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# Distance and Distributed Learning Environments: Perspectives and Strategies

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## **Editors**

William L. Havice

Pamela A. Havice

**54th Yearbook, 2005**

*Council on Technology Teacher Education*



**Glencoe**

New York, New York   Columbus, Ohio   Chicago, Illinois   Peoria, Illinois   Woodland Hills, California



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# FOREWORD

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This 54th annual yearbook of the Council on Technology Teacher Education continues a tradition of scholarly excellence and promotion of discourse in technology teacher education. In this time of educational reform and technological change, we are fortunate to have such a forum in these yearbooks to bring to the forefront the kinds of thinking and innovation that has kept our Council strong and vibrant. This year is no exception. For the first time in the history of this yearbook series, we celebrate a husband and wife team as editors. William L. Havice and Pamela A. Havice have assembled a yearbook that can serve as a catalyst within our field for engaging in professional discussions and development focused on distance/distributed learning environments. This yearbook provides our field with critical insight into the implications of distance/distributed learning for technology teacher education.

Not since section three of the 37th yearbook of the Council on Technology Teacher Education has as much attention been devoted to a delivery system for teaching technology. Technology education and indeed distance/distributed education have changed dramatically over the last 17 years. Technological developments have enabled interaction and collaboration among multiple users at a scale never imagined. New educational delivery methods such as the Internet, one- and two-way video and other electronic media make possible the delivery of instruction independent of time and distance, or proximity to a teacher. The advances and possibilities in distance/distributed learning environments discussed in this yearbook can open access and educational opportunities to under served populations who otherwise would not benefit from such resources. As the field of technology education expands and responds to changes in learning, instructional delivery, on-demand learning environments, synchronous and asynchronous learning, and modern information technology, so does the need to examine its fundamental assumptions, perspectives, and implications.

The yearbook's editors and chapter authors have given careful attention to explore distance/distributed learning approaches from diverse perspectives and to bring the key issues to focus for technology teacher education. The discussion begins with a thorough introduction to distance/distributed learning environments and examines their potential role and strategies for implementation in technology teacher education. Subsequent chapters examine varied state-of-the-art approaches to implementation, technology teacher certification, lessons to consider from student and faculty perspectives, assessment strategies, and ownership/copyright issues.

The chapter authors are to be commended for their insight and treatment of such a varied and challenging topic that is relatively new to the technology teacher education profession. We are grateful for their commitment to expanding our perspectives and provoking thought about innovation in teaching/learning environments.

On behalf of the Council and the Yearbook Committee, we are honored to present this yearbook to the profession. The Council is grateful to have Glencoe/McGraw-Hill publishing company as our partner in the yearbook series. Their shared commitment to technology teacher education has made a significant contribution to the field and is truly appreciated. Finally, I join with the Council membership in once again thanking everyone who has contributed to these remarkable series of scholarly works since 1952.

Michael A. De Miranda  
President, CTTE  
April 2005

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# YEARBOOK PROPOSALS

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Each year at the ITEA International Conference, the CTTE Yearbook Committee reviews the progress of yearbooks in preparation and evaluates proposals for additional yearbooks. Any member is welcome to submit a yearbook proposal, which should be written in sufficient detail for the committee to be able to understand the proposed substance and format. Fifteen copies of the proposal should be sent to the committee chairperson by February 1 of the year in which the conference is held. Below are the criteria employed by the committee in making yearbook selections.

CTTE Yearbook Committee

## **CTTE Yearbook Guidelines**

### **A. Purpose**

The CTTE Yearbook Series is intended as a vehicle for communicating major topics or issues related to technology teacher education in a structured, formal series that does not duplicate commercial textbook publishing activities.

### **B. Yearbook Topic Selection Criteria**

An appropriate yearbook topic should:

1. Make a direct contribution to the understanding and improvement of technology teacher education;
2. Add to the accumulated body of knowledge of technology teacher education and to the field of technology education;
3. Not duplicate publishing activities of other professional groups;
4. Provide a balanced view of the theme and not promote a single individual's or institution's philosophy or practices;
5. Actively seek to upgrade and modernize professional practice in technology teacher education; and,
6. Lend itself to team authorship as opposed to single authorship.

Proper yearbook themes related to technology teacher education may also be structured to:

1. Discuss and critique points of view that have gained a degree of acceptance by the profession;
2. Raise controversial questions in an effort to obtain a national hearing; and,
3. Consider and evaluate a variety of seemingly conflicting trends and statements emanating from several sources.

### **C. The Yearbook Proposal**

1. The yearbook proposal should provide adequate detail for the Yearbook Committee to evaluate its merits.
2. The yearbook proposal includes the following elements:
  - a) Defines and describes the topic of the yearbook;
  - b) Identifies the theme and describes the rationale for the theme;
  - c) Identifies the need for the yearbook and the potential audience or audiences;
  - d) Explains how the yearbook will advance the technology teacher education profession and technology education in general;
  - e) Diagram symbolically the intent of the yearbook;
  - f) Provides an outline of the yearbook which includes:
    - i) A table of contents;
    - ii) A brief description of the content or purpose of each chapter;
    - iii) At least a three level outline for each chapter;
    - iv) Identification of chapter authors (s) and backup authors;
    - v) An estimated number of pages for each yearbook chapter; and,
    - vi) An estimated number of pages for the yearbook (not to exceed 250 pages).
  - g) Provides a timeline for completing the yearbook.

It is understood that each author of a yearbook chapter will sign a CTTE Editor/Author Agreement and comply with the Agreement. Additional information on yearbook proposals is found on the CTTE Web site at <http://teched.vt.edu/ctte/>.



# PREVIOUSLY PUBLISHED YEARBOOKS

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- \*1. *Inventory Analysis of Industrial Arts Teacher Education Facilities, Personnel and Programs*, 1952.
- \*2. *Who's Who in Industrial Arts Teacher Education*, 1953.
- \*3. *Some Components of Current Leadership: Techniques of Selection and Guidance of Graduate Students; An Analysis of Textbook Emphases*, 1954, three studies.
- \*4. *Superior Practices in Industrial Arts Teacher Education*, 1955.
- \*5. *Problems and Issues in Industrial Arts Teacher Education*, 1956.
- \*6. *A Sourcebook of Reading in Education for Use in Industrial Arts and Industrial Arts Teacher Education*, 1957.
- \*7. *The Accreditation of Industrial Arts Teacher Education*, 1958.
- \*8. *Planning Industrial Arts Facilities*, 1959. Ralph K. Nair, ed.
- \*9. *Research in Industrial Arts Education*, 1960. Raymond Van Tassel, ed.
- \*10. *Graduate Study in Industrial Arts*, 1961. R. P. Norman and R. C. Bohn, eds.
- \*11. *Essentials of Preservice Preparation*, 1962. Donald G. Lux, ed.
- \*12. *Action and Thought in Industrial Arts Education*, 1963. E. A. T. Svendsen, ed.
- \*13. *Classroom Research in Industrial Arts*, 1964. Charles B. Porter, ed.
- \*14. *Approaches and Procedures in Industrial Arts*, 1965. G. S. Wall, ed.
- \*15. *Status of Research in Industrial Arts*, 1966. John D. Rowlett, ed.
- \*16. *Evaluation Guidelines for Contemporary Industrial Arts Programs*, 1967. Lloyd P. Nelson and William T. Sargent, eds.
- \*17. *A Historical Perspective of Industry*, 1968. Joseph F. Luetkemeyer Jr., ed.
- \*18. *Industrial Technology Education*, 1969. C. Thomas Dean and N. A. Hauer, eds.;  
*Who's Who in Industrial Arts Teacher Education*, 1969. John M. Pollock and Charles A. Bunten, eds.
- \*19. *Industrial Arts for Disadvantaged Youth*, 1970. Ralph O. Gallington, ed.
- \*20. *Components of Teacher Education*, 1971. W. E. Ray and J. Streichler, eds.
- \*21. *Industrial Arts for the Early Adolescent*, 1972. Daniel J. Householder, ed.
- \*22. *Industrial Arts in Senior High Schools*, 1973. Rutherford E. Lockette, ed.
- \*23. *Industrial Arts for the Elementary School*, 1974. Robert G. Thrower and Robert D. Weber, eds.
- \*24. *A Guide to the Planning of Industrial Arts Facilities*, 1975. D. E. Moon, ed.
- \*25. *Future Alternatives for Industrial Arts*, 1976. Lee H. Smalley, ed.
- \*26. *Competency-Based Industrial Arts Teacher Education*, 1977. Jack C. Brueckman and Stanley E. Brooks, eds.
- \*27. *Industrial Arts in the Open Access Curriculum*, 1978. L. D. Anderson, ed.
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- \*29. *Technology and Society: Interfaces with Industrial Arts*, 1980. Herbert A. Anderson and M. James Benson, eds.
- \*30. *An Interpretive History of Industrial Arts*, 1981. Richard Barella and Thomas Wright, eds.

- \*31. *The Contributions of Industrial Arts to Selected Areas of Education*, 1982. Donald Maley and Kendall N. Starkweather, eds.
- \*32. *The Dynamics of Creative Leadership for Industrial Arts Education*, 1983. Robert E. Wenig and John I. Mathews, eds.
- \*33. *Affective Learning in Industrial Arts*, 1984. Gerald L. Jennings, ed.
- \*34. *Perceptual and Psychomotor Learning in Industrial Arts Education*, 1985. John M. Shemick, ed.
- \*35. *Implementing Technology Education*, 1986. Ronald E. Jones and John R. Wright, eds.
- 36. *Conducting Technical Research*, 1987. Everett N. Israel and R. Thomas Wright, eds.
- \*37. *Instructional Strategies for Technology Education*, 1988. William H. Kemp and Anthony E. Schwaller, eds.
- \*38. *Technology Student Organizations*, 1989. M. Roger Betts and Arvid W. Van Dyke, eds.
- \*39. *Communication in Technology Education*, 1990. Jane A. Liedtke, ed.
- \*40. *Technological Literacy*, 1991. Michael J. Dyrenfurth and Michael R. Kozak, eds.
- 41. *Transportation in Technology Education*, 1992. John R. Wright and Stanley Komacek, eds.
- \*42. *Manufacturing in Technology Education*, 1993. Richard D. Seymour and Ray L. Shackelford, eds.
- \*43. *Construction in Technology Education*, 1994. Jack W. Wescott and Richard M. Henak, eds.
- 44. *Foundations of Technology Education*, 1995. G. Eugene Martin, ed.
- \*45. *Technology and the Quality of Life*, 1996. Rodney L. Custer and A. Emerson Wiens, eds.
- 46. *Elementary School Technology Education*, 1997. James J. Kirkwood and Patrick N. Foster, eds.
- 47. *Diversity in Technology Education*, 1998. Betty L. Rider, ed.
- 48. *Advancing Professionalism in Technology Education*, 1999. Anthony F. Gilberti and David L. Rouch, eds.
- \*49. *Technology Education for the 21st Century: A Collection of Essays*, 2000. G. Eugene Martin, ed.
- 50. *Appropriate Technology for Sustainable Living*, 2001. Robert C. Wicklein, ed.
- 51. *Standards for Technological Literacy: The Role of Teacher Education*, 2002. John M. Ritz, William E. Dugger, and Everett N. Israel, eds.
- 52. *Selecting Instructional Strategies for Technology Education*, 2003. Kurt R. Helgeson and Anthony E. Schwaller, eds.
- 53. *Ethics for Citizenship in a Technological World*, 2004. Roger B. Hill, ed.

\* Out-of-print yearbooks can be obtained in microfilm and in Xerox copies. For information on price and delivery, write to UMI, 300 North Zeeb Road, Dept. P.R., Ann Arbor, Michigan 48106.

# PREFACE

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The 54th CTTE Yearbook examines strategies and perspectives of distance and distributed learning environments. We believe the topic for this book is quite appropriate because the continuing emergence of sophisticated interactive digital media is transforming how learning can take place. This book will examine key issues that need to be considered by academic leaders, administrators, and faculty to effectively plan and implement distance and distributed learning environments.

Technology teachers worldwide are challenged to provide the best learning environments for their students. The goal for these learning environments is to help students learn what they need to know and to acquire the skills they need to compete in our expanding digital, global workplace as life long learners.

As educators in higher education for over 25 years, we know one of the most challenging issues facing educational institutions today is distance education, e-learning, on-line learning, distributed learning, etc. The terms distance education, remote learning, and distance learning all refer to learning environments whereby place and/or time separate the student and instructor; thus the student learns independent of contact with the instructor and, often, other students.

In our opinion, the term distance learning is too restrictive of a concept, though a commonly used term for many different types of non-traditional learning environments. We prefer instead to use the term distributed learning environment. Many of the technologies used to support distance learning students are now being used to also enhance the learning experience of students anywhere. Distributed learning environments encompass the delivery of degrees, programs, courses, etc. – which can be independent of fixed time and place. It is important to understand that distance learning is a subset of distributed learning environments. Therefore, for the purpose of this yearbook, the reader will find that we often use both words in the discussions but do prefer the term distributed learning to distance education.

The *Standards for Technological Literacy: Content for the Study of Technology*, released in March of 2000 by the International Technology Education Association with funding from the NSF and NASA, acknowledges that technologically literate citizens must have knowledge that extends beyond the design and operation of technological systems. Implementing the new technology education standards will require some adjustments in typical instructional activities. New materials, resources and instructional strategies, i.e. distributed learning environments, will be required for educators to develop and deliver relevant information to our ever changing society.

This yearbook was purposefully designed to reach a broad audience, with the primary audience comprised of undergraduate and graduate technology education majors, technology teacher educators, and technology teachers. This yearbook has been designed for educators involved in pre-service and in-service education of trainers, educators, and administrators. With this in mind, it is hoped that school board members, higher education administrators, and others concerned or interested in some of the latest information and emerging trends regarding distance and distributed learning environments will find this yearbook helpful.

As an organization of education professionals, CTTE needs to be a leader in innovative learning delivery systems. It was the desire of the authors who collectively developed the materials in this yearbook to advance the profession of technology education and technology teacher education by providing guidance and resources for the implementation of innovative distance and distributed learning environments. With the information, case studies, and discussion questions provided by the authors of the various chapters, this yearbook provides a framework for organizing and furthering professional discussions centered on distance and distributed learning environments.

As editors, we believe this yearbook will serve to advance the profession as people outside the field of technology education seek this edition as a resource. As professional educators we can be the leaders in innovative distance and distributed learning environments.

54th Yearbook Editors

William L. Havice and Pamela A. Havice

# ACKNOWLEDGMENTS

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We need to begin our acknowledgments by recognizing the commitment of the Council on Technology Teacher Education (CTTE) to the professional development of technology educators. The yearbook series provides a valuable source of information for technology educators as well as others interested in education.

The editors wish to thank Gene Martin and John Ritz, who provided encouragement and mentoring during the early stages of this project. These two men were instrumental in assisting us through the development stages of this yearbook. We would like to thank the editor of the 53rd Yearbook, Roger Hill, for being willing to share so freely his experiences and editing strategies. Also, we want to thank the other members of the CTTE Yearbook Committee, who decided that this topic was of significance for the profession.

This yearbook project has been a tremendous learning experience for both of us. Developing a CTTE yearbook is a long-term commitment beginning with the written proposal, to the proposal presentation in front of the CTTE Yearbook Committee, to the many months of drafts from authors and correspondence with the publishers. We are appreciative of the excellent, highly motivated and diligent authors who are part of this yearbook. Without these authors' willingness to contribute their time, energy, knowledge and experience, this yearbook would not exist. We sincerely thank you for your continued commitment to the profession!

The editors and authors, in addition to the members and officers of the Council on Technology Teacher Education, would like to acknowledge Glencoe/McGraw-Hill for its continued support of the Council's Yearbook Series. This yearbook, *Distance and Distributed Learning Environments: Perspectives and Strategies*, is the Council's 54th Yearbook Edition.

A special thanks goes to Stacy Whitaker at Clemson University who read every word of this book, and provided a thorough review and editing for this work. Her support and expertise were invaluable.

Finally, a very sincere thank you to our family for their patience and support during the four years of this undertaking. Our daughters, Brooke and Briana, have been supportive of our many professional endeavors over the years. Thank you girls for your continued love and understanding!

Our sincere hope is that this yearbook will make a valuable contribution to the technology education profession as well as serve as a resource for other education professionals. Therefore, it is our pleasure to present the 54th CTTE Yearbook.

54th Yearbook Editors

William L. Havice and Pamela A. Havice

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# Distance and Distributed Learning Environments: Enhancing the Teaching of Technology

## Chapter I

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William L. Havice and Pamela A. Havice  
Clemson University

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### INTRODUCTION

Imagine your life today without a cell phone. Let alone a cell phone with Internet capabilities, loaded with a digital camera that can record still photos or several minutes of live, dynamic video. The cell phone is an example of a modern technological marvel that is impacting and changing societal behavior and how we access and use information. Who would have ever imagined that cell phones would become ubiquitous like computers? Who would have ever imagined that today educators would struggle with the potential for improper use of cell phones?

Our students are using instant messaging (IM) everyday to communicate while often engaging in other forms of communication at the same time. For example, students multi-task using IM, while word processing a document, searching the Internet, and talking on the cell phone all at the same time. IM has also become a popular means of communication in organizations for short, time-sensitive messages. IM combines the immediacy of a cell phone call and text like e-mail. Today, it is becoming apparent that teaching our students time management skills, as well as IM etiquette is important. The ability to perform instant messaging will be a skill all of us will find vital in the near future.

Instant access to multiple forms of media in our society today has led students to expect “on demand” access to educational opportunities. Many students we have today were born long after the introduction of the microcomputer into the classroom. To them, computers have always been part of their life experience.

The changes brought about by innovative technology offer new and exciting opportunities for enhancing the learning and teaching environments within education and training. Educators now have access to electronic course management systems that allow for flexible and dynamic

course development and delivery. Along with these emerging tools and media come challenges for improved interactivity and communication among participants in the learning process.

During the recent past, media as well as theories of learning and instruction have changed a great deal. For example, learning has been redefined by Cobb (1997) as “a highly interactive set of events shared between a learner and various human/nonhuman agents, tools, and media . . . ” (p. 24). With the development of more interactive learning opportunities, educators are experimenting with a variety of learning theories and delivery methods.

The convergence of audio-visual, information technology, and multimedia is revolutionizing how information is being distributed and shared. Students and teachers are no longer required to meet face-to-face for learning to take place. Multiple forms of electronic media in presentations are growing including digital content, videos, and rich media clips. We have new opportunities for stimulating learning experiences. Learners today can interact with information for constructing knowledge in ways that were unheard of by previous generations. Easy-to-use multimedia development tools offer exciting educational experiences for the generation of students now exploring our image-rich digital landscape.

In this yearbook, you will find many references to distance education or distance learning. Certainly, many of the methods described within this yearbook are appropriate to distance education programs in which students spend little, if any, time in the traditional face-to-face classroom setting. We have chosen to focus on the term distributed learning environment rather than distance education because many of the technologies used to support students at a distance are now being used to enhance the learning experience of students anywhere (Dillon & Greene, 2003). Therefore, this yearbook is designed to provide educators, administrators, and other stakeholders with an overview of emerging distance and distributed education practices in technology education.

