There appeared to be a close relationship between the perspectives of OSEP staff who participated in the first focus group and SEA and RRC representatives participating in subsequent focus sessions.
8. The need for staff development for teachers is of critical importance. There was a clear perception among participants in the focus groups that a major investment needs to be made in models that allow for national dissemination such as through the features allowed by online instruction.
9. The topics in Table 8.1 reflect skills and knowledge that teachers need and which warrant serious attention in preservice teacher education. Additional research needs to be done to ascertain the extent to which preservice curriculum covers the topics judged to be of a high priority for practicing teachers.

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Appendix A

Online Academy Modules

(under separate cover)

Reading

- Module 0: Overview of Learning Disabilities and Reading Disabilities
- Module 1: Beginning Word Reading
- Module 2: Advanced Word and Developing Reading Fluency
- Module 3: Basic Principles in Readings Comprehension
- Module 4: Building Background Knowledge for Reading Comprehension
- Module 5: Analyzing Text to Enable Comprehension
- Module 6: Goal Specific Comprehension Strategies
- Module 7: Putting It All Together

Positive Behavioral Support

- Module 1: Foundations of PBS
- Module 2: Functional Assessment
- Module 3: Development & Implementation of PBS Plans
- Module 4: Intervention Strategies (Part I)
- Module 5: Intervention Strategies (Part II)
- Module 6: Redesigning Environmental Systems
- Module 7: Creating Positive Lifestyles

Technology in Education

- Module 1: Learning and Technology
- Module 2: Writing and Technology
- Module 3: Reading and Technology
- Module 4: Language and Technology
- Module 5: Mathematics and Technology
- Module 6: Data-Driven Instructional Decision Making
- Module 7: Exceptionality and Technology

Appendix B

e-Learning Design Laboratory
Mission and Organizational Structure

e-Learning Design Laboratory
Mission and Organizational Structure

NOTE: This document is a work in progress.
As the lab matures detailed policies and procedures will continue to be developed.

The e-Learning Design Laboratory is jointly sponsored by the Information and Telecommunications Technology Center (ITTC) and the Center for Research on Learning (CRL).

Mission

The mission of the e-Learning Design Laboratory is to create new solutions to the emerging challenges and opportunities in optimizing the application of technology to enhanced learning environments that transcend the educational and training needs of society. This involves the study, development, and research of new designs, principles, practices, tools, policies and learning environments that contribute to the engagement of learners across the life span in the pedagogy of e-learning.

Value Statement

The focus of those who participate in the e-Learning Design Laboratory is on sharing a common concern for enhancing learning through the use of technology. The participation of faculty, staff and students in activities of the lab is encouraged and valued. A culture supportive of collaboration and respect for all participants is central to the function of the lab. All participants in the organization share in the responsibility for creating and sustaining the culture.

Programmatic Model

The programmatic focus of the laboratory will center on the development of enhanced learning environments. These new learning environments will be based on interactive and intelligent personal computing environments integrated with on-line pedagogies designed to create interactive and user-friendly learner-based learning environments. The objective of the lab is to bring together research in learning technologies, both hardware and software, with the latest research in on-line pedagogy to create and develop these new technology-enhanced learning environments. There will be four dimensions to the work of the lab. These include (1) Policy and Technology Transfer, (2) Testing and Evaluation, (3) Learning Technology Research and (4) e-Learning Pedagogical Research.

1. Policy Development and Technology Transfer: The evolvement of e-learning as pedagogy is resulting in the creation and delivery of instructional programs in formats that add new dimensions to academic policies and technology transfer. How instruction is financed, developed, packaged and or delivered is contributing to the complexities of framing intellectual property policies. Issues of access and public goods are causing public institutions and for profit organizations to engage in creating e-learning instructional resources. This is resulting in the creation of new institutions of higher education in the category of virtual institutions committed primarily to e-learning environments. These institutions do not share the commitment to the academic policies, research infrastructure and values of traditional institutions of higher education. In K-12 education collaborative relationships among districts and in some cases with institutions of higher education are being formed to produce online instruction accessible to K-12 students. In the private sector e-learning is becoming a significant growth industry within e-commerce. A major dimension of this work will address the framing of policies that will benefit those engaged in these movements. Attention will also be given to maximizing the benefits of technology transfer to the commercial sector when processes, tools, software, hardware, and instruction developed by the laboratory warrant public