## **DISTANCE AND DISTRIBUTED LEARNING ENVIRONMENTS**

Distributed learning has become a popular term used to describe the use of the emerging electronic learning environments to deliver synchro-

nous and asynchronous instruction. “Distributed learning”, as defined by Oblinger, Barone, & Hawkins (2001), “refers to technology-mediated instruction that serves students both “on and off-campus, providing students with greater flexibility and eliminating time as a barrier to learning” (p. 1). Distributed learning environments integrate the interactive capabilities of networking, computing and multimedia with learner-centered teaching approaches such as collaboration, discovery learning and active learning. These tools have primarily been used for the delivery of entire courses to remote learners (distance education), but they are being used increasingly as supplements to classroom-based education as well. Distributed learning environments can include technologies, delivered in part through electronic media, such as videoconferencing, videotape, interactive television, electronic mail, and Web-based instruction for the distant learner, the commuting learner, as well as the traditional on-campus learner.

According to Dede (1997; 2004), a distributed learning environment can be defined as one that facilitates the orchestration of educational activities among classrooms, workplaces, homes, and community settings. One or more of the instructional events that traditionally have occurred in the classroom are distributed to learners so that they may occur while learners are separated by either time or space from one another and the course instructor. Learning can occur at the same time in different places, at different times in the same place, or at different times in different places (Locatis & Weisberg, 1997). In these situations, instructional events such as the presentation of information, discussion between members of the class, mid-course activities and exercises, and assessment are enabled through the use of technologies of instruction, some of which include printed course materials, books, videoconferencing, audiographics, CD-ROM, and, of course, Web-based media.

In a distributed learning environment, one or more specific course events are made available to either distant or local learners in non-traditional settings in order to enrich the instructional process and outcomes or in order to make the course more efficient or convenient for all parties concerned. Additionally, Saltzberg and Polyson (1995) state, “the distributed [learning environment] model can be used in combination with traditional classroom-based courses, with traditional distance learning courses, or it can be used to create wholly virtual classrooms” (pg. 1).

Distributed learning environments allow learners and content to be located in different, noncentralized locations allowing learning to occur independent of time and place (Saltzberg & Polyson, 1995; Dede, 1996; Granger & Bowman, 2003).

Distance education is a part of the distributed learning model. The terms distance education, remote learning, and distance learning all refer to learning environments whereby place and/or time separate the student and instructor; thus the student learns independent of contact with the instructor and, often, other students. One of the greatest advantages offered by modern information technologies is the ability for “time-shifting” instruction—experiencing instruction at some other time after the live lesson—and “place-shifting” instruction—experiencing instruction at some place away from the teacher (Smaldino, Russell, Heinich, & Molenda, 2005, p. 159).

Many of the methods (i.e., lectures and group discussions) and media (i.e., text, graphics, audio, and video) utilized in a distributed learning environment are not new to educators. What makes distributed learning environments revolutionary is that they enable learners to access a wide range of resources rapidly and economically through such channels as the Web or optical discs (i.e., CD-ROM’s, DVD’s). Additionally, learners now can participate in highly social learning communities at any time and from anywhere. Opportunities provided by new media have driven educators to seek alternatives that meet the complex needs of increasingly diverse populations of learners. In distributed learning environments learners are no longer required to meet face-to-face to have dynamic and productive learning experiences (Academic Technologies for Learning, 2002).

Course management systems like WebCT™, Blackboard™, eCollege™, etc., enable the efficient distribution of high-quality, online education. These management systems offer faculty easy-to-use teaching and learning tools for course development, distribution and management. With the use of these systems faculty are able to enhance traditional face-to-face courses by distributing and sharing information through online threaded discussions, online testing, video/tele-conferencing, online worksheets, team and group assignments, chat rooms, etc.

## **DISTRIBUTED LEARNING ENVIRONMENT MODEL**

Distributed learning environments allow learners opportunities for constructing knowledge, skills, and understanding. Figure 1 is a model we have developed that illustrates a broad array of options an educator has in designing and developing a distributed learning environment. This model depicts the overlap and fluidity that exists among the various components an educator must decide upon when designing a distributed learning environment. Furthermore, the model depicts the blending of traditional instructional elements, as well as those that have recently evolved with the advancement of communication technology.

Distributed learning environments, coupled with high-speed connectivity and vast information resources, may ultimately transform the process of education and redefine the roles of teacher and learner. These flexible learning spaces should emphasize what is needed by the learner to enhance the learning process and to construct knowledge for a lifetime. Therefore, “the learner” is at the center of our model. (See Figure 1.)

- **Time and Location**—learners can meet anytime and anywhere; regularly; occasionally; at a distance; in classrooms; at home; etc.
- **Instructional Media and Electronic Delivery Methods**—can include: computer based systems, teleconferencing, audio graphics, multimedia, hypertext, hypermedia, online chats, e-mail, listserves, whiteboards, application sharing, videoconferencing (satellite, desktop, microwave), computer mediated conferencing, audio conferencing (telephone or Internet), telecommunications, computer networks, audiotapes, streaming audio, videotapes, cable and broadcast television, streaming video, instructional or informational materials on the Internet—WWW, CD-ROM, DVD, portfolios, projected visuals, non-projected media, print materials, personal digital assistant (PDA), etc.
- **Instructional Methods and Strategies**—can include: presentations, tutorials, independent study, drill-and-practice, distance learning, demonstrations, cooperative learning groups, asynchronous & synchronous, face-to-face instruction, discussions, simulations, virtual reality, games, problem solving, discovery, service learning, competitions and challenges, etc.
- **Facilities**—can include: personal office space, home, libraries, computer labs, laboratories, etc.

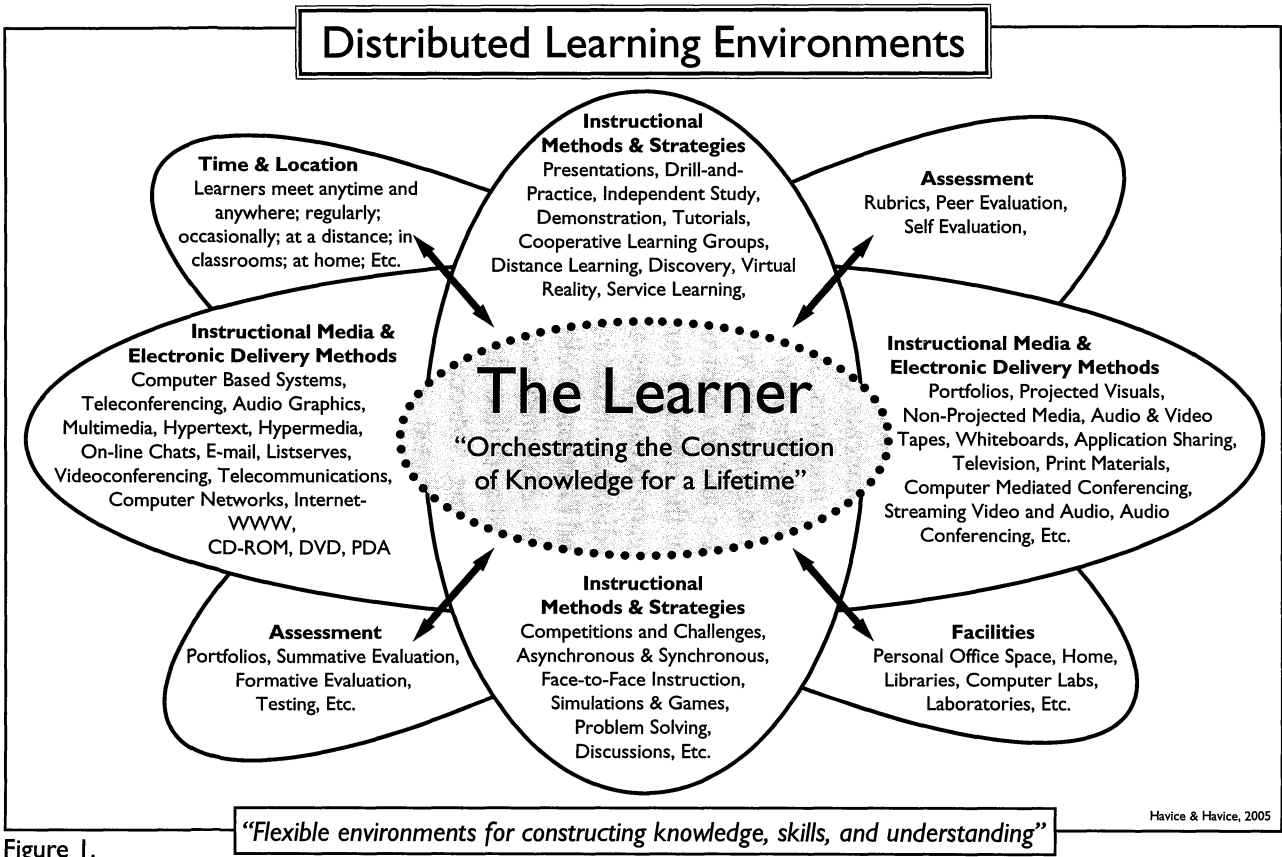


Figure 1.

- **Assessment**—can include: rubrics, peer evaluation, self evaluation, portfolios, summative evaluation, formative evaluation, testing, etc.

## **DESCRIPTION OF YEARBOOK**

The contents of this yearbook provide technology educators with strategies and perspectives for effectively planning, implementing and utilizing distance and distributed learning environments. At the end of each chapter are discussion questions or activities that provide a framework for continued discussion and exploration in the areas of distance and distributed learning.

In chapters 2, 3, and 4 the reader will find a number of ideas for planning and implementing distance and distributed learning environments in technology teacher education programs. The authors address issues ranging from the perspectives of program administrators toward planning and implementing distance and distributed learning, strategies for designing and managing these learning environments, as well as implications for technology education.

Next, chapters 5, 6, and 7 contain a variety of innovative strategies for implementing distance and distributed learning environments within diverse educational settings. Within these chapters are discussions centered on the authors' experiences and/or knowledge in the use of educational portals, digital portfolios, and collaborative and group activities to enhance the learning experience.

Chapters 8 through 11 explore issues of particular importance to faculty and administrators. Within these chapters the authors share lessons learned from both student and faculty perspectives and explore assessment strategies for use in distributed learning environments. Finally, an overview on issues of ownership and copyright that must be addressed when designing, developing or using electronically distributed instructional materials.

To complete this yearbook, chapters 12 and 13 provide some perspectives on the future of distance and distributed learning environments. With learning environments becoming more and more digitally integrated, the scope of what is possible is often limited only by our imagination. The final chapter of the book brings the focus of this yearbook back to exploring the future of distance and distributed learning environments in technology education.

## **SUMMARY**

Advances in information technology, particularly telecommunications, have created new possibilities for innovative and flexible learning by crossing the boundaries of time and place. With the advancement of computer networks, desktop videoconferencing, and the World Wide Web, learning modalities have greatly expanded, allowing for increased interactivity in the delivery of education and training. These advances in technology are creating new forms of electronic, interactive education, such as Web-based courses, that allow people to learn almost anything from anywhere at any-time, thus creating opportunities for lifelong learning (Heinich, et al., 1999).

As technology educators we are in a position to embrace the changes in information technology. With media convergence continuing to gain momentum and the digital generation now graduating from our education institutions, institutions of higher education have been forced to modify their curricula and integrate multimedia classroom learning tools. In distributed learning environments information can be transmitted anywhere; educators and learners can use this information to create and transmit new knowledge. Distributed learning environments, with the Internet and multimedia learning applications, can provide students with an interactive, dynamic and multi-dimensional educational experience that evolves according to learners' needs. Distributed learning environments coupled with high-speed connectivity and vast information resources may ultimately transform the process of technology education and redefine the roles of teacher and learner.

## **DISCUSSION QUESTIONS**

1. What is meant by the terms “distance education,” “e-learning,” or “distributed learning”?
2. Describe how the above terms differ from each other.
3. What components need to be considered when designing a distributed learning environment?
4. Discuss an initial plan for designing a distributed learning environment. Consider the five components depicted in the Distributed Learning Environment model.
5. Why is the “learner” in the center of the Distributed Learning Environment model described in this chapter?



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# Distance and Distributed Learning in Technology Teacher Education

## Chapter 2

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Rodney L. Custer  
Klaus Schmidt  
Illinois State University

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### **INTRODUCTION**

Administrators of technology education teacher education programs face a range of issues, pressures and challenges as they plan for and implement distance and distributed learning environments. As with other educational innovations, it is important for administrators to strike a balance between providing leadership and ensuring solid program management. Leadership issues include helping the faculty think through the larger strategic directions for distance education as well as how those directions align with the mission and goals of the university and department. Management issues include such matters as solid resource planning, making wise technological and delivery system decisions, planning for professional development, etc. This chapter is designed to provide assistance to and some critical perspective for program administrators as they plan and implement distance and distributed learning environments.

### **STRATEGIC PLANNING, PROGRAMMATIC GROWTH AND DISTANCE AND DISTRIBUTED LEARNING ENVIRONMENTS**

Dirr (2003) asserts that “distance education holds the potential to have a greater impact on higher education than any other single phenomenon for several decades” (p. 474). They then temper this optimism by observing that there is little evidence in the literature to suggest that critically important strategic and policy issues associated with distance and distributed learning environments are being addressed in any kind of systematic way. These important policy issues have to do with matters such as instructional quality assurance, equity and access, collaboration and commercialization, globalization, ownership and property rights, technology faculty support and development, and research and evaluation issues.

The point is well taken. While the potential is tremendous, a failure to address larger strategic and policy issues will eventually erode the promise and impact of emerging mediated technologies.

A number of universities around the U.S. are aggressively marketing and delivering courses and programs using a variety of mediated technologies. For example, Pennsylvania State University has reported distance education delivery growth rates at over 200 percent between 1999 and 2001. During this same period, the University of Maryland's University College reported a growth of over 1,000 percent (Maloney, 2001). Given the rapid growth of technology and the apparent success of these and other universities such as the University of Phoenix, this trend is certain to continue. Within this context of dramatic growth, optimism and opportunity, there is a real tendency to jump onto the distance education bandwagon because others are doing it or because the technology is in place to make it happen without addressing the larger strategic issues necessary to ensure success (Maloney, 2001).

Platter (1995), in an insightful discussion of the future of work in the academy, asserts that decisions about distance education should be made within the larger and strategic context of educational reform. This is an important point. Decisions about involvement in distance and distributed learning should be driven by issues that are larger than technological capability, opportunity, economics, market share, or institutional reputation. The appropriate starting point is to establish a larger, strategic context. The real focus should be on educational reform rather than distance and distributed learning. Educational leaders should ask, "How can new and emerging formats facilitate positive change in how students learn . . . ?" rather than "How can we become involved in distance education?" The point of departure should be with a well-formulated vision of learning that is hyperlinked and technologically intensive, constituent-based, asynchronous, multidisciplinary, and global. Rather than serving as yet another knowledge dispensation alternative, distance and distributed learning (cast within the context of educational reform) is uniquely positioned to address contemporary educational issues such as the collaborative construction of knowledge on a global and multidisciplinary scale and the use of simulations and models to facilitate learning in a variety of formats (Burbules & Callister, 2000).

Also at the strategic level, Olcott and Wright (1995) note that decisions about distance education participation should be embedded within the extended mission of the institution. What is the defined constituent base? What is the institutional mission and niche and what are the key institutional goals? How is the institution positioned within its larger national and regional context? Within what kind of cultural niche is the institution defined? These are important contextual and strategic questions that should be addressed before decisions are made to participate in new educational initiatives, including distance education. Kaufman and Lick (2000) have identified a set of characteristics typified by institutions that are functioning effectively in strategic, change-oriented environments. These include a long-term perspective, proactivity, a client orientation, an emphasis on visioning, and embracing a culture capable of change. These are the kinds of characteristics that are often absent from the academy.

Once the decision to invest in distance and distributed learning has been made, key policy issues must be identified and addressed. At a minimum, these include: defining the role of the faculty in decision making; addressing faculty reward structure issues; developing policies for faculty release time, training, compensation, and course load; addressing accreditation issues; establishing delivery boundaries and setting costs; and addressing technological infrastructure issues (Olcott & Wright, 1995). When these kinds of policy issues are not addressed, the tendency is for distance and distributed learning efforts to function at the margins of the university's core mission (Wolcott, 1997).

In sum, mission-based distance and distributed learning planning has the potential for triggering some fundamental and positive changes to the nature of education and educational institutions. As Beaudoin (2003) notes, "the academy is shifting from a campus-centric to a distributed education model, and although the administrative and institutional infrastructures that presently characterize most of our institutions will not necessarily disappear, they will be utilized in different ways" (p. 520). Further, educational administrators and planners must increasingly grapple with how to restructure institutional bureaucracy and large physical plants within an emerging environment where teaching and learning are rapidly becoming disconnected from specific geographic locations. The

emergence of distributed learning environments increasingly will cause colleges and universities to reevaluate their public image, “from that of the protective ivory tower to one of a networked, communication-rich, and much more accessible environment” (Hanna, 2003, p. 26). Viewed strategically, distributed learning environments have tremendous potential for causing some fundamental rethinking of the nature and structure of the delivery of higher education. But existing structures, systems, and values within higher education will need to change.

## **ADMINISTERING DISTANCE AND DISTRIBUTED LEARNING ENVIRONMENTS**

In addition to the larger strategic issues, the administration of distributed learning environments involves a number of practical implementation challenges. The following section includes a discussion of several of the most important of these issues including physical location, in-and out-of state enrollments, and accreditation.

### *Physical Location—In-State and Out-of-State Enrollments*

When discussing the significance of the physical location of students one can distinguish distance learning environments into two major types. The first type of programs is housed in institutions that were designed to exclusively deliver programs online and therefore do not have a campus, (visit <http://www.online-universities.org/> for a list of online universities). These online universities are not funded by any particular state or other public entity and thus do not receive state funding. To these universities the location of their students is irrelevant. All students are at a distance, all are treated as equals, even though they might be just around the block. Tuition discrimination does not exist.

The second type of program is housed in “residential campus” universities that have been traditionally delivering courses on campus and just now are striving for a share of the online pie. These programs can be further divided into two groups; state funded and private universities. The issue of physical location likely will have little affect on private institutions since they do not typically receive public monies and tuition is not based on physical location of students. However, in the case of state funded uni-

versities, physical location of the student matters when it comes to paying out of state or in-state tuition.

Since most public universities are now engaging in some type of distance education, a new challenge for regional universities has emerged: How can they compete with online institutions? With students from out-of-state having equal access to the online offerings of the otherwise traditional campus university a new issue arises. Should distributed learning students pay out-of-state or in-state fees? If so, will online institutions be more competitive and compete for our potential students? And, will economies of scale depend on students from out of state?

Clearly, the physical location of students (in-state and out-of-state) becomes an issue. On the one hand, universities try to reach out beyond their traditional borders to increase enrollment. This includes reaching out to students that otherwise could not (or would not) participate in higher education. On the other hand, one could question why distance learners within the same state should be treated differently than students outside the state. Costs involved with developing and delivering courses will not vary between in-state and out-of-state students. Due to economies of scale, it may become imperative to allow out-of-state enrollment at a competitive price. The development and delivery of online courses to only local students might become limited and cost prohibitive, even with state funding.

### *Credit Issues—Granting and Transferring Credit*

Program quality and integrity is a serious issue when it comes to transferring credit from online courses into otherwise traditional types of programs. Educators face three primary issues. First, how does credit that is granted by purely online based institutions transfer into “campus” based university programs? Second, how does credit transfer from courses completed online from an otherwise “campus” based university? And third, how do programs completed exclusively online enable students to continue their education with a higher degree (e.g., graduate school) at a “campus” based university?

The Distance Education and Training Council (DETC) is attempting to set high standards and distinguish between those online programs that actually deliver quality education from those that merely supply creden-

tials. However, although literature indicates that learning online can be equally effective as learning in the classroom (Neuhauser, 2002; Schmidt, 2002), and that the Council is recognized by the U.S. Department of Education, students of membership institutions are still not able to automatically transfer credits obtained from online institutions, to regionally accredited institutions. This refusal of many regionally accredited institutions seems to still reflect the attitude that institutions with DETC accreditation do not undergo as stringent a rigor as do those that are accredited by regional accrediting bodies (Lezberg, 2003).

### Accreditation Issues

Historically, distance education delivered by “campus-based” universities has technically been covered by an institution’s accreditation. Apparently, accreditation therefore has not been a major issue until online delivery of distance education came about, and the demand for such programs virtually exploded. With the emergence of purely online institutions, two major issues arise. First, who should accredit programs that are developed and delivered by purely online educational institutions? Second, should distance education courses that are developed and delivered by already accredited traditional campus universities, be accredited separately?

As online universities have emerged, organizations such as the DETC (visit: <http://www.detc.org/>) have been created and recognized by the U. S. Department of Education and the Council for Higher Education Accreditation (visit: <http://www.chea.org/>). The DETC establishes educational, ethical and business standards, and examines and evaluates distance education institutions in terms of these standards; and accredits those who qualify.

The scenario for “campus-based” universities is different. These universities have typically been accredited by their regional accrediting associations such as the Higher Learning Commission (visit: <http://www.ncahigherlearningcommission.org/>), for their traditional delivery of courses. We need to examine if the current criteria for accrediting programs delivered by “campus-based” universities suffice to accredit and incorporate distance and distributed learning, and if there may be a need to expand and incorporate educational, ethical, and business standards as they relate specifically to online teaching and learning. The Higher Learning Commission may have to address ways of adjusting standards for



programs delivered online. Flango (2000) found that the six regional accreditation commissions are indeed trying to adjust to the explosion of Web-based instruction. However, the policies of the commissions still differ regarding whether to accredit distance education programs within the normal institutional review, treat them as separate from the accreditation processes, or combine the two approaches.

Institutional accrediting bodies such as the North Central Association of Colleges and Schools have realized this need and have started to establish regulations that allow their members to include distance education offerings within their overall institutional accreditation (Lezberg, 1998; Flango, 2000; Shearer, 2000). However, the standards set by institutional accreditation associations do include criteria such as the qualifications of faculty and curricular offerings, library access, information services, student services (e.g., athletics), residence halls, counseling, and the organizational or administrative format of the institutions. Criteria such as network accessibility, quality of IT infrastructure, and faculty and student preparedness for online teaching are only marginally considered. It still appears that the overall criteria set by accreditors still assumes that the success and quality of education depends upon its taking place at certain times and in certain places where faculty and students are present in a locale appropriate for learning and with immediate access to a properly staffed library (Lezberg, 2003). Nevertheless, researchers continue to discuss quality issues in distance and distributed learning. Shaughnessy and Gaedke (2000) have developed a list of concerns specific to technology teacher education and certification. In particular, these focus on the concern that educators certified via online programs typically lack important classroom and on-campus experiences.

## **FACULTY PROFESSIONAL DEVELOPMENT FOR DISTANCE AND DISTRIBUTED LEARNING**

One of the most important challenges to implementing distance and distributed learning has to do with the professional development of faculty. Professional development challenges can be particularly problematic since the background and experience with technology as well as perspectives on pedagogy tend to span a wide range within most faculties. In

many cases, involved faculty will include the “early adopters” who are already technologically savvy and who are eager to explore new online methods of course delivery (Rogers, 1995). The challenges with these individuals often have more to do with such things as wise mentoring, career planning, time management, and learning how to balance appropriately the demands of teaching, research and service.

The professional development needs of these early adopters tend to be quite different from those of many senior faculty, who find the new technologies and associated new learning approaches to be quite challenging, perplexing, and even threatening. For these individuals, the professional development challenges typically include a steep learning curve with a variety of technologies as well as some significant rethinking of the nature of instruction in a distributed learning context (Rogers, 1995).

So, what are the key issues from the perspective of faculty professional development? Two of these will be identified and discussed in this section. The first issue has to do with the changing nature of pedagogy. Burbules (2000) asserts that “faculty should not romanticize the reality of the classroom as experienced by many students. Auditoriums with a thousand students, faculty lecturing from behind a podium on stage, discussion sections often run by inexperienced teaching assistants, office hours that afford a brief interview with a preoccupied or impatient professor are not so clearly superior to their online equivalents” (p. 276). The point to be made here is that emerging distance and distributed learning environments are causing many faculty to rethink their pedagogical strategies. This move aligns well with contemporary directions in education, where the focus is shifting away from faculty teaching to student learning. Lecture-based, instructor focused delivery systems are giving way to student and learning focused environments. The asynchronous, discovery-based, discussion oriented pedagogical strategies, which are typical with distributed learning classes, are perhaps more in line with contemporary educational pedagogy than are traditional systems.

While significant challenges remain to be resolved with distributed learning environments, they have tremendous potential for helping faculty to rethink and reinvent their approach to teaching and learning. The implications for faculty professional development are important. Professional development planning is typically much too narrow and often begins at the wrong point of departure. The tendency to focus pro-

fessional development on technical matters such as learning how to operate selected computer programs, managing online discussions, and developing curriculum materials appropriate for online delivery is premature and inappropriately narrow. These topics are important, but they are too technical.

The initial focus should rather concentrate on the larger pedagogical educational context. This involves issues such as how students can be encouraged to invest in constructing their own learning, procedures for facilitating learning, how knowledge is transferred across contexts, and how to maintain a focus on important concepts and how to assess knowledge in authentic contexts. Once the issues associated with this larger context have been formulated and (hopefully) resolved, learning the technical procedures involved in distributed learning environments becomes more meaningful and focused. In the absence of this larger context, professional development too often degenerates into a process of attempting to figure out how to repackage a teacher-oriented, single mode delivery system (i.e., lectures) into something that will work with the Web. In short, professional development, at its best, should begin with discussions of pedagogy rather than with how to operate a new set of tools.

A second (and related) set of issues for faculty professional development have to do with a host of logistical and educational processes. Massy (1998) notes that increasingly, faculty will likely spend less time “professing” and more time on educational process matters. These issues involve things such as learning how to identify and interact with technical support staff, how to sort through the logistics of coordinating diverse groups of students across geographic boundaries, and how to manage the logistics of communicating with students (and essentially conducting class) on a real time basis. These kinds of process issues represent a daunting and often discouraging challenge for many faculty, who have become accustomed to a relatively simple set of processes (grab the course binder and deliver the lecture).

The set of issues described above presents a significant challenge for faculty professional development planners. When packaging professional development experiences, it is very difficult to identify individuals capable of maintaining a balance between the technical and broader pedagogical and process aspects of distance and distributed learning. What too often

occurs is that planners opt for one or the other. Again, the key to successful professional development is to address the necessary technical details within the larger context of appropriate, contemporary, pedagogy.

*Characteristics of Effective Professional Development for Distributed Learning*

Willis (1993) has developed a useful framework for faculty professional development. When viewed within the larger context discussed above, a number of characteristics emerge. These include the following:

- The primary focus should be on creating new delivery systems rather than on simply adapting or reformatting existing materials into a new format;
- The orientation to new technologies should be done in a manner that is as non-technical and jargon free as possible;
- Establish faculty ownership and involvement early in the process. Do not relegate professional development planning to technicians;
- Include as many hands-on-experiences as possible throughout the professional development process. Develop materials that will actually be used by faculty in their classes;
- Identify a distance education champion, someone who has developed a successful track record to serve as a model;
- Address faculty concerns openly and honestly. Of particular importance are time and course management issues and faculty load and reward implications;
- Help faculty maintain a clear alignment between core concepts, course learning goals, learning activities, and distributed education learning tools; and
- Encourage faculty to engage in reflective discussion throughout the process.

In summary, as with virtually all aspects of modern society, technology is having a profound impact on the broader educational enterprise. The potential for positive change in how students learn as well as in the nature of faculty work is tremendous. At the same time, there is a serious risk that the quality of educational delivery and the role of faculty will be eroded as a result of implementing distributed learning in inappropriate

ways. Effective, broadly conceived, and well-planned faculty professional development is essential if the potential of these new technologies is to be realized.

## **FINANCIAL, FACILITY, PERSONNEL, AND LOGISTICAL ISSUES AND CONSTRAINTS**

In addition to professional development and formulating efficient and effective distance education delivery models, another major set of challenges occur associated with the reallocation and redistribution of resources. Should there be a preferred delivery system for a university or department? What might be some funding strategies, and how will traditional geographic boundaries be addressed in an increasingly competitive distance education environment? These issues and questions will be addressed specifically in the following sections.

### *Delivery Systems—Making the Right Financial Decisions*

Resource and financial decision-making related to distance and distributed learning hinge to some extent on the target market. What type of student is being recruited and, hopefully, attracted? For those universities that are focused primarily on distance education delivery mechanisms, the financial choices are relatively straightforward. Most of the resources are targeted to attract more online students. Other universities however, where some courses are taught online and some in the classroom, confront difficult financial decisions.

Various models exist to assist universities to make such decisions. Jewett (2000) discusses a computerized cost-simulation model (BRIDGE) that is designed to compare the cost of expanding a campus using distance instruction to that of classroom instruction. Whalen and Right (1999) discuss a case study to address the cost-effectiveness of Web-based training. It should be noted, however, that they focus on the appropriateness of Web-based training based on cost-benefit factors, rather than on learning outcomes.

In addition to the question of what percentage of courses should be taught online versus in the traditional classroom, another emerging trend must also be addressed. This issue has to do with emerging forms of distributed learning where instructors employ for a mix of online and tradi-

tional classroom instruction. For each of these delivery systems a different set of issues must be addressed including those that are infrastructural and financial. While online programs often must exclusively rely on tuition revenues, mixed models and classroom-based models in public universities receive state funding as an additional source.

Most universities have their infrastructure for the traditional classroom delivery system already in place. Additional courses can only be offered with additional classrooms and/or seats available and most likely additional teachers. With full classroom capacities and teachers teaching a full teaching load, maximum economies of scale are achieved. Economies of scale occur when adding more students results in lower average costs per students.

In the online/distance and distributed learning environment, however, the necessary infrastructure is interwoven into the existing university infrastructure. Infrastructural decisions typically cannot be made at the departmental level, apart from the university's larger information technology infrastructure. During the last decade or two, the need to improve the information technology infrastructure has not only enabled universities to engage in online education, but also to enhance classroom instruction with multi-media and Web-enhanced features. Even though a new set of limitations have emerged (e.g., faculty and student readiness), the infrastructure can be designed and configured for a greater reach of students with little additional costs, thus exceeding the economy of scale associated with traditional classroom instruction (Rumble, 2003).

However, looking at the cost of course delivery purely from a cost-causing or actual costs point of view is insufficient for making financial decisions. University administrators rather must explore the opportunities associated with being able to reach students that otherwise would not have been able to obtain a college education. Administrators must also consider the prospect of improving traditional classroom instruction with Web-enhanced features that may address a broader array of learning styles.

### *Strategies for Funding Distance and Distributed Learning*

Major changes might occur in the way education, or more particularly distance and distributed learning may be funded. Considering the success of online universities where the funding is mostly generated by student

tuition, state funding might receive more scrutiny. The traditionally strong base of state funding for public universities might switch more so than ever to learner based funding and/or enterprise based funding. However, in addition to funding strategies, careful attention should be given to cost-benefit strategies. In particular, more attention should be given to cost factors carried by development as well as the costs paid for by students (Jung, 2003). This awareness could help to better match cost sources with cost factors. Inglis (1999) argues that the primary benefit of online education is that costs can be distributed over a larger number of students and thus assume that increasing enrollment would lower the cost per student and operating expenses. Thus, distance education could (at least theoretically) become more affordable to students, even without state sponsorship.

Jung (2003) discusses four approaches to address cost-benefit issues for distance and distributed learning. The value-based approach emphasizes the pedagogical needs and values of an educational institution. For example, if an institution sees small-group interaction as an important learning experience, the institution will be more likely to view interaction as a benefit to be considered in the cost/benefit analysis. The mathematical modeling approach focuses on quantifiable factors such as costs for videoconferencing or cost savings from faculty traveling to remote site versus interactive television. The comparative approach (Cukier, 1997) attempts to compare two or more delivery mechanisms for the same course material (i.e., online education and traditional face-to-face instruction). The last of the four approaches is the return-on-investment approach that attributes micro-economic values to benefits of a new delivery method/system and measures its monetary gains.

One growing funding source has emerged throughout the last decade by forming partnerships with businesses. This has been particularly true for purely online institutions and organizations that offer short, very technical type of courses, that are not typically accredited and/or do not provide college credit. However, there seems to be a trend towards building more partnerships with industry among public universities. These kinds of partnerships may help to spread the risk in the initial development costs for online courses.

*Negotiating and Expanding Traditional Geographic Boundaries*

There are numerous reasons why universities start to expand traditional geographic boundaries. One of the main reasons is globalization. Even though globalization is more commonly obtained through a free flow of goods and services, due to the abolishment of trade tariffs, a free flow of education as a commodity or more specifically credit transfer is not as easily facilitated. Mason (2003) states that the main reason for this lag behind economic globalization is that there is no international system of transferring credit from one university to another in place. Mason (2003) continues that the monopoly on accreditation that universities have enjoyed in the past will be sidestepped by organizations offering courses, information, resources and education opportunities that the market is demanding. This is already true in the information technology industry where certain certifications are often valued more than college education.

Nevertheless, the trends toward “borderless education” and “international education” are receiving increased attention around the world. Online education has become the media of choice for most universities engaged in distance education. Numerous researchers believe that international education or borderless education will become a major market in the future. Mason (2003) lists reasons why “borderless education” will continue to be successful on a global scale. First, increasing numbers of students want to study abroad which may lead to an increase in the demand for online courses without a residency requirement in another country. Second, an increased interest in multicultural learning environments whether online or on campus. Third, an increasing global circulation of ideas and particularly Western pedagogical systems and values. Last, a rise of international and virtual organizations offering training and education online.

Wonnacutt (2001), Smith and Eddy (2000), Coyler (1997), and Lipinski (1999) identify a third dimension of concern with regard to expanding traditional boundaries: Copyrights! Even though current U.S. copyright law provides for a rather liberal use of copyrighted materials for education purposes, the distribution of copyrighted material via the Internet often goes beyond the provisions of the law. This is even more challenging on an international basis, where copyright provisions might have implications different from the ones in the U.S.



Two issues of concern may arise by expanding into the global education market. In particular, in the attempt to increase the market share, prestigious western universities might undermine local and national universities around the world and lead to a cultural homogeneity (Mason, 2003). Thus, the possibility to obtain a degree from a western university might counteract what might otherwise have been a great opportunity for cultural, national, and educational diversity. A second issue is access to the online learning environment. A large body of literature exists about the digital divide. In particular, regions with a less developed information technology infrastructure may be unable to experience the benefits of higher education delivered online. Reeve, Hardwick, Kemp, and Ploszajska (2000) therefore state that technology should not be the central consideration when developing distance and distributed learning environments. Rather, an array of access possibilities should be provided, depending on the various levels for technological infrastructure.

## **RETHINKING THE FACULTY REWARD SYSTEM**

One of the most important issues that must be addressed as various forms of distributed learning are visioned and implemented is that of faculty motivation and reward. The review of the literature revealed considerable ambivalence among faculty related to becoming involved in distance and distributed learning delivery, particularly concerning such factors as tenure and promotion consideration, work load, administrative support, and compensation. This section will identify and discuss a number of faculty motivation issues triggered by alternative forms of educational delivery.

### *Motivation for Participation*

One key motivational factor has to do with the perceived value of distance and distributed learning within the academy, particularly in more research oriented universities. Wolcott (1997) has observed that, in many institutions, distance education and other innovative delivery systems have typically been viewed as part of the outreach arm of the university. These activities are often delivered through extension services and are often viewed as part of the service function of the university. While there may be general support for extending the reach of the university out to unserved

or underserved constituencies, these types of extension activities can do real damage to a faculty member's tenure and promotion record, when they are viewed primarily as service activities. Thus, it is very important that faculty (particularly junior faculty) pay particular attention to how distributed learning activities fit within the culture and reward structure of their particular university. If extensive participation in extension based, time intensive, distance education teaching is not valued, then it should be reconsidered in favor of activities that do fit within the reward structure.

This point is particularly important given what the literature has to say about why faculty typically become involved in distance education (Betts, 1998; Schifter, 2000; Rockwell, Schauer, Fritz, & Marx, 1999; Wolcott, 2003). According to their research, faculty participating in distance education tend to be motivated by intrinsic (and even altruistic) rather than extrinsic rewards. Specifically, Wolcott (2003) notes intrinsic motivational factors such as having the opportunity to work with students from remote locations, being able to extend the reach of their classes, the opportunity to work with new technologies, and the enjoyment and novelty of working in new learning environments. These faculty tend to be "early adopters", who enjoy innovative approaches to education as well as new technological advances (Rogers, 1995).

This said, it is interesting to note that administrative perceptions of faculty motivation may miss this important intrinsic dimension. Research conducted by Betts' (1998) and Rockwell, et al. (1999) on distance education in higher education, indicates that administrators thought that the key issues to distance education participation for faculty had to do with such things as salary, release time, personal credit, etc. While these factors were also noted by faculty, intrinsic factors were rated much higher by faculty than were extrinsic rewards.

Academic administrators should pay particular attention to this mismatch in perceptions. As with the adoption of any new innovation, one of the keys to ultimate success is in developing a clear understanding of how individuals involved is accurately perceiving the value of certain motivators within the system. While extrinsic reward factors certainly count, it is vital that administrators become more aware of the intrinsic faculty motivators. This is particularly important in the long term, since the appeal among some junior faculty to participate in innovative activities (an intrinsic motivator) may ultimately be unwise, given the requirements to

participate in research and other scholarly activities in order to achieve tenure. In essence, it might be wise, particularly in the case of junior faculty, for educational administrators to encourage faculty to shift their focus more on the key extrinsic demands that will affect their careers.

### Incentives and Disincentives

A number of factors have been identified that should be addressed in order to ensure the long-term viability of distributed learning environments in higher education. Olcott and Wright (1995) have observed that distance education delivery has tended to be viewed as inferior to more traditional forms of instructional delivery, both in terms of quality and status. Given the emphasis on education reform and the advancement in technological capability, these perceptions are hopefully changing. The second factor noted by Olcott and Wright (1995) is the concern among some faculty that distributed learning environments may undermine their autonomy and control of the curriculum.

Within this larger context, several incentives and disincentives have been identified and should be addressed by academic administrators. This focus on administrators is necessary and appropriate, given their key support and decision making role related to the implementation of new programs and initiatives (Wolcott, 2003).