access. Technology transfer may take different forms. Dissemination could become a major source of technology transfer. Products produced by the lab or by other organizations could be marketed through technology transfer relationships. Training on the use of new products or technologies developed by the lab has the potential of becoming a major service. Leadership preparation, as a function, will be carefully considered. Academic programs are the provinces of academic departments, thus the lab will always collaborate with an academic department when seeking support for leadership preparation or when engaging in instructional activities. The work of the lab should complement the work of academic departments and in no way compete with academic departments.

2. Testing and Evaluation Services: The rapid growth in the evolvement of e-learning has resulted in e-learning being created and offered without the benefit of adequate research or evaluation. The laboratory will not only subject all that it produces to appropriate research and evaluation processes prior to release, but will also engage in the research of products produced by others. One goal is to develop a validation process equivalent to the "Good House Keeping Seal of Approval" for e-learning. As industry becomes more responsive to the product and service needs of e-learning, opportunities will be sought by the lab to carry out Beta testing of new products for industry. Such relationships might lead to joint ventures for the development of new tools or products that could provide a revenue stream. The motivation for this initiative is related to concerns for the protection of learners and enhancing the quality of e-learning.

3. Learning Technology Research: The recent explosion of computing and networking technologies that have started our transformation into a knowledge-based society have still not been fully understood and utilized in the learning environments of either our existing educational system or in the workplace. One aspect of the research pursued in the e-**L**earning **D**esign **L**ab will be to explore and develop new hardware and software technologies that will allow the creation and development of intelligent interactive learning environments.

4. e-Learning Pedagogical Research: In addition to research in the basic learning technologies, the e-Learning Design Lab will also explore and development new e-learning pedagogies that take advantage of the strengths of these new technologies to enhance the learning environment for learners. This will include studies identifying the effectiveness (and ineffectiveness) of the different technologies in enhancing the learning process.

Programmatic Structure

General Description: Focusing the lab on the pedagogy of online instruction includes the full range of research and development activities that surround any programmatic research effort. It also includes the dissemination of information, products and training related to building an understanding **of** both the technologies of e-Learning and e-Learning as pedagogy. Underlying the research and development effort will be a commitment to identify, develop and institutionalize those elements of teaching online that are inherent in a mature pedagogy.

Central to the creation and sustainability of the lab is the development of an infrastructure with a funding mechanism that allows it to ultimately be self-supporting. Competing for grants and contracts from federal, state, and private is central to funding the lab. The intent is not to compete with other organizations within the university, but to strengthen the institution's capacity to be competitive for support of R&D related to the pedagogy of e-learning. It is anticipated that the lab will employ a collaborative strategy in competing

for_funds by joining with others having similar interests and complementary resources. Successful efforts in technology transfer will also contribute to the support base.
The functional infrastructure will emphasize those strengths that have emerged from the array of projects that contributed to the establishment of the lab. Collectively they represent a set of core functions central to the study, development and promulgation of e-learning as a pedagogy.

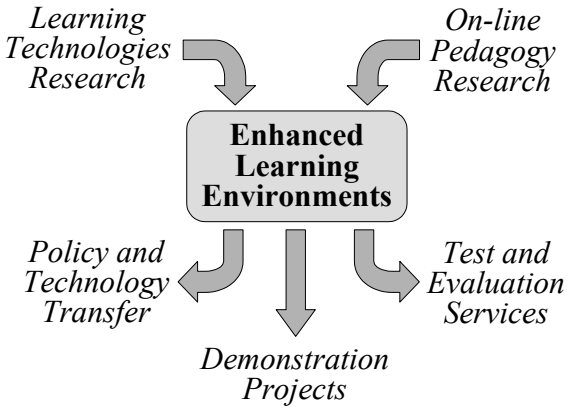

Figure 1. e-Learning Design Lab Functional Elements.