- **Workload:** Teaching load is a critical factor for faculty. Workload issues are becoming increasingly more important as the emphasis on research continues to escalate, particularly in regional universities where good teaching used to be sufficient for tenure and promotion. The course development and delivery demands tend to be time-intensive, particularly during the initial stages. Whenever possible, administrators should make reasonable and equitable workload accommodations for faculty. Olcott and Wright (1995) note that “how institutions deal with issues as release time and teaching load conveys values and priorities of the institution” (p. 3).
- **Compensation:** Fairweather (1993), in a study of faculty compensation issues, observed a strong correlation between low faculty salaries and participation in public-service activities. In other words, distance education faculty often tend to be compensated at levels less than those teaching in more traditional formats. Part of this disparity, of course, is also due to the larger percentage of participation in distance education

delivery among junior faculty, who are compensated at lower levels than senior faculty. The important point for educational administrators is to find ways of compensating faculty that offset the time demands and rigors involved with teaching via distance education.

- **Recognition:** The point made earlier about the importance of intrinsic rewards is important in this context. During tight budget times, when formal compensatory rewards (e.g., release time and additional salary) may be difficult to award, the importance of recognition should not be underestimated. Most institutions have mechanisms for formally and informally recognizing the exemplary efforts of the faculty. Most faculty understand institutional constraints and genuinely appreciate the efforts of administrators who find ways to promote and recognize their creative and hard work.

A final point that should be made within this context is that faculty should be encouraged to find ways to creatively and consistently commingle their work with distributed learning environments and research productivity. When distributed learning is viewed from the perspective of educational reform, there are numerous possibilities for conducting research into areas such as how students learn and transfer their knowledge in various delivery formats, how instructional quality is developed and maintained, and how various delivery mechanisms are perceived by various constituencies. The old axiom, “Try to accomplish at least two things with every activity” is particularly valuable for innovative teaching strategies. Often, it takes very little additional effort to generate a publication or apply for a grant in addition to work that has already been accomplished.

In sum, distributed learning technologies are impacting the reward structures across the academy. Educational administrators, particularly department heads and chairs, serve a key role in influencing the system to ensure that the faculty is appropriately rewarded. They are also responsible for providing wise and prudent counsel to faculty, to make certain that the reward structures are well understood and navigated.

## **SUMMARY**

A number of critical issues confront administrators of technology teacher education programs as they attempt to incorporate distributed learning components into their programs. Traditional and distributed delivery systems are similar to traditional delivery systems in many respects. In other ways, they are distinctly different. Key differences include the impact on faculty (e.g., tenure, workload, reward, etc.) and larger strategic and planning issues (e.g., growth, outreach, political constraints, finances, etc.). Perhaps the most important contrasts, however, have to do with the larger philosophical issues dealing with the nature of education and educational reform.

## **DISCUSSION QUESTIONS**

1. How can the lessons learned from distance education change how instruction is delivered in traditional classrooms? What are the implications, if any, for educational reform?
2. What mechanisms should be put in place to ensure quality delivery of distributed learning environments, especially when they can be delivered to remote locations around the country and globe?
3. To what extent should local programs consider the implications of technology education content for international audiences where standards and accreditation practices may be distinctly different from those in the U.S.?
4. How can administrators be proactive and strategic in planning for future involvement in distributed learning given the ongoing pace of change in information technology?
5. What possible changes could be made in how faculty are rewarded and prepared to encourage them to participate in distributed learning activities?

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# Strategy for Planning, Designing, and Managing Distance and Distributed Learning at the University

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## Chapter 3

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Kenneth P. Pisel  
Joint Forces Staff College

John M. Ritz  
Old Dominion University

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### INTRODUCTION

Universities are coming to rely more and more on distance and distributed learning environments to meet the challenges posed by constrained funding, increased competition, and rapid advances in technology. Online courses alone increased nearly 20% in 2002 with over 1.6 million students taking at least one such course (Read, 2003). Leaders in academe are making decisions that move the university in this direction. However, to be effective, the decisions to implement distance and distributed learning environments are not simple. Just as distance and distributed learning should not be considered a panacea or a quick fix, its inception and implementation should not be taken lightly; it requires vision, analysis, and coordination to be effective. These same elements are the keys to strategic planning. Keller (1983) writes, “to have a strategy is to put your own intelligence, foresight, and will in charge instead of outside forces or disordered concerns” (p. 75).

Conversely, without a strategy, implementation of a distance and distributed learning environment can be reactive; a constant string of incremental changes in response to pressure without a clear vision to anchor the process. Such a poorly implemented distance and distributed learning environment is not an answer—it is more likely a potential failure and a drain on the organization, regardless of whether it is a university, school system, or corporate training enterprise. The key to successful implementation is effective strategic planning.

Essentially, distance and distributed learning environments are student-centered—the learner has greater control over the time and place

where the educational transaction occurs. However, although the learner is ostensibly in the driver's seat, it is the university that must plan, develop, and implement the learning programs. Moore's (1990) definition of distance education captures this relationship: "Distance education consists of all arrangements for providing instructions through print or electronic communications media to persons engaged in planned learning in a place or time different from that of the instructor or instructors" (p. xv).

To establish an infrastructure—Moore's "arrangements" that will allow learners to engage in "planned learning"—it is essential that the university itself engage in planning. Good planning is an absolute necessity, but it is more art than science. Boar (1993) reinforces the concept of strategy as art stating "the results of the process are only as good as the intellectual investment of the participants in thinking deeply about the issues. What makes the difference is insight, not rote execution of analytical steps" (p. 15). In the end, there is no accreditation body to check on the planning process; however, universities and individuals are continually evaluated on results—the successes or failures of the planning process.

## **STRATEGIC THOUGHT AND VISION**

Strategic planning is a continuous process that enables any university—public, private, profit, or nonprofit—to achieve its long-range mission or vision. Such planning enables the university to progress logically and analytically from a vague concept to a decision on how to proceed. Then, once a decision is made, a plan is finalized and the implementation phase begins. However, a plan is only the means to achieve a goal and not the goal itself. Dwight Eisenhower once said, "plans are nothing, planning is everything" (Aaker, 1992, p. 3). Plans left to fend for themselves in a constantly changing world ultimately fail because they are static. Planning, at all levels, is a dynamic, continuous process. This process is the key to success.

Strategic planning has a broad focus that enables the university to identify where it is going and focuses on broad policy issues (Moscow, 1981). "What could be?" "What should be?" This vision is compared to the current state to identify the gap the strategy is intended to fill (Herman, 1990).

A university plans strategically to identify how it will commit resources over the long term in order to accomplish its mission (Hunt, et al., 1997). The strategic planning process enables an organization to com-

municate and motivate (both internally and externally), pursue opportunities, and employ systematic decision-making (Brickner, 1977). Keller (1983) notes “any organization with competitors, with aspirations of greatness, or with threats of decline has come to feel the need for a strategy, a plan to overcome” (p. 75). Keller’s brief observation captures three significant elements of strategic planning—external threats, internal vision, and analysis to project the future state of the organization. While these three elements are keys to successful strategic planning, there is an additional key—focus. Planning strategically must also put the organizational focus on the desired ends and this must occur before considering the means or methods to achieve them. Kaufman and English (1979) point out, “many of our failures in education are not due to poor methods and procedures; they are due to selecting methods without carefully considering and determining the results, or outcomes, of education” (p. 31).

Ultimately, four keys to strategic planning emerge from the literature: a clearly defined desired end state, a focus on the environment (both internal and external), analyses, and continual feedback. These keys will be addressed in greater detail in this chapter.

## **LEVELS OF PLANNING**

Planning is comprised of multiple levels defined by their scope and duration. All levels of planning will be involved in the successful implementation of a distance education program. The focus of this chapter is the strategic level of planning.

There are up to three distinct levels of interrelated planning—strategic, operational, and tactical. Strategic is the highest level of the planning trilogy. The importance of comprehending this trifurcation of planning is that misunderstanding and misapplication are often causal factors in the perceived failure of strategic planning. What is often called strategic planning is actually focused at operational or tactical issues (Kaufman, 1992). Meredith, Cope, and Lenning (1987) performed a survey in 1985 that found that 87% of higher education institutions reported that they conducted strategic planning. However, Meredith, Cope, and Lenning cautioned that the definition of strategic planning used by these institutions might have been too broad. The result was that any planning performed was assigned the strategic label. On further study they determined that only around one in three institutions actually performed bona fide strategic planning.

Demarcation of where one level stops and the other begins is generally a function of time and focus. Cope (1986) writes, “strategy evolves through a series of today’s decisions as they take identifiable patterns over time” (p. 7). Strategic planning focuses on a broad vision for the entire organization. Operational planning is a step down in the organizational hierarchy. This level of planning is performed by elements of the organization or university and includes plans developed by the library, registrar, or other element in support of the overall strategy. Finally, tactical planning is focused on implementation. It is performed at the lowest level and turns strategy into reality.

Time is another defining characteristic for planning. At the high end of the continuum, strategic planning projects forward as little as 3 to 5 (Barry, 1998) or as much as 10 to 20 years (Herman, 1990; Hunt, et al., 1997; Rumble, 1986). Operational plans encompass from one to five years. At the other end of the spectrum, tactical plans have the shortest outlook of typically less than one year (Barry, 1998; Herman, 1990; Rumble, 1986).

## **SYSTEMS APPROACH**

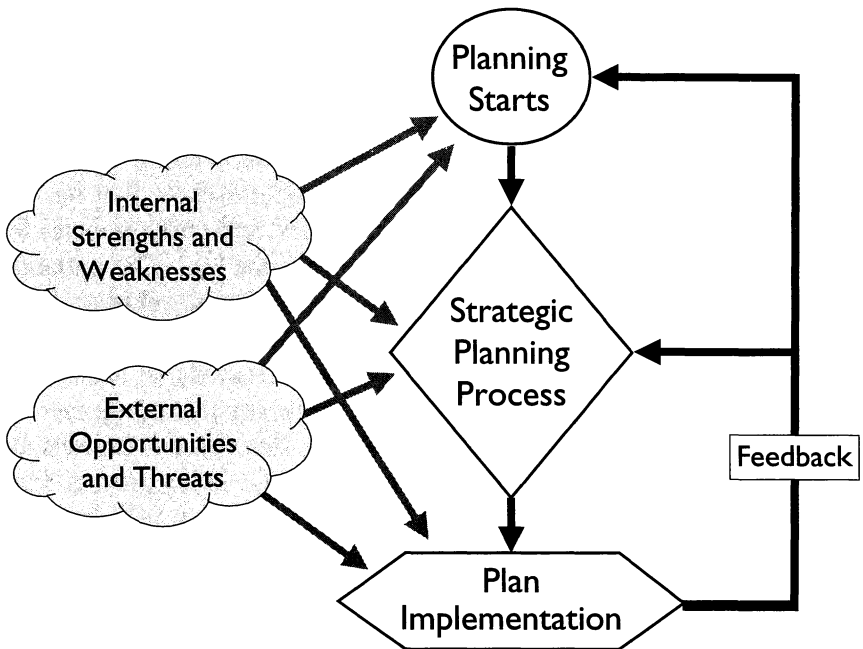
Keller’s earlier observation about external threats and internal vision speaks to the reality that universities do not operate in a vacuum. A strategic plan cannot be developed based on the realities of today projected ahead for the out years. Such a plan would be static, envisioning a mythical future that will never occur. The university’s customers, competitors, and a myriad of other factors are constantly changing. In the earlier days of strategic planning—up to the 1960s—the terms long-range and strategic planning were used interchangeably. This mode of planning employed such concepts as logical incrementalism or extrapolative forecasting as the foundation of planning. Ansoff (1988) stated that logical incrementalism was based on the belief that the environment remained stable and that the future could be planned by analyzing the past. With a predictable setting, organizations could progress in a lockstep or incremental fashion. However, such an incremental approach is intended to maintain a status quo—not foster change.

Covey (1992) compared the old way of planning (long-range) to a road map. Such a planning paradigm was viable only as long as the environment (the road structure) was unchanged. Morrison, Renfro, and Boucher (1984) saw the difference between long-range and strategic planning as the

difference between two futures: one where “*the future happens to the institution*” and the other where “*the future happens for the institution*” (p. 9).

Education was particularly vulnerable to this change. When it could rely on a stable flow of funding, its predictable five-year long-range blueprint was adequate. However, this static planning approach in a dynamic world is no longer viable (Penney, 1996). Universities must recognize that strategic planning takes place in a dynamic environment and there must be a strategic planning *process* that is responsive to that environment. Systematic continuous feedback is the mechanism in the planning process that enables this response (Figure 1). The strategic planning process employs a systems approach to help the university to avoid being tied to the assumptions and realities of the past and to be better able to respond and adapt to the reality of change. The ability to focus on the environment and systematically adapt to change through continuous feedback is a key to proper strategic planning.

Figure 1. Environmental Factors



## **STRATEGIC PLANNING PROCESS**

A systematic approach to strategic planning for distance education for higher education was developed in 2001 (Pisel, 2001). The research employed a panel of experts in the field to develop, refine, and validate a model of the strategic planning process for distance education. The product of the research was a 10-phase model with over 200 issues and questions that should be considered in developing and implementing a strategic plan for distance education. In practice the lines between the planning phases may become blurred as individual steps collapse together. The importance of each phase will also vary with the experience of the planner and the situation. The phases of the model (Figure 2) include Planning Initiation, Planning Guidance and Scheduling, Analyses, Mission Refinement, Assumptions, Strategy Development and Courses of Action, Functional Analyses, Implementation, Assessment, and Periodic Review.

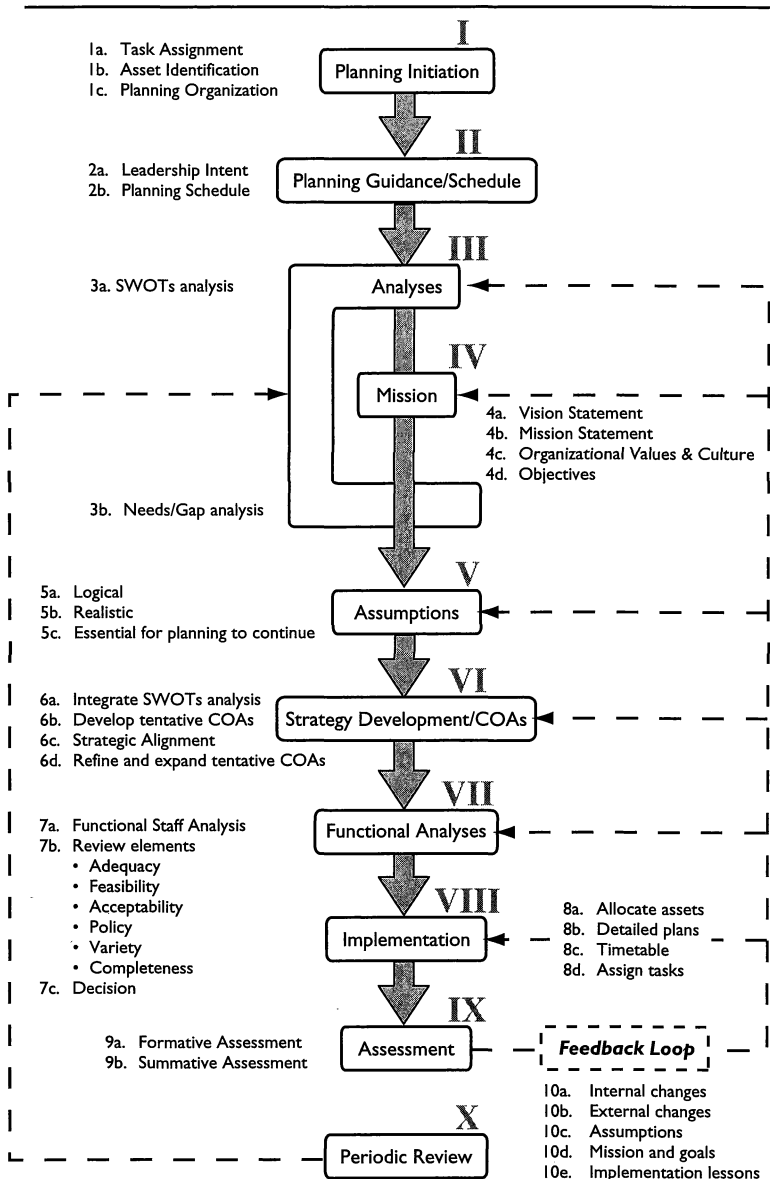
### **PLANNING INITIATION**

The concept that everything must start somewhere may be a blinding flash of the obvious, but it is absolutely true. A strategic plan begins with an idea. This idea can be either internal or external to the university. At a public university it is very possible that the idea is driven from the state legislature or other directive body and forces the university to embark in planning. At a private university, it may be an internal decision. Regardless of the source, an individual or group within the university that has the authority to approve the plan, allocate resources, and create policies for implementation and accountability must assume the lead. The initiation phase serves to align both personnel and infrastructure to achieve a common outcome and sets the tone for all phases to follow.

Like a cook preparing a meal must know the available ingredients before a menu can be written, so too must university planners know the resources available before they can truly begin. Resources and assets are critical issues that must be resolved at this early stage in the process. Such information identifies the capabilities and constraints that will shape the rest of the process (Berge, 2001). The leadership must identify and prioritize the assets that are available. Typically, the primary assets of the university include faculty, support services, technology infrastructure and support, and funding, but planners must also consider intangible assets such as expertise and experience.



Figure 2. Strategic Planning Process Model



Notes:  
SWOT - Strengths, Weaknesses, Opportunities, & Threats  
COA - Course of Action

Pisel, 2001

Funding is often the first issue and is always significant. When considering funding, the planners must know the kinds of budgets or fiscal allocations to be assigned. It is essential to understand whether there will be a fixed budget, one-time funding, or ongoing money. Each approach to funding poses different challenges and opportunities.

Major planning efforts are rarely a solo performance. A team is typically involved (Ward, 2003). Participants in this planning process must be identified and their roles defined. It is also important that all who are to be involved are clear about their roles in the planning process. Having a team engages more talent and produces a better plan, but even more important is getting stakeholders involved in this planning process. The team approach helps to provide buy-in to the final product (Brewer, Brewer, & Hawksley, 2000). The importance of buy-in cannot be understated. Distance education is a knowledge-based service enterprise. Everyone in the organization must be aligned with the strategic vision for the process to succeed (Kaplan & Norton, 2001).

Once a planning team is formed, some level of authority commensurate with the tasking is delegated to it and made clear to the rest of the organization. Limits of that authority must also be established.

What should a planning team look like? Obviously, it always depends on the individual university and its culture. Research shows that an ideal strategic planning body for distance education consists of two parts. One part is a core element of 2–4 members who jointly design and lead the planning process and do all critical writing. A second group, with broad representation of the various functional areas, is called in at various key points in the process to participate. The size of the second group will vary, but is typically around 9–10 members (Pisel, 2001). However, it should be as large as necessary to include all key stakeholders. Typical candidates come from a variety of functional areas within the university. A listing of these areas is in Table 1 but remember that the actual title for each function may vary from one university to another.

Table 1. Planning Team Functional Areas

Distance education office
Institutional leadership
Faculty
Information systems (IS)/Instructional technology (IT)
Student services
Fiscal
Library
Instructional system design
Students/customer
Faculty development
Marketing
Registrar
Graduate studies
Planning/research office
Learning center
Operations
Production

## PLANNING GUIDANCE AND SCHEDULING

Like a ship beginning a voyage, the planning process casts off lines and is underway after the initiation phase. However, like that ship, there must be a heading and speed to enable the ship to navigate and achieve a goal. This phase plots the course for all to follow by establishing the philosophical and temporal direction of the planning process.

Clearly articulated leadership intent sets the course and speed of planning—it is a guiding statement that defines for the planning team and the university the purpose of the planning effort. It gives the opportunity for all involved to understand the need for and overall goals of the planning effort (Beaudoin, 2002). It is also a clear statement of ownership of the planning process by the university leadership. Such guidance should include the intended direction of the planning process and any predetermined constraints. If the planning task is externally driven, it is essential that there be a clear understanding of all guidance and stipulations that accompanied it.

Along with direction, speed and timing are critical. The planning schedule is designed to keep the process moving forward at a defined pace for all involved. It establishes realistic parameters for the planning process based on leadership intent. Periodic milestones and/or phases can be used to reduce the process into more-manageable elements that give the ability to gauge the progress of planning. Keep in mind that not all milestones will be the same. Some may be absolutely rigid and must be completed by a set date. Others are more flexible and allow some margin of error. The planning schedule should note where the objectives are rigidly set and where there is flexibility. Consideration should also be given to other calendars and schedules such as the fiscal or academic year, which more often than not will drive target dates.

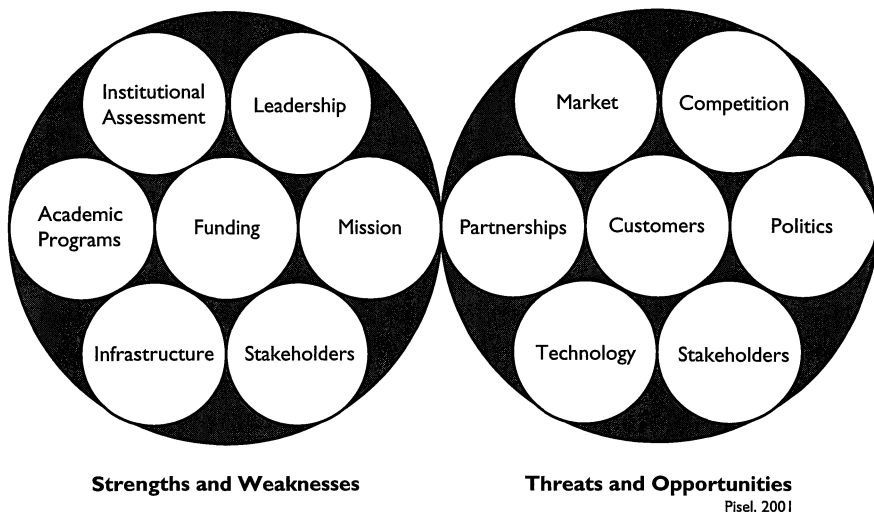
## **ANALYSES**

Analysis is one of the key elements in successful strategic planning. In this phase there are two critical and distinct elements of analysis—an environmental analysis of strengths, weaknesses, opportunities, and threats (SWOTs) and a needs/gap analysis. These two individual analyses bracket the Mission phase that follows, effectively causing the two phases to run concurrently. Mintzberg (1994) describes strategy as a pattern that reflects the dynamics of the environment. It is this phase that enables the planning process to assess the environment.

### SWOTs Analysis

Strategic planning is a process for aligning services and activities with changed and changing environmental conditions. SWOTs Analysis is the means to achieve that end. It is the part of the Analyses phase that precedes the Mission phase and gives it shape. “SWOTs” is an acronym for Strengths, Weaknesses, Opportunities, and Threats. It is a critical assessment of the internal strengths and weaknesses of the university and the opportunities and threats existing in the external environment. In a dynamic market environment, it is essential to understand planning factors driven by the external environment and the university’s ability to muster an internal response.

Figure 3. SWOTs Analysis



There are seven areas internal to the university that must be analyzed to determine the institutional strengths and weaknesses:

- **Institutional Assessment**—The institutional assessment analyzes the core of the university focusing on policies, organizational culture, expertise, the organizational decision-making process, risk tolerance, internal communications and collaboration, organizational history, and the track record for performing and acting on continuous assessment. From this review, the planning team will be better able to identify how to develop the program (build or buy) and the magnitude of internal obstacles.
- **Leadership**—The leadership assessment seeks to identify the level of support and commitment that can be expected from the university leaders.
- **Mission**—Mission review assesses how the new program aligns with the existing university mission and vision. If the current mission emphasizes the value of a brick-and-mortar education, then there will be some considerable obstacles to overcome.

- **Stakeholders**—Similarly, planners must understand how the stakeholders view distance education. Most of all, planners must understand whether the faculty is an enabling or constraining influence and what the general expectations are for all stakeholders regarding a distance education program.
- **Infrastructure**—Planners must understand what infrastructure exists and to what extent it can support a new program. This is not strictly a technology issue but should include student and faculty support issues.
- **Academic Programs**—A review of academic programs is an internal market analysis. First identify whether there are prestigious courses at the university that would be an easy sell. Then look to see if there are bottlenecks where student demand outpaces capacity or the opposite, where a quality course could use a larger student base to justify retaining it.
- **Funding**—Ultimately, it all comes down to funding. If there is no funding available or possible in the future, you probably are not reading this chapter. Planners must fully understand what funds are available, their form and timing, and whether investment funding will be up-front or if revenues from operations will be necessary to fund infrastructure and growth.

External analysis of the threats and opportunities facing the planners is equally important. There are also seven external areas that must be assessed:

- **Market**—The market and competition analyses are closely related. Market analysis will first identify the niche that the university can fill and whether one even exists. It must look at the institutional boundaries (if any), what the university's reputation is inside this target area, and what pricing structure it will support. Finally, it will determine the marketing strategies to be pursued; whether mass marketing or a business-to-business approach is best.
- **Competition**—Once the university has identified its niche, it must see who is competing to fill it. In distance education the competition can be from anywhere in the world. Learn what they are doing and how your plans compare.
- **Politics**—Politics are particularly important for state-supported universities. Planners must know of any regulatory issues (licensure/certi-

fication issues imposed by accreditation agencies, professional associations, etc.) that could impact the proposed plan. If the state legislature or another governing body initiated the proposed program, it is essential that planners know exactly what is expected to include specific locations, content, or media.

- **Customers (students)**—The customer must be identified. Understand who they are, their needs, and their technological capabilities or limitations. It is also important to gauge their readiness for distance education.
- **Partnerships**—Partners are also an option that must be explored. If there are existing partnerships determine if they can or should be expanded. If not, determine whether there are opportunities to partner or collaborate with other educational institutions, business and industry, or communities.
- **Stakeholders**—Finally, off-campus stakeholders are key to the success of the program. Their input must be sought as part of the strategic planning process and they must be given a way to “buy-in” to the process.
- **Technology**—Technology is the final external area to assess. In this step the planners look at customers and external infrastructure. It is essential to know the learners’ access to technology. Do not create a leading edge program that the targeted customer base cannot access. Also look at the technology infrastructure within the state. Identify whether there are state assets that can be leveraged to support the plan. Finally, know technology—where it is going and how quickly. Creating something that customers cannot access is wrong but creating something that the customers see as yesterday’s technology may be an equally egregious mistake.

When the internal and external analyses are completed they must be compared. Planners must know where they are strong and what external opportunities exist that play to their strengths. The university must also work to minimize the internal weaknesses and play to their strength to offset the weaknesses. Finally, it must assess the external threats to see how they compare to internal factors. Over 2,000 years ago Sun Tzu advised the planner to:

Know the enemy and know yourself; in a hundred battles you will never be in peril. When you are ignorant of the enemy but know yourself, your chances of winning or losing are equal. If ignorant of both your enemy and yourself, you are certain in every battle to be in peril. (Griffith, 1971, p. 84).

While there is no pure enemy in the context of planning for distance and distributed learning, there are competitors who create what Ansoff (1988) refers to as “a vector of potentially antagonistic objectives” (p. 23). In a true strategic plan the university will know itself and its competition.

### Needs/Gap Analysis

The Needs/Gap Analysis assesses the differential between the current status and the stated goals. It follows the Mission phase of the model, which allows it to be based on a comparison of the knowledge derived from the SWOTs analysis and the mission—a comparison of the environment and the university vision. An effective planning effort begins with a full understanding of the university’s true status (readiness) to undertake this process. This starting point is compared with the desired end state to create a “picture” of any existing gaps. Lacking this analysis, institutions set off in inappropriate directions without a true understanding of where they are and what is needed to launch an effective distance education initiative.

## **MISSION**

The Mission phase is critical for describing the ways in which distance and distributed learning is important to and aligned with the core mission and future vision of the university. The mission serves to inform both internal and external constituents. This phase is often problematic for two reasons. First, universities frequently want to jump in and start working on strategies without building a strong foundation for the plan. Conversely, it can also become a bottleneck. Participants spend so much time arguing about where they need to go that they run out of steam when it comes to actually going there. This phase is a staple in every planning textbook, but in reality it can become more of an intellectual than a practical exercise. If planners are not cautious, it may lead to seeing the plan as the end rather than the means to achieve it.



Before a mission can be developed, the university first must identify a vision or ideal vision, according to Kaufman (1995). In contrast to the mission, the vision is for internal consumption, designed to provide direction and inspiration for the university (Aaker, 1992; Hoyle, 1995). The vision statement defines success, describing what it looks like and adds value to the university's long-term (three to four years) core intentions. Keep in mind that timing within the process is important—the ideal vision must be developed first, before restricting the group's imagination with real-world data (Kaufman & Herman, 1991).

A mission should be stated in measurable terms and provide a clear and concise picture of what is to be accomplished and why (Kaufman & Grise, 1995; AFSC, 1997). It will serve as the basis for all phases to follow. This statement tells everyone what is to be accomplished, by whom (person or organization), when, where (target audience), and why. Normally, the "how" (the means by which the mission will be executed) is left to the course of action (COA) development phase, but it may be known if the process is commenced with preconceived political objectives. The focus of the mission is on the ends—not the means to achieve them. Kaufman (1995) stresses the importance of understanding the difference between ends and means. Ends are the desired results, accomplishments, and outcomes, while means are the way to achieve those ends. Means include such things as the resources and methods employed in a plan.

Two of the most significant factors that planners must consider in developing the vision and mission are the organizational culture and values—items identified in the internal analysis. The design, structure, and leadership of an organization are unique functions of its culture and values (Hardy, 1991; Murgatroyd & Woudstra, 1989; Saxby, et al., 2002). Strategy, because it is an organizational process, is inseparable from the structure, behavior, and culture of the organization in which it occurs (Andrews, 1987). Ultimately, whatever strategy is developed will have to survive and be implemented through that same filter of culture and values (Vestal, Fralicx, & Spreier, 1997). As an example, if a university's culture is to avoid risk, it is doubtful that the leadership will adopt a mission and vision that take a leading-edge (also known as bleeding edge) technological approach.

## **ASSUMPTIONS**

The Assumptions phase is one of the least understood elements of strategic planning. It supports the planning process by accounting for issues that cannot be determined. A planning assumption is a hypothesis on the current situation or on the future course of events that is assumed to be true in the absence of positive proof. Valid assumptions have three characteristics: they are logical, realistic, and essential for the planning to continue. They are never items of convenience—they must be necessities. Only those items necessary to enable planners to complete an estimate of the situation and make decisions can become assumptions. Assumptions normally cover issues over which the planning team has no control and are used to fill a gap in knowledge so planning can continue. Because of their influence on planning, the fewest possible number of assumptions should be included.

As planning proceeds, additional assumptions may be needed, some early assumptions may prove to be faulty, and still others may be replaced with facts or new information gained during the planning process. All planning assumptions should be documented to ensure that everyone involved—even those who come on board later—has a common frame of reference. This documentation also facilitates the Periodic Review phase by clearly stating what was assumed in planning.

## **STRATEGY/COURSE OF ACTION (COA) DEVELOPMENT PHASE**

This phase is where the analysis of the earlier phases is crafted into a strategic direction. Armed with the results of the gap analysis, the planning group should be able to move forward with strategic options for consideration and assessment. COA development begins with scouring the SWOTs analysis for its strategic significance. Planners look for commonalities or trends in the data that indicate a market niche (e.g., students to be served, academic program areas, degree versus nondegree studies, credit versus noncredit, geographic areas, etc.). Planners critically assess the competition and look for potential partners/collaborators that can be exploited to “jump-start” the development process. It is essential to ensure that this step is done as “open-mindedly” as possible—sometimes opportunities are disguised as roadblocks.

Once this analysis is complete tentative COAs are developed. Tentative COAs are unconstrained broad concepts that can be developed to realize the university Mission and Vision. Typically, multiple COAs (around three) are developed, analyzed, and presented for a decision. Planners may initially develop a large number of COAs; however, too many COAs can be problematic. Unless the COAs are reduced to a reasonable number of supportable options they will create a monumental task in the next planning phase.

As the tentative COAs are developed, it is important to avoid politics, weak analysis, or protectionist COAs. Distance education shakes the foundations of the higher education enterprise—it raises questions that many want to avoid. The last step in developing tentative COAs is to ensure that they are consistent with the mission and vision. Ideally, planners will specify how the COAs support the mission and vision to answer questions before they are asked.

Once the planners have their acceptable COAs, they begin a process to refine and expand them. This step takes the process beyond identifying who, what, when, where, and why by specifying how the institution intends to achieve its mission and vision. The process must focus each COA on the customer/student and content. Do not permit technology to be the driver of the plan. When the combination of content and customer demand is ready for technological delivery, the optimum technologies of that moment can be adopted. Unless the customer is served with a viable product, the program cannot be sustained. An essential element of this step is to ensure that there is broad staff involvement and all stakeholders are informed. This is an opportunity for buy in.

## **FUNCTIONAL ANALYSES**

The planning team has performed detailed analyses, developed a mission and vision, and created some viable COAs to achieve them. Now, in the Functional Analyses phase the broadest cross section of the planning team will perform a detailed analysis of each COA. In a sense, this phase formally addresses a function that hopefully has been happening throughout the development process. It represents the final opportunity for the planning team to resolve issues before a decision is made on one COA and implementation begins.

At the foundation of this phase is the assumption that almost all organizations engaged in a distance and distributed learning planning effort have a staff hierarchy that will be engaged in the planning and implementation of any proposed program. These staff functions also comprise the stakeholders of the process. This phase takes each of these staff elements and reviews the COAs through the lens of its functional expertise. There is a note of caution for this phase. Each staff element identifies the strengths and weaknesses of each COA from their functional perspective. This analysis allows details to surface from functional experts that may not otherwise be visible to a planning team. There is no intent to give each staff element and their constituency veto power. Unless each element has remained engaged throughout the process and has bought into the concept, this phase can provide a forum for debate and distracting agendas.

This phase is particularly important for a distance and distributed learning strategic plan developed by a campus-wide planning team or by administrators two or three steps removed from implementation. When those directly involved in or only one step removed from implementation do the planning, most of these issues are addressed in the act of planning and are unnecessary as a separate step. However, even if this is not the case, this phase plays a key role in gaining stakeholder acceptance.

The planning team reviews the results of all staff analyses to determine which COA to recommend to the institutional leadership for approval. The means for making that decision will vary, but should include the following review elements:

- **Policy**—Review existing policies (e.g., enrollment, class length, geographic service areas, funding options, intellectual property, faculty workload, promotion and tenure, and copyright as a minimum). Identify where new policy is required to accommodate the changes generated by distance education.
- **Feasibility**—Confirm that the required resources are available (e.g., the personnel, the technology, the funding, the facilities, etc.) or that they can be made available in the time contemplated.
- **Adequacy**—Determine whether the courses of action will actually accomplish the mission when carried out successfully and that they are aimed at the correct objectives. It is not unthinkable to see an elaborate plan developed that lost sight of the desired outcome.

- **Acceptability**—Even if the COAs will accomplish the mission and the necessary resources are available, the planners must ensure that the benefit is worth the cost.
- **Completeness**—When the COAs have been reduced to a manageable number, a last check is given to confirm that they are technically complete and that each retained course of action adequately answer the following: who, what, when, where, and why.
- **Variety**—There are situations in which only one feasible course of action exists. Generally, this is not the case. The goal is to analyze and compare substantially different courses of action. Listing alternative COAs that are only superficially different defeats the purpose of this process.

The final element of this phase is a decision by the leadership reached after the planning team briefs the leadership on the proposed COAs, makes a recommendation for one COA, and gives the rationale for that recommendation. It is best if that decision were in writing. Be careful when finally recommending a COA to the leadership. The team must clearly articulate its rationale for favoring one COA over the others. It is not unusual for an attractive element of an otherwise unacceptable COA to catch the leaders' attention. In such cases the team must be able to explain why this COA is not the best. It may ultimately be that the final COA is a hybrid of multiple proposed COAs.

## **IMPLEMENTATION**

The Implementation phase marks a major milestone in the process. In this phase the lead shifts away from the planning team to those who will actually implement the program. The university leadership must clearly define who has the authority and responsibility for implementation along with those elements of the university that are responsible for support. Additionally, allocation of assets is resolved, detailed plans are implemented, an implementation timetable is established, and tasks are assigned.

The shift from planners to implementers will be a major test of the planning process. If the leadership has effectively articulated the strategic vision and if the planning team members have kept their peers informed of the process, this step could be smooth. Conversely, if there is not buy-in at the implementation level, the plan will meet resistance (Leitzel, Corvey, & Hiley, 2004).

Asset allocation is an extension of the Planning Initiation phase. Like Phase I, the personnel, infrastructure, and fiscal resources required to achieve the objectives are identified. The difference is that there may be changes between the initiation phase and implementation. If there were assumptions made about funding, personnel, or other assets, these must now be reconciled. It could also be that there are changes in the previously known facts—funding levels are different, personnel have changed, or there is a new state-supported technology initiative.

Detailed (operational and tactical) plans identify near-term objectives that must be achieved to implement the strategic plan. These plans may include a marketing plan, new or revised university policies, a business plan for the program to be self-sustaining in the future, or a sustainable human resources/staffing plan and payment strategy that includes the appropriate proportions of full-time/part-time faculty, purchased services, and outsourcing.

Timetables are the responsibility of the implementation team and are derived from the leadership intent and planning schedule in Phase II. Realistic and feasible completion deadlines must be developed for each task. Special consideration must be given to objectives that are driven by external forces, if any. These may be items that are aligned with other calendars (academic or fiscal) and will have less flexibility in the timetable.

Finally, task assignment is the responsibility of the individual responsible for the overall implementation. Personnel must be designated from supporting units to ensure that there is a hierarchy of those who are ultimately responsible for ensuring that each task is completed.

## **ASSESSMENT**

Benchmarking and evaluating progress toward agreed-upon goals and objectives is a critical phase in the strategic planning process. This phase should employ both formative and summative assessments to gauge the success of the plan. The formative assessment is part of a continuous feedback loop to the previous phases of the process. There must be consistent, meaningful evaluation, with a willingness to act upon the findings for the process to succeed. Specific metrics (outcome, output, or process measures) must be defined to determine success and when and how they will be measured. Metrics can include, but are not limited to, the following: costs, learning effectiveness, student satisfaction, cultural change, and faculty satisfaction.

Since strategic planning is a continuous process, the argument can be made that there is no summative assessment. However, in the context of this model, summative assessment refers to the evaluation of individual objectives and milestones that have been completed. This assessment is typically a formal written document submitted to the university leadership.

## **PERIODIC REVIEW**

This phase has as its objective the continuation of the planning cycle. The strategic plan is a living document that allows for modifications as changes occur within and outside the university. Periodic review evaluates what has been developed and makes necessary adjustments. This is the continuous planning process that is critical for the university by enabling it to adapt to short-term volatility while maintaining its long-term strategic vision.