Figure 1 illustrates the relationship among the functional elements of the e-Learning Design Lab infrastructure. In principle, the research in both pedagogy and learning technologies should create the enhanced learning environments of tomorrow. One of the primary objectives of the new laboratory is to integrate the research advances into project demonstrators supported by industrial and governmental funding sources. As these new ideas and intellectual property are being developed, they will require the development of supporting policy and the means to transfer this intellectual property from the academic environment to industry. Finally, the laboratory will explore opportunities to work with industry and government by providing testing and evaluation services for new learning products under development.

Laboratory Organization

Co-Directors: the directors of the ITTC and the CRL in consultation with PIs will appoint the co-directors and set terms. The co-directors will be responsible for the daily operations of the lab. They will recommend policies to the e-Learning Design Lab Board. It will be the responsibility of the co-directors to develop procedures for implementing board policies and sound organizational practices. The division of labor between the co-directors will be mutually agreed upon depending on the skill and expertise each brings to the role.

The e-Learning Design Lab National Board of Directors: The National Board of Directors will comprise representatives from industry, academe, e-commerce, national centers, training, and the research community. The role of the board will be to advise the directors of ITTC and the CRL on opportunities, external relationships, emerging trends, funding/revenue opportunities, unmet needs and new technologies. The board will meet annually and via teleconferencing as needed. Officers will include a chair and associate chair. Terms will be for two and three years (3 each) and staggered to insure continuity.

Membership: The board will be comprised of six members.

- Academe (1)
- Industry (2)
- e-commerce (1)
- Research (1)
- National Centers (1)

The e-Learning Design Advisory Board: The board will advise the directors of the ITTC, CRL and the e-Learning Design Laboratory on mission, policies, procedures, opportunities and relationships to the University. The board will meet semi-annually. Officers will include a chair and associate chair. Terms will be for two and three years (5 each) and staggered to insure continuity.

Membership: The board will be comprised of nine members.

- Affiliated Project PIs (2)
- ITTC (1)
- CRL (1)
- The Division of Continuing Education Lawrence Campus (2)
- Kansas University Medical Center (1)
- K-12 Education (1)
- Business training (1)

Council of Principal Investigator(s): Each principal investigator of a project affiliated with the lab will serve on the council. The purpose of the council is to advise how the lab can best accommodate the needs of affiliated projects, participate in the planning of future projects, and to enhance the sharing of resources where appropriate.

Management Team: The management team will deal with topics and issues related to daily operations, personnel, resources, external funding, procedures, coordination of projects, assignment of tasks and the implementation of policies. It will meet on a regularly scheduled basis. The membership of the team will comprise the co-directors, the administrative coordinator, one member of the PI council and others as designated by the co-directors.

Appendix C

Articles Resulting from the Online Academy

Articles Resulting from the Online Academy

Aust, R. J., Isaacson, R. E., Meyen, E. L., & Newberry, B. W. (in prep.). Designing and Evaluating User Interfaces for eLearning Modules.

Aust, R. J., Newberry, B. W., Meyen, E. L., & Spurgin, D. (submitted). Extendible Tools and Architecture for Developing eLearning Modules. *Journal of International Forum of Educational Technology & Society and IEEE Learning Technology Task Force*.

Aust, R. J., Noble, C., Meyen, E. L., Isaacson, R. E., & Newberry, B. W. (submitted). Dynamic eLearning Production. *Virtual University Journal.*

Meyen, E. L., & Bui, Y. N. (submitted). The Online Academy: Content Validation Through a Juror Process: *Journal of Technology and Teacher Education.*

Meyen, E. L., Ramp, E., Harrod, C. A., & Bui, Y. N. (submitted). A National Assessment of Staff Development Needs Related to the Education of Students with Disabilities: *Teacher Education and Special Education.*

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Meyen, E. L., Aust, R. J., Newberry, B. W., Ramp, E., & Bui, Y. N. (submitted). The Online Academy: An Extranet Approach to Virtual Implementation. *Journal of Interactive Learning Research.*