The university must establish a schedule for review. The university can consider aligning this review with existing cycles, such as the annual budget cycle or academic cycles. Also, it must determine how lessons learned will be communicated and modifications made to the larger organization. This review can include a broad range of issues but should address the following as a minimum:

- **External changes**—An audit mechanism will be required to ensure ongoing assessment of conditions that have changed in the external environment since the plan was written. As a minimum, this audit will look for changes in the market, competitors, technology, regulatory policy, and the political environment.
- **Internal changes**—Similarly, an internal audit mechanism will be required to ensure ongoing assessment of conditions that have changed within the organization since the plan was written. As a minimum, this audit will look for shifts in institutional priorities or organizational change that might require a review of project alignment.
- **Assumptions**—All previous assumptions must be reviewed to ensure that they still apply. Any new assumptions that must be made to continue effective planning should be identified. Finally, as many assumptions as possible made in the original planning process or at the last review cycle should be confirmed as fact or refuted as invalid.
- **Mission and strategic goals**—The strategic end state must be reviewed to ensure that they continue to express the vision of the organization

and the objectives required in achieving that vision. Confirm that the mission and strategic goals remain valid and realistic, despite external and internal changes.

- **Implementation lessons**—Those lessons learned from the planning effort may require modifications in sustained strategic plan implementation.

## **PLANNING CONSIDERATIONS**

When strategically planning for distance and distributed learning, there are media issues that have no clear place in the process. When does media selection take place? Is it a strategic, operational, or tactical decision? Kaufman and Grise (1995) advise that strategic planning should avoid addressing “how-to-do-it.” The problem with such advice in this context is that once an organization begins planning to distribute the educational product, there is already a broad de facto decision on how it is to be done. Wagner (1990) states that media selection comes well after the design issues related to the instruction itself are resolved. Unfortunately, the literature does not address when or if instructional systems design occurs in the planning process. So the question of when media selection takes place remains unanswered.

## **EDUCATIONAL ISSUES**

Regardless of when media selection should take place, there are educational issues that will drive that process. One might assume that one medium is superior to another for specific learning needs. However, R. E. Clark and Robert Gagne challenge this assumption. Clark (1983) refers to hundreds of media comparison studies and submits that “[t]he best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in nutrition” (p. 445). Gagne (1970) notes:

So far as learning is concerned, the medium is not the message. No single medium possesses properties which are uniquely adopted to perform one or a combination of instructional functions. Instead they all perform some of these functions well, and some not so well (p. 17).



Rather than focus on the media, the process should focus on educational issues—course design, degree of interaction required, and the learners (Schrum, 1991). Instructional design for distance and distributed learning is discussed in another chapter, but can be an element of planning, particularly if the planning process is focused on making a specific course available via distance education media. A course with lower-order cognitive learning objectives will have different media selection criteria than one that seeks to achieve higher-order cognitive and affective learning objectives. As Gagne points out, there is probably no single medium that would effectively address that broad a scope of learning outcomes. The solution is to have either the experience to enable a qualified intuitive decision or a media selection process to support the planner.

## MEDIA SELECTION

The origins of distance education can be traced back to 1728 (Holmberg, 1989). In the hundreds of years that it has been in practice, the number of media available to support it has expanded significantly beyond print-based correspondence study. Advances in technology have added audio and video recordings, radio, television, teleconferencing, and computers, but these advances do not eliminate the technologies that precede them—they simply add complexity to the planning process. Table 2 shows a cross section of media available to the planning team. These media can be used in varying combinations to manipulate the degree of interactivity available to the student. For example, watching a televised class or using a CD-ROM-based computer-based instruction program can become interactive with the addition of email (Shea, Motiwalla, & Lewis, 2001). Similarly, the level of interactivity can be increased for asynchronous courseware by adding threaded discussions. While many planners

Table 2. Distance Education Media

Non-interactive	Interactive	Conferencing
Print Audio tape Videotape Television	Hypertext Computer-based instruction Multimedia/Hypermedia Simulations	Audio conferencing Audio graphics Teleconferencing Computer-mediated conferencing

look to modern technologies for solutions; print remains a viable choice for many distance applications. The key is to understand the needs of the learner (Moore & Thompson, 1990).

Like strategic planning, media selection requires a process to assess institutional and learner needs, media capabilities, and costs to arrive at the best fit between program and media. Supporting this process are numerous media selection models, however, only around 10% of the planners use them (Moore, 1990; Roth, et al., 1990). With or without a model, the selection process traditionally looks to the learning needs dictated by the subject matter. Moore and Thompson (1990) emphasize the importance of clearly defining these learning needs. Media selection models are one means of achieving this end. These models have made significant strides over the last few decades. In 1973, Braby noted that the media selection techniques were limited, inexact, and too complicated. Twenty years later there were paper-and-pencil algorithmic models that were effective in matching a medium with a particular instructional event (Lane, 1992; Reiser, 1981; USAF, 1994). As the quality of the models' analysis improved, the concern shifted to the models' inability to address practical issues not involved with instructional design like return on investment and organizational requirements (Bates, 1995). Such shortcomings in these models made it difficult to make strategic decisions about which technologies to choose.

Today, there are very effective computer-based applications that satisfy the concerns of Braby and Bates. A product called ADVISOR from BNH, Inc., is one such tool. It has been used with the Department of Defense and is the only computer-based tool that was found in an Internet search as late as September 2003. This tool rates the effectiveness and provides a comparison of various delivery options from face-to-face classroom delivery to asynchronous computer-based applications. Additionally, it analyzes the various delivery options and determines development time, up-front investment required to implement each option, direct and indirect savings over the life of the training program, and break-even point. The application of such computer-based decision tools not only enables planners to better document and justify a recommendation, but it also permits them to perform "What if?" scenarios. These scenarios allow some of the assumptions and other variables to be modeled and tested before a decision is taken. Such analysis empowers the planners with a far more robust decision-making process.

The best alternatives to algorithmic models are the use of preset criteria or personal judgment and expertise (Bates, 1995). However, Bates (1995) suggests:

Crucial technology decisions have tended to be made primarily for commercial, administrative or political reasons. . . . Consequently, three decision-making scenarios are common. The first is basically to do nothing. The second is sympathetic anarchy: an organization leaves it to individual, enthusiastic teachers or trainers to use whatever media they can lay their hands on. The third is monomedia mania: a government, company or institution decides to invest heavily in a single technology for all teaching throughout its system (p. 33).

Bates (1995) offers an alternative approach that he calls ACTIONS. His approach is for the institution to base its media selection analysis on the following set of questions:

**A**—Access: how accessible is a particular technology for learners? How flexible is it for a particular target group?

**C**—Costs: what is the cost structure of each technology? What is the unit cost per learner?

**T**—Teaching and learning: what kinds of learning are needed? What instructional approaches will best meet these needs? What are the best technologies for supporting this teaching and learning?

**I**—Interactivity and user-friendliness: what kind of interaction does this technology enable? How easy is it to use?

**O**—Organizational issues: what are the organizational requirements, and the barriers to be removed, before this technology can be used successfully? What changes in organization need to be made?

**N**—Novelty: how new is this technology?

**S**—Speed: how quickly can courses be mounted with this technology? How quickly can materials be changed? (p. 2)

Regardless of when the media selection process is completed or the approach taken, it is a necessity at some point in the planning process. One can argue effectively that media selection is not a strategic decision, but there is a strong probability that the leadership will want to know what media are planned for in any course of action.

## **SUMMARY**

Distance and distributed learning is an issue confronting all levels of education and training. Regardless of whether it is higher education, secondary education, business and industry, or government, each is faced with a challenge to reach the greatest constituencies of learners or employees and to keep them abreast of the most up-to-date knowledge in their respective field of study or profession. Distance and distributed learning is a most viable option to achieve such a goal. However, to successfully deliver education at a distance requires some form of strategy and a plan to achieve it.

A strategic planning process facilitates decision-making by focusing on the university's internal vision and its external threats. Through analyses of these and other factors, strategic planners are able to project the future state of the university, identifying the desired end state and the means to achieve it. Ultimately, the strategic planning process aids in managing and sustaining a distance and distributed learning program.

Strategic planning is the key ingredient in successfully moving the university forward into distance and distributed learning. Without a grand vision and a plan to achieve it, the university may not risk outright failure, but it will certainly risk failing to achieve the vast potential opportunities that distance education offers the institution and the learner.

## **DISCUSSION QUESTIONS**

1. Why is it important to use strategic planning to guide an organization that wishes to develop a distance/distributed learning program?
2. What should an institution consider when selecting distance and distributed learning media?
3. Discuss the steps in the Pisel (2001) Strategic Planning Process Model. Do the 10 steps require a linear progression?
4. Why should an organization analyze its strengths, weaknesses, opportunities, and threats when planning a distance/distributed learning program?
5. How are internal and external communication important in developing and implementing a strategic plan for distance and distributed learning?
6. What roles do periodic review and feedback play in implementing a strategic plan for distance and distributed learning?

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# Distributed Learning Environments and Implications for Technology Education: A State-of-the-Art Approach

## Chapter 4

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Anthony F. Gilberti  
Indiana State University

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### INTRODUCTION

This chapter provides an overview of the development of a distributed learning environment for the Industrial Technology Education Department at Indiana State University. The chapter offers a case study of how the faculty of the department redesigned courses, delivery methods, and strategically planned for the future in light of declining enrollments. The perspective taken during this process of course and program design was a commitment to total quality management in order to improve both teaching and learning by both students and faculty.

### OVERVIEW OF THE DEPARTMENT

In 1996, the Industrial Technology Education Department at Indiana State University was not unlike many other Technology Education programs in the United States. The faculty of the Department offered four programs of study at the undergraduate level and a variety of graduate degree programs. Programs at the undergraduate level consisted of an Associate Degree in Vocational Trade-Industrial-Technical Education, and Bachelor of Science Degrees in Human Resource Development, Technology Education, and Vocational-Technical Education. The Technology Education and Vocational-Technical Education Degrees prepared individuals for employment as educators. Additionally, the Vocational-Technical Education Degree had a non-teaching Bachelor of Science Degree option.

The Department at the graduate level consisted of Master of Science Degrees in Human Resource Development, Technology Education, and Vocational-Technical Education. A student could also obtain a Ph.D. in Curriculum Media and Instructional Technology with concentrations in

each of the content areas listed above. The Department also offered a number of educational endorsements at the graduate level in regard to Vocational Education.

The primary delivery method for courses offered in the department was a traditional face-to-face format. However, the faculty of the department had been using distance learning since 1986. This consisted of correspondence courses and the Indiana Higher Education Television System (IHETS) that was used to deliver the graduate degree program in Human Resource Development. IHETS consisted of a one-way video and two-way audio system with over 300 receiving sites in the state. Additionally, the faculty of the department regularly offered numerous off-site programs to a variety of industries. Most of these off-site programs required faculty to drive in excess of three hours (one-way) to deliver these programs.

## **NEED FOR CHANGE**

In spite of the numerous programs and alternative delivery methods being used by the faculty, the Industrial Technology Education Department was in danger of losing programs and majors. Enrollments in the department were declining, and the faculty produced the lowest Student-Credit Hours (SCH) in the School of Technology and one of the lowest SCH at Indiana State University (i.e., 138.00 SCH per faculty member). During the fall of 1996 the department had only 67 undergraduate majors and 115 graduate majors enrolled in courses. With eight full-time faculty members the department was clearly in danger of facing a reduction in staff, program elimination, and the possible closure of the department. In fact, as a brand new Chairperson in the department, the Dean of the School of Technology gave this writer a very clear mandate during the first week of the fall semester. Correct the declining enrollment trends or the department would be closed. In retrospect, it is interesting how none of this information had surfaced during the interview period. It should be noted also that the School of Technology was well into the process of constructing a new building. In the building plans, the Industrial Technology Education Department was losing much of its laboratory space, and only five faculty offices were allocated. Clearly, the department was in trouble, and the University was planning on the eventual reduction in staff.

To address the concerns of a declining student enrollment the faculty met in numerous departmental meetings to share ideas and reflect on the

current condition of the department. These discussions led the faculty to conclude that data needed to be collected on student interests, the quality of academic advising, the perceived value of the programs offered, and the needs of the customer (i.e., students, business, industry, and the university).

The faculty of the department held a series of focus groups to facilitate its data collection efforts. These focus groups consisted of the departmental Advisory Committee, students currently enrolled in the program, faculty from other departmental units, and administrators at Indiana State University. The results of these focus groups were both enlightening and distressing. On the positive side, the quality of the course offerings and program array were meeting the needs of students. Faculty were perceived as extremely caring and dedicated to the teaching and learning environment. The programs offered were aligned with the business and industry needs in the regional community, and graduates were securing quality positions within their selected career paths.

The focus groups also revealed that the institution did not understand the purposes of the Vocational Trade-Industrial-Technical Education degree program. Administrators questioned the need for such a program at a four-year institution. The student population also had problems communicating the overall goals and career paths in this degree option. Data collected on academic advising illustrated that faculty members needed to spend greater amounts of time with students discussing career paths and mentoring students. By far the most important information gathered from these focus groups was that the traditional on-campus face-to-face delivery method was not meeting the needs of students.

The focus groups revealed that most of the non-traditional student population was not attending school on a full-time basis. This group would enroll in courses during semesters with an average of 3–6 credit hours. Members of this group would often enroll in one semester, elect not to enroll in the next semester, and then return at some future time. The focus groups revealed that many students had financial burdens, and they were time or place bound. Thus, many of the students currently enrolled (as well as potential students) desired more flexibility in how courses were scheduled and delivered.

This flexibility in course scheduling and delivery was only a minor aspect in what students desired. Of primary importance was the need to deliver entire programs of study using distributed learning environments.

Several courses in a program of study delivered via distributed learning would not meet the needs of the student population. Thus, the Industrial Technology Education Department needed to find appropriate methods to delivering both courses and programs of study beyond the campus community.

## **COMMITMENT TO TOTAL QUALITY MANAGEMENT**

In order to address the issues from the data collected and the focus group meetings, the faculty developed a strategic plan. The plan reviewed each of the programs of study and provided data to administrators regarding faculty load, student-credit hour production, enrollment trends, indicators of quality improvement, marketing directions, and a rationale for continuing the programs within the department. Among the items presented for increasing student majors at the undergraduate and graduate levels were specific recommendations to:

- Seek state approval to deliver programs of study via IHETS;
- Provide greater course access to students whom were time or place bound; and
- Develop and deliver a Human Resource Development degree program via the Internet.

While the strategic plan helped to bring the faculty together and establish an action plan, the three recommendations above helped to create a unique structure to both retain and reach out to a previously unidentified student population. Moreover, these three recommendations had a lasting consequence on the teaching/learning model used by the faculty in the Industrial Technology Education Department.

## **IMPLEMENTING DISTRIBUTED LEARNING**

The implementation of a distributed learning program requires careful planning. Eastmond, Nickel, du Plessis, and Smith (2000) noted that a number of different approaches could be undertaken in the development of Web courses or a complete program of study. These approaches involve issues of faculty development in the areas of technical skill, developing a

customer-centered focus, and meeting the individual learning styles of students.

While some faculty members have acquired the necessary skills to deliver a distributed course, the majority of faculty requires assistance in the design, development, and even teaching of these courses. Many faculty learned their craft of teaching from a face-to-face model with their prior instructors and with their own students. Within this model, there is a great deal of spoken and unspoken interaction, and this feedback is often immediate. Further, an excellent instructor in a traditional classroom setting does not require knowledge of graphic design, instructional design, the Internet, radio or television production, etc. However, these types of skills are essential to the instructor involved with the design, development, and delivery of distributed learning environments.

In a traditional classroom environment there can be a strong connection to the needs of students. The instructor in a lecture or laboratory-based environment is able to instruct, illustrate examples, foster student interaction, and mentor learners. In this environment, the student is able to interact with the instructor as often as necessary to clarify the subject matter or key concepts being presented. In this environment a sense of trust is developed and fostered among students and the instructor. The student quickly learns those instructors that are student-centered and have a customer-focus in meeting their needs (Leasure, Davis, & Thievon, 2000; Sakurai, 2002).

In a distributed learning environment the need to maintain a student-centered focus becomes even more important. Leasure, Davis, and Thievon (2000) demonstrated that students prefer not to learn in a distributed education format. While there are times when the convenience of distributed education outweighs the desire to learn in a traditional classroom setting, the majority of students prefer the interaction of other students and faculty in a classroom or laboratory experience. The student is able to address their individual learning needs, seek guidance from his or her peers, develop social skills, and obtain feedback from the instructor in short order.

Faculty involved with distributed learning have a more difficult task in creating a student-centered learning environment. First, the instructor must realize that the student often has selected a distributed learning envi-

ronment because of their immediate circumstance (i.e., their work schedule does not permit them to attend the on-campus class, the meeting times or days conflict with other commitments, they are place bound, and cannot attend the college or university of their choice, etc.).

Secondly, the faculty member involved with a distributed learning environment must create a *classroom* environment that simulates an actual on-campus class. The course being delivered must contain the same set of goals and objectives as the traditional on-campus course if students are to acquire the same learning outcomes. Students further require the same level of interaction between themselves and their instructor. Further, students expect to have the same level of experiential learning experiences as the on-campus class. The nature of distributed learning requires faculty to become even more student-centered in order to deliver more effective learning environments that meet their individual learning styles (Alavi, Marakas, & Yoo, 2002). Thus, the perspective taken here is that a collaborative distributed learning model is consistent with the social learning theory identified by Vygotsky (1929).

The social learning theory emphasizes the social creation of knowledge by employing group problem-solving, and the opportunity of the group members to reflect and provide feedback on each other's thinking, opinions, and beliefs. In this process of learning new knowledge and skills, group members may be challenged of his/her initial understanding and thus, further motivated by the instructor and learning processes. The challenge for the instructor in a distributed learning environment is to enable flexibility, timeliness, and increased frequency of group interaction and communication with the content and experiences under study (Alavi, Marakas, & Yoo, 2002).

## **COURSE REDESIGN**

In the development of distributed learning environments considerable time must be spent in the redesign of a course. Havice and Chang (2002) noted that the delivery of distributed learning courses could take a variety of synchronous or asynchronous forms to deliver instruction. This could consist of audiocassettes, computer disks, CD-ROM, film, the Internet, print, radio, television, video, etc. Despite the use of these technologies, the course content remains fundamentally unchanged. Thus, distributed learning takes the traditional curricula and delivers it over a distance to

individuals separated from each other in both time and space.

This delivery of distributed learning programs requires the instructor to pay particular attention to how the content is structured and presented. The reason for this is that content delivered in a traditional on-campus class relies heavily on student and teacher interaction. It is the interaction with the subject matter that allows the student to master the content being delivered. Traditional courses rely on group projects, teamwork, and experiential learning to make the learning relevant (Marsden, 1996).

The fundamental problem in delivering a course using distributed technologies is to maintain the same level of student-to-student and student-to-faculty member interaction as with a traditional course. The content must be structured in such a way to allow the student to acquire the same level of knowledge, skills, and attitudes that would be developed in the traditional on-campus course. The learning experiences must also be extended to the community and workplace if the content being delivered is to be relevant (cf. Gagne, Briggs, & Wagner, 1988).