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Appendix D

Invitation Letter and Other Information Sent to 750 Teacher Education Programs

Sample Letter to Deans of Schools/Colleges of Education

Date

Name
Title
Address
City, State, zip

Dear ___ _____ _:

There is growing public concern regarding the preparation of teachers to meet the needs of all students in today's schools. We also know that the classroom environments faced by teachers are not always conducive to good teaching. At the same time, we continue to strengthen our programs and remain sensitive to our obligations to ensure that students preparing to be teachers have access to the most current information on research-based teaching practices. Having served as dean, I appreciate the challenge faculty experience in keeping current with the knowledge base in their field while also fulfilling their teaching and research responsibilities. With advances in technology, however, effective and efficient dissemination systems are now available to shorten the time between research and its implementation in practice. The purpose of this letter is to introduce you to an emerging opportunity in this area.

Last fall, the Office of Special Education Programs (OSEP) announced a major initiative to bridge the gap between research and practice. The initiative focuses on creating research-based instructional resources for preservice teacher education in the areas of reading, positive behavior support and technology in education. The University of Kansas was selected to create an Online Academy to review research-based teaching practices in the three content areas and to develop instructional modules for use by teacher education programs to teach those interventions. While the focus is on teaching interventions for students with disabilities, the goal of the Academy is to enhance the efforts of teacher education programs in preparing teachers to meet the needs of all students in academically and socially diverse classes.

The modules are designed to be offered online via the Internet, making them easily accessible to users nationally. The modules also have been designed to operate from a server at participating institutions, rather than a server at the University of Kansas. This allows participating faculty to manage the instructional modules as they desire and to identify the modules with their own institution.

We have engaged nationally recognized content experts to assist us in the selection of research-based teaching practices and in the development of modules. While the modules are designed for delivery online, elements within the modules are structured so that they can also be used as resources in traditional course formats. The online modules can be used individually, to supplement a course, or in combination to create a course. They are intended to be integrated into existing teacher education programs. The modules can also be configured to be offered as in-service courses to practicing teachers in your area.

Please visit our home page at **www.onlineacademy.org** for additional information on the Academy. The only costs associated with participation are those related to the maintenance of the modules on your institution's server and the involvement of faculty in the integrating of the modules into their curriculum.

Beta testing of modules will begin this fall. While some modules will be available for implementation by the beginning of the spring semester, more will be available as they are developed. If you have an interest in using Academy online modules or related resources in your teacher education program, please complete the enclosed form. Gene Ramp, Coordinator for Implementation, will then work directly with that person in sharing information on content covered by the modules, how to use them, and the procedures for installing modules on your server. Orientation modules have also been developed for instructors to assist them in determining how best to incorporate the modules into their teaching.

I appreciate your consideration of this opportunity. We have made a major investment in identifying research-based teaching practices and are committed to developing instructional resources that will be helpful to teacher educators and will benefit teacher education.

Respectfully,

Edward L. Meyen
Principal Investigator

cc. Donald D. Deshler, Chair, Board of Governors

Academic Institution Implementation Agreement

The Online Academy
The University of Kansas

Pursuant to the terms of the federal contract under which the Academy modules have been developed, the Online Academy agrees to make Academy modules available to_____ for use in its pre-service teacher education program. The modules will be made available for downloading to a server at no cost to the institution for the modules as long as an institutional commitment to implement the modules is made in accordance with the timeline set forth in this agreement.

Conditions of implementation:

1. The modules or lessons may be offered as independent courses or integrated into regularly offered courses in the pre-service teacher education program.
2. The tuition pricing policies of the institution shall apply in the offering of the modules.
3. The modules shall not be offered for Continuing Education credit**.**
4. The institution may add its name and course identification to the modules in order to meet its enrollment needs; however, the University of Kansas credits for the development and design of the modules must remain as embedded in the modules.
5. No modifications shall be permitted to the content of the module. The modules, however, maybe used in total or in part.
6. The Online Academy and University of Kansas expressly disclaim any and all express or implied warranties and make no express or implied warranties or representations of any kind whatsoever including but not limited to warranties of merchantability, of fitness for a particular purpose, and that the use of the Academy modules will not infringe on any patent, copyright, trademark or other rights. Further, the Online Academy and the University of Kansas make no representations whatsoever that the Academy Modules are free from liability for patent infringement or may be used without infringing any other patent, except to the limited extent that the Online Academy and the University of Kansas represent that, as of the effective date of this agreement, neither the Online Academy nor the University of Kansas has actual knowledge that the Academy modules infringe any valid and enforceable patent held by a third party.

Institutional requirements for implementation:

1. Adherence to the above "conditions for implementation."
2. Designate a faculty member and a technical support person as the contact people during the installation process.
   - Provide the technical assistance and server support needed to install and maintain the modules on an institution-based server. The Online Academy is not responsible for any installation, maintenance, or troubleshooting, which may be required for installation and operation of these modules. A functioning Web server of any type is recommended with at least 50 MB of free storage space per module and a functioning Real Networks G2 server with at least 20 MB of free space per module.
   - A system administrator with Web server and G2 skills should be identified, as should a technical support person with whom instructors and students will work. (see No. 2 above.)
6. Require instructors to complete the instructor's module prior to teaching the modules.
7. Agree to make general technical assistance available to students as needed.

Dean or Program Head	Date	Director, Center for Research on Learning	Date

List of contacts:

Faculty Name:	Phone Number:	Email Address:
Technician Name:	Phone Number:	Email Address:

D R A F T

(optional agreement – not implemented)

Letter and Agreement

Academic Institution Implementation Agreement

Pursuant to the terms of the federal contract under which the Academy modules have been developed, the Online Academy agrees to make Academy modules available to _____for use in its preservice teacher education program. The modules will be made available for downloading to a server at no cost to the institution for the modules as long as an institutional commitment to implement the modules is made in accordance with the timeline set forth in this agreement.

_____	_____	_____	_____
Dean or Program Head	Date	Director, Center for Research on Learning	Date

List of contacts:

Faculty Name:	Phone Number:	Email Address:
Technician Name:	Phone Number:	Email Address:

Appendix E

Universities Involved in the Online Academy Modules

List of Universities

Alliant University
Appalachian State University
Arkansas Tech University
Armstrong Atlantic State University
Athens State University
Auburn University-Montgomery
Avila College
Ball State University
Baylor University
Bellarmine College
Benedictine College
Birmingham-Southern College
Boston College
Bowling Green State University
Bradley University
Butler University
California State University-Bakersfield
California State University-Chico
California State University-Fresno
California State University-Fullerton
California State University-Hayward
Campbell University
Catholic University of America
Central College
Central Michigan State
Chadron State College
Charleston Southern University
Clemson University
Cleveland State University
College of Mount Saint Joseph
College of Mount Saint Vincent
College of Saint Catherine
College of William and Mary
Cornell University
Dakota State University
Delaware State University
East Central University
East Tennessee State University
Elmhurst College
Fordham University
Fort Lewis College
Furman University
George Mason University
Georgia Southwestern State University
Georgia State University
Governors State University
Graceland University
Grambling State University
Hamline University
Hastings College
Hiram College
Holy Family College
Howard University
Illinois State University
Indiana University
Johns Hopkins
Kansas State University
Lander University
Langston University
Lehigh University
Lock Haven University
Louisiana State University
Loyola College of Maryland
Loyola of Chicago
Manhattan College
Marian College
Marshall University
Mayville State University
Michigan State University
MidAmerican Nazarene University
Midwestern State University
Mississippi State University
Missouri Southern State College
Monmouth University
North Carolina A&T State University
North Carolina Central University
North Carolina State University
Northeastern Illinois University
Northern Arizona University
Northwest Missouri State University
Northwest Nazarene University
Northwestern State University
Oklahoma Panhandle State University
Pennsylvania State University
Portland State University
Purdue University
Radford University
Regent University
Saint Augustine's College
Saint John's University
Saint Mary College
Seattle Pacific University
Southeastern Louisiana University
Southwest Texas State University
Stillman College
Temple University
Tennessee State University
Texas A & M University-Commerce
Texas A&M University
Texas A&M University-Kingsville
Texas Christian University
Texas Woman's University