In the redesign of courses for the Industrial Technology Education Department, considerable discussion took place on how to design distributed courses that would maintain the same level of content and experiences as those in traditional offerings. During departmental meetings faculty conducted *peer review* sessions of viable technologies and course design. This consisted of Web pages displaying content and the activities (i.e., assignments, student projects, discussion items to be posted to a Listserv, etc.). While technologies were illustrated for ease of use and their ability to deliver the specified content, the emphasis of the discussions centered on how to maintain the integrity of the course and the expected learning outcomes for students. The process of peer review has been cited as an acceptable method for assuring quality in distributed learning environments (Nordstrom, 1995; Tait, 1993). Thus, it was decided that each course developed had to maintain the same content and experiences as those provided in a traditional delivery method.

The process of maintaining the same content in a distributed learning environment is a relatively simple task. However, it is far more difficult to foster and maintain active student involvement and learning experiences when faculty and students are separated by both time and space. The issue of concern here is one of quality assurance. Broad (1999) noted that the

first step towards obtaining agreement on student outcomes is to collaborate with colleagues who are accountable for attaining course objectives.

The process of collaboration in course design is a relatively uncommon practice. While courses are regularly reviewed prior to a college or university submission process, this review is rarely done in an attempt to *improve teaching and learning*. Rather the content is reviewed and modified without the critical analysis of how the course will: foster student growth and development, utilize effective teaching strategies and student projects, or extend independent learning. This is because faculty often perceive a review of their work as a threat to their academic freedom.

It is the author's opinion that the faculty of the Industrial Technology Education Department did not approach the peer review process of distributed courses as a threat during the developmental phase from 1996–1998. Likely, this occurred as a result of the faculty previously adopting a commitment to the concept of total quality management in education, a newly developed strategic plan, and the real threat of a loss of faculty and programs. Perhaps the lack of adversarial discussion and the focus on improving the teaching and learning environment was also the result of a lack of expertise in designing Web-based courses. Faculty had never taught in such a unique format, and they were learning from each other of the numerous possibilities for providing a quality learning experience. Therefore, the overall purpose of these discussions was not to approve or reject a course but to review the redesigned courses in a formative evaluation in order to improve their overall quality.

As a result of the numerous peer reviews and commitment to designing a distributed learning environment, the faculty of the department successfully developed two courses for Web delivery during the spring semester of 1997. Both of these courses were in the Master of Science Degree program for Human Resource Development. These first two courses represented an *incremental approach* to the delivery of a distributed course.

## **INCREMENTAL APPROACH TO COURSE DESIGN**

The incremental approach used by the faculty in the Industrial Technology Education Department consisted of providing enhancements



to existing courses. The faculty developed a set of Web pages that could be used by students enrolled in the on-campus and IHETS sections of the course. The Web pages consisted of a home page with active links to the course syllabus, PowerPoint lessons and an expanded section of faculty lecture notes, suggested readings, and assignments. This incremental approach allowed faculty and students to experiment with online content as faculty continued the review of appropriate technologies and course redesign efforts. It should be noted that students did not have the option of enrolling in a pure Web-based course during this development period. Rather, students enrolled in the distance education sections (i.e., IHETS and videotape courses) or the on-campus class could review content previously presented by the instructor.

During midterm and at the end of the spring semester the faculty collected specific data from both on-campus and distance education students with regard to the efforts to deliver content using distributed technologies. This consisted of faculty evaluation forms with standardized and open-ended questions. Overwhelmingly, students were extremely satisfied with the efforts to improve the teaching and learning environment and the possibilities to expand the current distributed course offerings. Responses collected on the student evaluation forms revealed that these two courses had a statistically significant positive response rate when compared to the same two courses taught by the same professors during previous semesters. A number of written comments by students illustrated the same theme:

- “Web pages are a wonderful addition to the course. I can always go back and review the lecture notes from the class.”
- “Lessons posted to the Web page in advance are helpful.”
- “The Web pages were very useful, and I used them regularly.”
- “When will you offer a complete course by the Internet? The Web pages are great.”

The efforts expended by the faculty during the trial period convinced the majority of the faculty to continue to expand the distributed course offerings. This resulted in faculty continuing to redesign courses in order to deliver a Human Resource Development degree program via the Internet as outlined in the departmental strategic plan. To facilitate this process the Chairperson began a course rollout where each semester 3–5

redesigned courses would be added to the distributed course offerings. This provided faculty with a minimum of five months to prepare for teaching using these new strategies and delivery methods. Additionally, a plan was developed to illustrate target dates for redesign for the remaining courses in the Human Resource Development Master of Science Degree. During this same period, faculty continued to access new technologies and teaching methods in an effort to improve the overall quality of the courses being redesigned. This resulted in the adoption of a variety of strategies to connect the distance learner to the traditional campus student.

## **UNIVERSITY SUPPORT**

At the time the faculty of the Industrial Technology Education Department were designing the distributed learning environment, there was little support by the University to assist faculty in these endeavors. Thus, the faculty of the department were pioneers in this effort and had to rely on each other to transform the courses within their program areas. Today, it can be found that most Universities involved in distributed learning have varying levels of support for faculty. Lee (2002) reported that post-secondary institutions are now offering a wide variety of instructional support to help faculty members improve their instruction. This support includes:

People who have specialties in certain areas in instruction. It usually comes from people who have specialties in certain areas in which faculty members need training and assistance to conduct their teaching effectively. Specialists include instructional designers, editors, technicians, graphic designers, radio and/or television producers, teaching assistants, and librarians. In a distance education environment, instructional support can take the forms of course redesign support, training in the use and application of distance education technologies, training in teaching methods, and media and technical support (p. 28).

This support is often viewed as essential since faculty members are confident in the content and learning experiences required in educational endeavors, but they do not have the requisite skills, time, or abilities to comfortably design distributed courses or entire programs of study. The level of support provided to a faculty member is likely never to be ade-

quate. Faculty require professional development programs to assist them in the delivery of distributed courses. This development can help faculty to engage students in the mastery of both content and process learning activities. Faculty development can also assist faculty in determining what types of courses are best suited for distributed learning. Clearly, the delivery of laboratory-based courses requires the use of unique delivery strategies and student interaction if the content is to be delivered effectively (Millis, 1994).

Professional development programs for faculty can fall into three categories: instructional support (i.e., course design, micro teaching, media support, and class diagnosis), personal development (i.e., life planning workshops, interpersonal skills training, and therapeutic counseling), and organizational development (i.e., team building, conflict management, and departmental decision making) (Lee, 2002). Of these professional development programs available, instructional support programs have become more widely used to assist faculty in the development of distributed learning environments. At Indiana State University, this consisted of professional development through the Course Transformation Academy.

The Course Transformation Academy was an attempt to educate faculty members of the variety of strategies and technologies available to deliver quality instruction. Faculty involved in the Academy came together for one-day per week for 16 weeks during an academic semester. During this professional development faculty were introduced to a variety of technologies to incorporate the use of audio, video, IHETS, or Web-based instruction into a course of their choice. Faculty members could meet with an instructional designer and editor in the review of course content and teaching materials. A faculty member who transformed an existing course to use distributive methodologies received a \$500.00 stipend at the end of the professional development activity.

It should be noted, however, that the majority of the redesign effort focused only on the technologies. Faculty could not be made proficient in any of these technologies during this limited timeframe, the bulk of the work rested upon the faculty member. Like most post-secondary institutions, human resources in the areas of instructional designers and technicians are limited, and the faculty member must take on the burden of transforming their own courses for distributed delivery.

## WHAT A COURSE LOOKS LIKE

The faculty of the Industrial Technology Education Department took a unique perspective in the design of their courses. With the strong commitment to improving the teaching and learning environment while providing for distributed learning, the faculty designed courses to maximize the connection between the distance and traditional campus student. To do this, faculty conducted their teaching in four unique formats: teaching in front of a traditional classroom, teaching using IHETS, and the delivery of videotape and Web-based courses. The teaching schedule was also altered to provide for late afternoon start times, with the last course ending at 9:30 pm. A Saturday morning course was also offered each semester.

The faculty of the department attempted to develop *ideal* courses during the redesign phase. This ideal was similar to the approach of online course development advocated by Carr-Chellman and Duchastel (2000). All of the courses redesigned had a robust set of Web pages to facilitate learning. Within each of these pages could be found a course syllabus, an introduction to the course, major assignments and projects, a tentative teaching schedule, and background and contact information for the faculty member. The Web pages provide the necessary links to order textbooks or videos from the on-campus televised class. The Web pages also contained examples of previous student work. These samples included small written assignments, audio files, or examples of a major research project. The purpose of these samples was to help students to understand both the requirements of the course while providing tangible objects to refer back to during the course.

Some of the course Web pages also contained study guides to assist the student in reaching specific learning outcomes. These guides provided a list of learning resources, articles to review, and Web sites of interest beyond those presented in a particular lesson. PowerPoint slides and detailed lecture notes were presented in each lesson. The lessons contained numerous hyperlinks to additional readings, videos, or audio recordings to further present the key concepts being presented. Each lesson was also accompanied with an audio file from the on-campus lecture or demonstration. These audio files were typically two hours in length, but they were made available in 12–15 minute segments to follow the PowerPoint presentations.

Lastly, and perhaps most importantly, the faculty developed both asynchronous and synchronous exchanges between the distance education learner, the on-campus students, and faculty member. Courses utilized Listservs, and Internet chats to allow all students to interact with each other in a discussion of the material presented. Further, distance education students were assigned to group projects with on-campus students. These unique approaches became a hallmark of course delivery in the Industrial Technology Education Department, and customer satisfaction was notably increased based on course evaluations and student feedback.

## **RESULTS OF COURSE AND PROGRAM REDESIGN**

By the fall of 2003, the faculty in the Industrial Technology Education Department were providing five complete degree programs via distributed learning, and over thirty-five courses were redesigned. These degree programs consisted of Associate Degree in Career and Technical Education; a Bachelor of Science degree in Career and Technical Education; a Bachelor of Science and Master of Science Degree in Human Resource Development; and a specialization in Human Resource Development and Industrial Training in the School of Technology Ph.D. Program for Technology Management. Faculty were also continuing the development on several other degree options planned for distributive delivery as well.

From a programmatic standpoint, the Industrial Technology Education Department was no longer in jeopardy of program or faculty elimination. In fact, after two years of course redesign the program was experiencing a twenty-four percent growth rate in departmental undergraduate majors. By the spring of 2003, the department had the largest graduate degree program on the campus of Indiana State University, and faculty were producing the 5th largest SCH on campus (i.e., over 350 SCH per faculty member). Further, the department that had once been on the brink of elimination now had the largest concentration of majors in the School of Technology (over 400 majors). More importantly, student perception of what they were learning and their satisfaction with the overall department increased significantly. This data was supported by annual data analysis of all course evaluations completed at Indiana State University. Using a 4.0 scale, departmental averages were 0.6–0.9 higher

than the School of Technology, and University in virtually every question asked with regard to student satisfaction.

## **THE ROLE OF THE CHAIRPERSON**

One of the largest concerns of developing and maintaining a programmatic distributed learning environment is keeping the initiative moving in the right direction. This often consists of maintaining faculty involvement in the process. Maintaining faculty involvement can be undertaken on a number of different fronts. This would include making a connection with the strategic plan and course or program assessments. The Chairperson can encourage faculty to develop goals and objectives for themselves in the form of a professional development plan, and listing goals and objectives that relate to departmental initiatives.

The Chairperson can also assist in the process of course and curriculum redesign for distributed learning by adjusting faculty loads and providing both funding and time to work on these endeavors. In the Industrial Technology Education Department the Chairperson assigns a load of six credit hours for each distance education course taught. The rationale behind this higher load is that the faculty member is teaching using a variety of teaching methodologies (i.e., on-campus, IHETS, and Web-based) all at the same time. Additionally, these types of courses generally have a larger enrollment and more faculty to student interaction than a traditional on-campus course. Most faculty in the Industrial Technology Education Department teach only two courses per semester as compared to the three or four course load of an educator teaching an on-campus course.

The Chairperson can also assist faculty by providing additional funding to develop a distributed learning environment. This could take the form of overload pay or release time during development periods. The assignment of graduate assistants to faculty developing distributed learning courses can also increase the likelihood of success during course redesign. Lastly, the Chairperson could assist faculty in securing funding for distributed learning by helping faculty members to acquire both internal and external funding. Numerous grants are available to support these endeavors, and these grants cover a variety of course design issues or professional development activities.

## **PROTECTING COURSES FOR DEPARTMENT USE**

Once distributed learning programs and courses are developed, the institution must provide mechanisms to protect both the faculty member and the department for the rights to use these materials. The discussion of ownership of the content created for distributed learning has been a heated debate. In general, legal precedent has established that employees creating copyright-eligible work on the employer's time, using employer's equipment and assistance is the property of the employer (Simpson & Turner, 2001). At Indiana State University, faculty members reserve their copyright to distributed course development. However, the faculty allows the university to use the developed materials for three years even if the developer is no longer assigned to the course or employed at Indiana State University. This is done with a signed agreement form between the faculty member and the department. Such agreements protect the institution from a loss in their investment should a faculty member want to remove the developed material from a computer server.

## **COURSES AND PROGRAMS OF STUDY IN THE FUTURE**

While distance learning has been used for over 150 years, the use of the Internet and alternative delivery strategies has been relatively new. As new technologies and teaching strategies are developed it may soon be possible to deliver a quality Bachelor of Science Degree for Technology Education. Courses are already being delivered to teach such topics as electronics and computer-aided design with distributed learning. One possible model for Technology Education would be to deliver the course content using the methods presented previously in this paper. The student could then interact with faculty and faculty mentors at selected sites to demonstrate the needed knowledge, skills, and attitudes for this profession. Using two-way interactive technologies, both students and faculty could interact in a meaningful way to develop the desired competencies. From an educational standpoint, this teaching methodology may be a valuable strategy for reaching out and preparing future educators whom are currently unable to attend a traditional teacher education program.

In addition to the above challenge of delivering a Bachelor of Science Degree for Technology Education via a distributed learning environment, the faculty of the Industrial Technology Education Department have a number of new initiatives planned. These initiatives include the use of new software to manage courses while delivering both audio and video content that is keyed to lecture notes, a greater use of interactive television in the region, the development of CD-ROMs to supplement teaching and learning, and the delivery of programs of study internationally. It is expected that the programs fostered for international delivery will take a consortium based approach to maximize faculty expertise and financial resources. Finally, the faculty of the department are examining all of the program offerings and delivery methods to improve both the quality of the courses and programs of study. The approach being taken is again one of total quality management based on a research model to collect data that can be used to improve the overall quality of the department. In this process, each course is being evaluated based on its goals, objectives, content, experiential learning, and delivery method. The particular goal of this process is to capitalize on our strengths while expanding our programs based on the needs of students and business and industry.

## **SUMMARY**

Students are demanding increased access to education. Faculty in institutions of higher learning have an obligation to provide the best opportunities for student growth and development, and opportunities for individuals who might otherwise be unable to pursue their education. The development of distributed learning environments demands strategic planning and a commitment of faculty and administration. Faculty have the responsibility to utilize sound teaching and learning methods, and the professional development gained from the experience of teaching in a distributed delivery format can transcend to the traditional on-campus class. In the future the use of distributed learning technologies will become even more commonplace. Pre-service and seasoned educators alike can find numerous educational benefits for incorporating these strategies into their daily on-campus instruction. Future plans will include the teaching of Technology Education programs for licensure with distributed learning as a viable model for delivery to students.



## DISCUSSION QUESTIONS

Questions to consider when thinking about developing distributed learning environments:

1. At some institutions administrators have allowed distributed learning to become part of their institution's instructional activities with a decentralized approach. Other administrators have selected an approach to institutionalize distributed learning through careful planning and implementation. What are the advantages and disadvantages to each approach? Is the infrastructure in place to support distributed learning? How can either approach help an institution achieve its goals and mission?
2. How are faculty and support staff prepared to facilitate distributed learning environments? What is the timeframe needed to develop faculty, staff, and courses or programs? What constitutes a faculty load in this teaching format, and how will faculty be compensated for course or program development?
3. Does the institution have a policy to protect intellectual property? How does the existing policy apply to teaching in distributed environments, and what is the incentive for faculty to participate in these activities?
4. Lastly, because institutional resources are limited, who will be served by distributed learning, and what programs should be developed? What are the characteristics of those being served (i.e., traditional or nontraditional students who may be time or place bound, and what level of education should be provided—undergraduate or graduate education)? Do those being served have equal access to the technology and the skills necessary to succeed in a distributed learning environment? What are the best technologies for delivering distributed learning? How will enrollments be managed?

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Mark E. Sanders

Virginia Polytechnic Institute & State University

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## INTRODUCTION

My 1996 proposal for the “Graphic Comm Central” project suggested it would become “the hub on the Web for graphic communication teachers and students.” I did not refer to it as a “portal,” because that term was still several years away from becoming part of the lexicon of the Web. Portal is the term now commonly used to describe a Web site that provides a first point of access to the Web, or a reasonably well-defined subset of content thereof.

The magnitude of data accessible via the Web makes it by far the most useful information channel of our time. Paradoxically, there is so much information accessible electronically that finding what you really need is often a time-consuming process. Historically, the challenge of researching a topic was one of finding enough relevant information. The Web has transposed the problem to one of finding too much information, most of which is only marginally related to the topic of interest. Despite increasingly sophisticated search engines, the end user must typically invest significant time and expertise to filter unwanted information from the long list of “hits” generated by a search.

The search engines are, in fact, remarkable. Google, a current favorite searches 3.3 billion pages and almost instantly prioritizes what it finds the way you might rank restaurants in a town you drive through for the first time. Just as you might forego restaurants with few cars in their lot, stopping instead at one with many cars out front (on the theory that more patrons suggests good food), Google prioritizes URLs according to the number of times a page is linked from other Web pages.

That scheme is helpful, but still yields far more chaff than wheat. The problem is that search engine filtering algorithms are designed for the masses, not for individual researchers. At some point in the future, your computer will sense who you are—e.g., from biometric information provided by your eyes—and will then tailor the search using a sophisticated set of your preferences, which it accesses from a Web database. But, until

that time, we should expect most Web searches to result in more possible choices than we are able and willing to effectively evaluate. For example, a Google search on the term “portal” currently yields about 36.2 million “hits,” “education portal” (exact phrase) narrows the hit list down to 49,700 Web sites, and “Technology Education portal” yields only 32 responses, only one of which seemed useful in writing this chapter.

## **ABOUT PORTALS**

In recent years, portals have sprung up like mushrooms in the night to begin to address the problem of too much information. They do so by offering users relatively convenient access to filtered information sources. There are two general types of portals: those that provide access to the entire Web, known as “Web,” “horizontal,” or “mega” portals; and those that provide access to information relating to a specific topic or field, which are known as “vertical” portals. Google’s Directory currently lists 107 “Web portals” (Computers > Internet > On the Web > Web Portals) beginning with such giants as Lycos, Excite, AOL Anywhere, and My Yahoo! The Web site of the International Technology Education Association is considered a vertical portal. In addition to descriptors such as horizontal and vertical, portals designed for corporations have been referred to as “enterprise information,” “intranet,” or simply “corporate” portals.

Throughout this chapter, portal will generally refer to vertical portals, since portals relating to a specific field or topic such as technology education are vertical portals by definition. Portals for technology education may have been conceived and developed by those within the field, such as the ITEA Web site, or by others who have developed a portal that, by nature of its content, is of particular use to those in the field. NASA Spacelink (<http://spacelink.nasa.gov/>) is an example of the latter.