Troy State University
Troy State University-Dothan
Truman State
University of Alabama
University of Alabama-Birmingham
University of Central Oklahoma
University of Colorado-Denver
University of Findlay
University of Georgia
University of Hawaii-Manoa
University of Illinois-Chicago
University of Kansas
University of Kentucky
University of Louisiana-Lafayette
University of Louisiana-Monroe
University of Maine
University of Mary Hardin-Baylor
University of Michigan-Flint
University of Minnesota-Morris
University of Missouri-Saint Louis
University of Montana
University of Nebraska-Lincoln
University of New Orleans
University of North Alabama
University of North Carolina General Administration
University of North Carolina-Chapel Hill
University of North Carolina-Charlotte
University of North Florida
University of North Texas
University of Oregon
University of Pittsburg
University of Saint Thomas
University of San Diego
University of San Francisco
University of South Alabama
University of South Florida
University of Southern Mississippi
University of Texas-Austin
University of Utah
University of West Alabama
University of Wisconsin-Madison
University of Wisconsin-Platteville
University of Wisconsin-Stout
University of Wisconsin-Whitewater
Utah State Department of Education
Valdosta State University
Vanderbilt University
Virginia Commonwealth University
Wabash College
Wagner College
Wayne State University
Weber State University
Webster University
West Virginia University
Western Illinois University
Western Kentucky University
Western New Mexico University
Western Oregon University
Winston-Salem State University
Xavier University of Louisiana

Appendix F

The Online Academy Presentations (Partial List)

The Online Academy
National Conferences Presentations
(Partial List)

1998

January 17	TAM – Technical and Media Division: CEC/ Atlanta Presenter: Meyen
July 14-16:	CEC leadership Training Conference—Washington, DC Keynote: Ed Meyen
October 29:	Council presentation Presenter: Meyen
November 11-14:	TED/Teacher Education Division for the Council for Exceptional Children Dallas, TX Presenters: Meyen and Gildroy
December 2-5:	TASH/The Association of Persons with Severe Handicaps Presenters: Sailor, Poston, Freeman, Anderson

1999

January 21-23:	TAM/Technology for People with Special Needs Portland, Oregon Presenters: Meyen
February 24-27:	AACTE/American Association of Colleges of Teacher Education Washington, DC Presenters: Meyen, Deshler, Aust
March 16 – 20:	Technology and Persons with Disabilities International Conference/California State, Northridge Los Angeles, California Presenters: Meyen

March 29-31:	International Conference on Technology and Education Edinburgh, Scotland
April 12-16:	CEC/Council for Exceptional Children Pre-conference workshop – full day Charlotte, North Carolina Presenters: Meyen, Aust, Ramp, Ault
May 6-7:	Summit NCLD Meeting Presenter: Meyen
June 8:	OSEP Staff presentations May 6-7: Summit NCLD Meeting Presenter: Meyen and Deshler
June 22-24:	NECC / National Educational Computing Conference Atlantic City, New Jersey Presenters: Meyen and Isaacson

Appendix G

Module Production Credits

Module Credits: Reading

The Online Academy gratefully acknowledges the dedication and assistance of those people who have contributed to the design and development of the online modules. Following is a comprehensive list of these persons and their contributions. Citations for attribution are also included.

The Online Academy at the University of Kansas Center for Research on Learning and the Department of Special Education is supported by the U. S. Department of Education, Office of Special Education, Project #H029K973002. Collaborators include the University Affiliated Programs (UAP), the students and faculty of the Department of Teaching and Leadership, and the Department of Electrical Engineering and Computer Science at the University of Kansas.

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Don Deshler, Chair of Governors
Gene Ramp, Implementation Coordinator
Anne Daugherty, Research Associate
Tom Skrtic, Academy Fellow
Cheryl Harrod, Administrative Coordinator
Brenda Kissam, Editor
Cindy Lian, Assistant
Claudia Tey, Assistant
Yvonne Bui, Research Assistant

The Academy Board of Governors

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Lynne Cook, California State University, Northridge
Rob Fenty, Intel Corporation
David G. Imig, American Association of Colleges For Teacher Education
Martin Kaufman, University of Oregon
Joe Kitchens, Western Heights School District - Oklahoma City
M. Jean Miller, Council of Chief State School Officers
Paul Resta, University of Texas at Austin
Jon Snyder, University of California, Santa Barbara
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Helen Thornton, Office of Special Education Programs, Washington, D.C. (ex officio)

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Eahab Alias - Programmer
Allen Quesada - Lead Web Developer
Amanda Coleman - Lead Designer
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Satha Phongsatha - Instructional Materials Developer

Yang Ping - Instructional Materials Developer
Nick Nourie - Designer
Misty Bruna Designer
Nick Sever - Designer
Heath O'Campo - Designer
Joel Pfannensteil - Designer
Dana Hill - Designer
Jerry O'Leary - Audio Engineer
Alvaro Berg - Media Production Assistant
Brian Barteldt - Media Specialist
Seth Schnebel - Web Developer
Adam Pavich - Programmer
Tom Shorock - Systems Support and Programmer

Reading Jurors

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Candace S. Bos, University of Texas-Austin
Hugh Catts, University of Kansas
Joe Jenkins, University of Washington
Jennifer Jones, Kansas State Department of Education
Joe Torgesen, Florida State University
Michael Pressley, University of Notre Dame
Johanna Williams, Columbia University
Anita Archer, Educational Consultant, Portland, OR

Reading Development Team

Irma Brasseur – Writer
Donald D. Deshler - Guest Writer
Barbara J. Ehren - Writer
Joseph B. Fisher - Guest Writer
Patricia G. Gildroy - Lead Writer
Sherrel Lee Haight - Guest Writer
B. Keith Lenz - Coordinator and Writer
Melinda McKnight - Coordinating Editor
Mary Weinberg - Assistant Editor
David Gnojek – Graphics
Reva Hemme - Project Assistant
Jessica Hemme - Project Assistant

Citations

Meyen, E. L. *The Online Academy: Linking teacher education to advances in research*. Lawrence, KS: University of Kansas Center for Research on Learning. (Contract No. H029K973002; 1997 -- 2000, U. S. Department of Education, Office of Special Education Programs).

Module II Citation

Gildroy, P. G. (2000). *Advanced word reading* [Online]. Lawrence, KS: University of Kansas, Center for Research on Learning. Available: Onlineacademy.org.

Module II Lesson Citations

Gildroy, P. G. (2000). Teaching word patterns (Module II, Lesson 1). *Advanced word reading* [Online]. Lawrence, KS: University of Kansas, Center for Research on Learning. Available: Onlineacademy.org.

Gildroy, P. G. (2000). Conquering multisyllabic words (Module II, Lesson 2). *Advanced word reading* [Online]. Lawrence, KS: University of Kansas, Center for Research on Learning. Available: Onlineacademy.org.

Gildroy, P. G., & Brasseur, I. (2000). Developing reading fluency (Module II, Lesson 3). *Advanced word reading* [Online]. Lawrence, KS: University of Kansas, Center for Research on Learning. Available: Onlineacademy.org.

Gildroy, P. G. (2000). Developing school-wide reading fluency programs (Module II, Lesson 4). *Advanced word reading* [Online]. Lawrence, KS: University of Kansas, Center for Research on Learning. Available: Onlineacademy.org

Gildroy, P. G. (2000). Regular, irregular, and site words (Module II, Lesson 2). *Advanced word reading* [Online]. Lawrence, KS: University of Kansas, Center for Research on Learning. Available: Onlineacademy.org

Module Credits: Technology in Education

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Dana Hill – Designer
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Alvaro Berg - Media Production Assistant
Brian Barteldt - Media Specialist
Seth Schnebel - Web Developer
Adam Pavich - Programmer
Tom Shorock - Systems Support and Programmer

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Malika Weil (Writer and Editor)
Janel Hinrichsen (Writer and Editor)
Brenda Kissam (Editor)

Kirsten McBride (Editor)
Anne Daugherty (Editor)

Citations

Meyen, E. L. *The Online Academy: Linking teacher education to advances in research*. Lawrence, KS: University of Kansas Center for Research on Learning. (Contract No. H029K973002; 1997 -- 2000, U. S. Department of Education, Office of Special Education Programs).

Meyen, E. L. *Module 1: Integrating the Academy Modules into Your Teacher Education Programs* [Online]. Lawrence, KS: University of Kansas, Center for Research on Learning. Available: Onlineacademy.org.

Hasselbring, T. S. (2001). Human learning and technology. (Module 1, Lesson 1). In L. E. O'Donnell (Ed.), *Technology in Education* [Online]. Center for Research on Learning, Online Academy Project (OSEP Project #CFDA 84.029K3). Lawrence, KS: University of Kansas. Available: www.Onlineacademy.org

O'Donnell, L. E. (2001). Vision and implications. (Module 1, Lesson 2). In L. E. O'Donnell (Ed.), *Technology in Education* [Online]. Center for Research on Learning, Online Academy Project (OSEP Project #CFDA 84.029K3). Lawrence, KS: University of Kansas. Available: www.Onlineacademy.org

Smith, S. J. (2001). Infusion and web-based cases. (Module 1, Lesson 3). In L. E. O'Donnell (Ed.), *Technology in Education* [Online]. Center for Research on Learning, Online Academy Project (OSEP Project #CFDA 84.029K3). Lawrence, KS: University of Kansas. Available: www.Onlineacademy.org

Module Credits: Positive Behavior Support

The Online Academy gratefully acknowledges the dedication and assistance of those people who have contributed to the design and development of the online modules. Following is a comprehensive list of these persons and their contributions. Citations for attribution are also included.

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Alvaro Berg - Media Production Assistant
Brian Barteldt - Media Specialist
Seth Schnebel - Web Developer
Adam Pavich - Programmer
Tom Shorock - Systems Support and Programmer

Positive Behavioral Support Jurors

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Victoria B. McMullen, Webster University
Robert H. Horner, University of Oregon
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Ursula Markey, Pyramid Parent Training Program, New Orleans, LA

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Rachel Freeman, Team Leader
Jody Britten, Coordinating Editor and Writer
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Chris Smith, Research Coordinator and Editor
Linda Heitzman-Powell, Content Consultant

Citations

Meyen, E. L. *The Online Academy: Linking teacher education to advances in research.* Lawrence, KS: University of Kansas Center for Research on Learning. (Contract No. H029K973002; 1997 -- 2000, U. S. Department of Education, Office of Special Education Programs).

Freeman, R. L., Britten, J., Smith, C., McCart, A., & Sailor, W. (Eds) (2000). *Creating positive lifestyles* (Module 7) [Online]. Lawrence, KS: Kansas University Affiliated Program, Center for Research on Learning. Available: Onlineacademy.org

Smith, C., McCart, A., Britten, J., Freeman, R. L., & Sailor, W. (2000). Person-centered planning (Module 7, Lesson 1). *Creating positive lifestyles* [Online]. Lawrence, KS: Kansas University Affiliated Program, Center for Research on Learning. Available: Onlineacademy.org.

Smith, C., McCart, A., Britten, J., Freeman, R. L., & Sailor, W. (2000). Self-determination (Module 7, Lesson 2). *Creating positive lifestyles* [Online]. Lawrence, KS: Kansas University Affiliated Program, Center for Research on Learning. Available: Onlineacademy.org.

Smith, C., McCart, A., Britten, J., Freeman, R. L., & Sailor, W. (2000). Quality of life (Module 7, Lesson 3). *Creating positive lifestyles* [Online]. Lawrence, KS: Kansas University Affiliated Program, Center for Research on Learning. Available: Onlineacademy.org.

Appendix H

Content Maps

Appendix I

Module Outlines

Appendix J

Informational Brochure And Handouts