At one extreme, portals may simply provide links to content scattered across the Web. On the other end of the spectrum, there are portals that provide all or most of the site’s content from the host server. Google is a horizontal portal that provides very little of its own content, whereas most of the content on NASA Spacelink was developed by NASA.

The demand for centralized access to information has led to large projects such as the National Science Digital Library (NSDL) project. Funded by the National Science Foundation and others, the NSDL is a portal to

information deemed appropriate for those engaged in the fields of science, technology, engineering, and mathematics. The Innovation Curriculum Online Network (ICON) Web site, a project of the ITEA, is a part of the NSDL, as are many other such projects.

The costs of maintaining and expanding portals, whether horizontal or vertical, are significant. For this reason, portals are usually supported by state or federal governments, professional associations, funded projects, or corporate sponsors. Some portals began as funded projects and later morphed into commercial sites with corporate sponsors.

Most portals seek to build a sense of community among their users, which they do by offering services such as login protocols, discussion forums, email, internal and external search engines, and current news. Some corporate portals provide tools such as these to their employees, with the intent of enhancing their sense of community and their ability to perform their work. Commercial Web sites seek to build a sense of community to encourage their shoppers to return regularly. Educational portals, such as those hosted by associations and universities, attempt to build a sense of community with similar communication tools.

## **THE ROLE OF PORTALS IN DISTRIBUTED AND DISTANCE EDUCATION**

Portals have a key role to play in distributed learning and distance education. Distributed learning refers to “the delivery of postsecondary education degrees, programs, and courses . . . is independent of fixed time and place, and delivers course content online to distant, commuting, and residential students alike (Oblinger, Barone, and Hawkins, 2003, p. 1). Distance education implies the repurposing of conventional courses to reach students beyond the traditional classroom. Early distance education “correspondence courses” relied upon the U.S. mail service for the shuttling of printed materials between teacher and distant students. More recent distance education modes have incorporated strategies such as the use of facsimile machines for information distribution and mailing VHS videotaped lectures to students to mimic the conventional classroom experience. Further along the continuum, one-way, point-to-point video systems allowed educators to transmit talking head lectures to students in distant locations.

The Internet, of course, facilitated the metamorphosis of plain vanilla distance education models to far more elaborate distributed learning environments. The notion of networked information systems allowed full-scale interaction among teachers and students and coordinated efforts among institutional partners. The advent of a new set of client/server architecture and applications in the 1990s, including Listservs, the World Wide Web, MOOs, chat rooms, Instant Messenger, and videoconferencing morphed the relatively conventional distance education model into a much more sophisticated multi-dimensional distributed learning environment. Instruction once constrained by synchronous barriers—the need for teachers and students to be communicating in real time—was opened wide by asynchronous technologies. While synchronous strategies such as a telephone “conference call,” require that all parties be connected at the same time, asynchronous technologies like the Web allow users to access information sources at any time. Learners in this distributed learning environment may download digital audio or video lectures, class notes, PowerPoint presentations and such whenever it best suits their schedule. Fully interactive asynchronous communication technologies such as Listservs, threaded discussions, and chat rooms facilitate conversations and information dissemination among teachers and students in ways never before possible in conventional classrooms. Universities now routinely utilize all of these strategies to deliver courses and degree programs in the distributed learning model.

Portals play a critically important role in distributed learning environments. They are the central component of the new information infrastructure upon which distributed learning depends. Portals provide relatively seamless access to information scattered about the globe. As educators and students increasingly engage in distributed learning, the demand for filtered information skyrockets. As Dede (2003) described, “Many people are still reeling from the first impact of high performance computing and communications: shifting from the challenge of not getting enough information to the challenge of surviving too much information” (p.2). In this new environment, students and teachers alike will increasingly appreciate and utilize vertical portals that provide access to filtered information relating to specific disciplines and topics.

Portals are also critical to the new partnerships that have become integral to distributed learning. Katz, Ferrara, and Napier (2002) identify



seven different forms of distributed learning partnership strategies including collaborations involving: institutions within a state, institutions from different states, inter- and intra-governmental consortia, for-profit/non-profit alliances, and consortia of college, university, and corporate programs. Web portals enable such partnerships. They are the practical interface that make the incredibly complex amalgamation of resources appear relatively simple and congruent to the end user. Without portals, distributed learning partnerships would appear as bureaucratic monstrosities.

Most educational portals are asynchronous in nature. Virginia Tech's portal to electronic journals (<http://scholar.lib.vt.edu/ejournals/>) provides access to more than two dozen scholarly journals hosted on a Virginia Tech server—as well as hundreds of e-journals hosted elsewhere—that anyone with a Web connection may access at any time. They simply browse to the journal / article that interests them, and download it. This site provides continuous access to three of the major journals in the field of technology education. As such, it is an extremely important site for technology education faculty, graduate students, teachers, and researchers.

Many educational portals sponsor Listservs—asynchronous email discussion groups for persons sharing a common interest. They facilitate dialogue on whatever topics the listserv subscribers wish to discuss. Since Listservs do not require the message sender and receiver to be online concurrently, they have been described as asynchronous learning communities. The Graphic Comm Central Listserv has facilitated daily conversations among communication technology educators continuously since 1997, and the ITEA hosts several Listservs on different topics to which any ITEA member may subscribe.

Some educational portals provide synchronous learning opportunities. For example, a portal might provide a streamed video of a keynote speaker's address at a major conference that may only be accessible via the Web while the presentation is happening live. A more common mode of synchronous communication used in distributed learning environments is the chat room, which allows users to engage in real-time text-based conversations over the Internet. America Online's Instant Messenger service is the most popular tool for personal chats, but some portals provide this conferencing capability for distributed and distance learning purposes.

*Educational Portals Research*

Because educational portals are very new, research on their use and efficacy is still quite scarce. Some studies have proposed educational portals as new models in education. Dadabhoy (2002) studied the potential use of portals by the Student Affairs group at the University of Colorado, Denver. He developed a prototypical design for transforming the Student Affairs home page into a Web portal that would be rich in content and offer ease of information access. Chowdhury (2002) studied the use of networking technologies for teacher professional development, and concluded that the two most-used technologies were email and Web-based resources for the improvement of instruction. Greer (2002) proposed a model for a portal that would provide off-campus users with easy and straightforward access to library support. She used survey feedback to develop an interface that facilitated interactive synchronous and asynchronous library support via the Internet.

Hird (1999) examined the potential of the Internet to facilitate constructivist approaches in education. Her conclusions speak to both the potential of educational portals as well as to a primary obstacle to their widespread use in education. Regarding their potential: "For students, the value the Internet as a learning tool lies in online communication around shared information. Students understand that experts and information on any topic are conveniently available online" (p. 1). Despite their potential use, Hird speaks to a primary reason why teachers may be ill-prepared to take full advantage of educational portals:

The students' Internet use calls into question the assumption upon which the teacher-student relationship is traditionally based: that the teacher's authority in the classroom is founded on his/her role as dispenser of knowledge to which students do not otherwise have access. Teachers have the opportunity to engage students in renegotiation of this relationship to bring classroom learning into closer alignment with students' online learning. Before this can happen, students need to see teachers as experienced online learners. School support of teachers' own online learning may help address the incongruity students recognize: that teachers are expected to guide students in learning with innovative technology which was not part of the teacher's own experience with students (p. 2).

York (1998) surveyed educators to determine their attitudes about using educational resources on the Web. Her study focused on the use of environmental education resources, but the findings are applicable to educational portals in general:

. . . a small percentage of respondents reported they are already using the Web to find curricular resources. Most importantly, 86% [of respondents] indicate they would visit and use an environmental education Web site designed specifically for teachers. Findings also indicate that time is a major constraint faced by teachers; Web sites must offer high-quality information and be easy to navigate (p. 2).

This last finding speaks directly to the benefit of educational portals designed by and for educators. The filtering process provided by those who build educational portals is what teachers and students find appealing. A well-designed educational portal allows teachers and students to find information they need in an extremely efficient manner. Rather than sorting through literally thousands of related but irrelevant sites identified by a search engine, teachers benefit from the filtering and organization provided by a well-designed portal.

## **PORTALS FOR TECHNOLOGY EDUCATION**

### *Government Sponsored Portals*

For the most part, the ideas and initiatives that technology education has championed have come from within the profession, with relatively little external influence. Technology education, therefore, has much to learn from portals developed by those outside the profession, including portals created and maintained by government agencies. In recent years, federal, state, and local agencies have expended substantial resources to develop a network of Web portals that provide unprecedented public access to vast amounts of educational data and resources.

#### **US Department of Education (<http://www.ed.gov>)**

Technology educators seeking to better understand the global issues that frame education in America might turn to the Web site of the United States Department of Education (USDoE). The USDoE engages 4,800 employees and \$54.4 billion budget to:

- Establish policies relating to, distributing, and monitoring federal financial aid for education;
- Collect and disseminate data on America's schools; and
- Focus national attention on the educational issues it prioritizes. (<http://www.ed.gov>)

In support of these goals, the USDoE has developed ED.gov (<http://www.ed.gov>)—a Web site that serves as the primary access point to federal information relating to education in America.

Access to the information on the site is categorized for parents, teachers, students, and administrators. The menu structure includes access to White House initiatives, publications, reports, jobs, press releases, and photographs. Among the searchable topics are: Accountability, Charter Schools, Early Childhood, FAFSA, Find a School, International Education, Learning Resources, Math, Reading, Science, Teacher Quality, Technology, and What Works. Educational programs may be sorted by title, subject, assistance type, or eligibility.

In addition, ED.gov provides access to a wide array of electronic publications offering current information on key issues and topics in education. Among those to which users may subscribe are:

- *The Achiever*—a twice-a-month newsletter on efforts to make sure “no child is left behind.”
- *No Child Left Behind Extra Credit*—a daily look at progress on NCLB.
- *E-Press Release Digest*—a weekly email message on USDoE press releases.
- *EDInfo*—a free information service that provides two email messages each week on new reports, new initiatives, funding opportunities from the USDoE, etc.
- *ED Review*—an email update on USDoE activities relevant to the inter-governmental and corporate community.
- *NewsFlash*—email announcements of new publications and news from the National Center for Education Statistics (NCES).
- *EDTV*—USDoE monthly television series entitled Education News Parents Can Use.
- Beyond this access to federal data and publications which the USDoE oversees, ED.gov also provides access to:

- State departments of education, K–12 schools, school districts, colleges and universities
- Other government Web resources
- Libraries
- Education organizations

Similarly, state departments of education host robust Web sites that address issues and initiatives deemed important within the individual states. Technology educators, administrators, and policy/decision-makers will find these state education portals to be valuable sources of information regarding budgeting, licensure, alternative licensure, state standards of learning, testing programs, and other statewide education initiatives. Moreover, these state portals should have a dedicated section for technology education. State-developed technology education curriculum materials, and all other key information pertaining to technology education across the state should be accessible from the state portal.

#### **NASA Spacelink <http://spacelink.nasa.gov/>**

NASA Spacelink is another government-sponsored portal with a great deal to offer technology educators. NASA bills Spacelink as “An Aeronautics and Space Resource for Education Since 1988,” because it was a database of educational resources long before the Web became a ubiquitous tool. In moving to the Web, Spacelink radically expanded access to the materials it had long been developing in print. In addition, they added a variety of non-print services that make for a very robust portal for technology education. Unlike many portals, most of the content to which Spacelink provides access resides on the NASA’s server. NASA has been a serious educational content developer and provider of print materials for educators for decades, and this Spacelink portal was the logical dissemination pathway for the vast array of educational materials they’ve developed over those decades.

Because NASA hosts its own content, and because there is so much material, they use “library” as a metaphor for their site: “The Library is the heart of NASA Spacelink and the official home to the NASA Education Division’s electronic publications and NASA Television’s education schedule. The Library is also your guide to NASA’s Internet resources with hundreds of subject oriented pages and the capability to search all of NASA.” (<http://spacelink.nasa.gov/>)

A virtual search of The Library reveals the vastness of the Spacelink database. Content areas are arranged alphabetically. For sake of illustration, the letter “A” contains 50 alphabetized links, from “A Century of Firsts—On-Line Educational Activity” to “Aviation for Little Folks—On-Line Educational Activity. The former is a list of 18 questions with more than 18 different links that direct the user to information sources—most with NASA URLs—that address the question posed. The Instructional Materials section of the site lists nearly 200 different educational products. These are high-quality materials, each developed by professionals with substantial NASA support.

The site map provides another means of accessing the vast database. From the site map, technology educators will find easy access to anything and everything relating to aviation and space-related technologies, as well as information on topics of relevance such as: “Careers,” “Educational Technology,” “Robotics,” “Physics,” “Models,” “Biotechnology,” “Remote Sensing,” “Satellites,” “Environment,” and “Aerospace Medicine.”

### *Association Portals*

Much of the information about technology education can be found through the portals developed by associations representing the profession. These include the International Technology Education Association (ITEA), Council On Technology Teacher Education, Council of Supervisors, Technology Education for Children Council, and state technology education associations. Most of these may be accessed from the ITEA portal.

#### **ITEA (<http://www.iteawww.org>) and Affiliate Web Sites**

The ITEA Web site, established in 1995, quickly expanded to provide access to a wide array of information that promotes the Association and the profession and which provides resources for technology educators. The site has both public access and a section which only ITEA members may access.

The public component of the ITEA site promotes the services and activities of the Association. Anyone browsing the site may access:

- information regarding the Standards for Technological Literacy (ITEA, 2000) and related publications;

- annual conference information;
- promotional brochures and fliers;
- classroom activities;
- links to ITEA projects and initiatives;
- information describing ongoing partnerships;
- professional development opportunities;
- grant and award opportunities; and
- the Technology Education Resources section, which provides links to information sources scattered across the Web.

The private “For Members Only” section of the ITEA Web portal provides ITEA members with access to:

- PDF versions of back issues of *The Technology Teacher* (dating to 2000);
- PDF versions of featured articles from *The Technology Teacher*;
- ITEA monographs;
- archives from the IdeaGarden Listserv and the TrendScout e-newsletter;
- curriculum materials and instructional activities for teachers;
- Web sites recommended by technology teachers;
- governmental relations (political action) information; and
- discounts for hotels, loan programs, insurance, travel, and credit cards.

The ITEA portal also includes links to its affiliated Councils: Council on Teacher Education (CTTE), the Council of Supervisors, and the Technology Education for Children Council. Each Council targets a different subset of technology education professionals; their Web sites therefore serve as information portals for their respective constituencies.

As a case in point, the CTTE Web site (<http://teched.vt.edu/CTTE/>) serves technology teacher educators working in four-year colleges and universities, and thus is more focused on the research and scholarship of the profession than are the other association portals. Among the materials to which it currently provides scholars in the field access, are:

- the *Journal of Technology Education*, which the CTTE and ITEA co-sponsor;

- 17 monographs published by the CTTE;
- a comprehensive database of most technology education doctoral dissertations and masters theses dating to the 19th century;
- a compilation of currently funded research projects in the profession;
- an index to all of the CTTE Yearbooks, dating to 1952;
- proceedings from professional conferences in technology education; and
- the technology teacher education accreditation standards, developed by the CTTE, which are used by the National Council for the Accreditation of Teacher Education (NCATE).

### *Portals Established through Funded Projects*

Funded projects have resulted in many portals that were developed specifically for the technology education profession. Relatively free of commercial influence, these sites are rich in content that has been developed or identified by project directors and/or members of their staffs.

#### **National Science Digital Library / ICON (<http://icontechlit.enc.org/>)**

National Science Digital Library project is a large project funded primarily by the National Science Foundation that provides support for the development of a wide range of vertical portals in the areas of Science, Technology, Engineering and Mathematics.

The Innovation Curriculum Online Network (ICON, <http://icontechlit.enc.org/>)—a subcomponent of the National Science Digital Library—is a portal to information about technology and innovation. It connects teachers, students, museum staff, and parents with developmentally-appropriate content and related resources that support the delivery of technological literacy. Information on the site is categorized according to the Standards for Technological Literacy.

#### **PreK–12 Engineering.org (<http://www.prek-12engineering.org/>)**

The PreK–12 Engineering.org (<http://www.prek-12engineering.org/>) Web site was established in conjunction with the efforts that resulted in the Massachusetts Science and Technology/Engineering Curriculum Frameworks. It provides a free resource for educators seeking to integrate engineering concepts and activities into pre-K–12. classrooms.



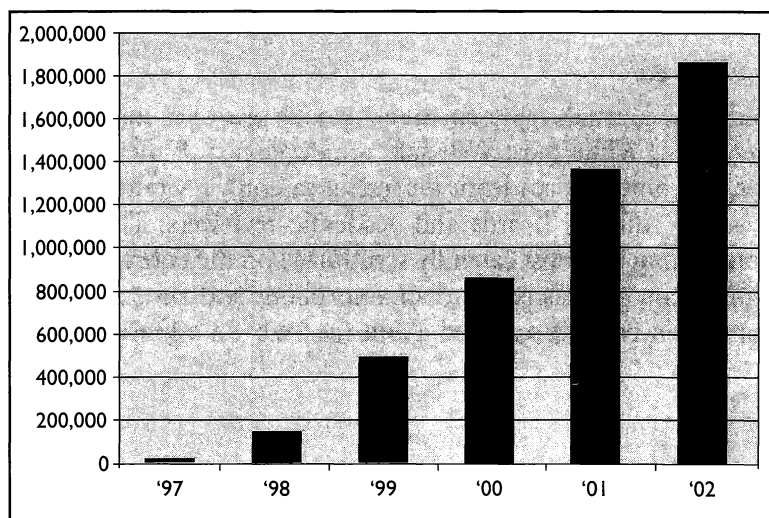
### Graphic Comm Central (<http://teched.vt.edu/GCC/>)

Graphic Comm Central (<http://teched.vt.edu/GCC/>) was established in 1997 explicitly as a non-commercial portal for graphic communication educators and their students. Funded by the Graphic Arts Education and Research Foundation, the site currently has about 4,000 links to content hosted on the project server or external Web sites.

From the onset, the site enjoyed high visibility in a relatively small field. The ITEA promoted it in print, and the International Graphic Arts Education Association featured the site on the cover of its newsletter. It took less than a year for roughly 325 of the most active graphic communication educators to subscribe to the GCC Listserv, a virtual learning community that has communicated almost daily since the inception of the project.

Site usage climbed steadily to its current level of nearly 2 million electronic accesses/year. (See Figure 1.) The GCC portal currently includes more than 900 online articles and tutorials in its Virtual Textbook section, nearly a hundred trade publications; more than 30 virtual tours; searchable databases of 230+ college/university and 250+ high school graphic communication programs; a section designed for K–5 learners, instructional materials; curriculum materials, competitions, university programs of study; student resumes & portfolios; extensive career information, and nearly a thousand equipment/supply vendors arranged by category.

Figure 1. Graphic Comm Central: Electronic Accesses, 1997–2002



## Commercial Portals

### **HowStuffWorks (<http://www.howstuffworks.com>)**

When I first discovered the “How Stuff Works” Web site in the mid-late 1990s, it was a non-commercial site with a quaint look and feel that a physics professor had developed as a way of explaining how various technologies worked. Word of the site spread quickly throughout the technology education profession and obviously, across the entire Web. It wasn’t long before the site was sporting the trappings of commercial success.

The current site is very commercial, and no longer bears any resemblance to the original. Brightly colored promotional messages from the sponsor adorn the crowded main page. The content has expanded to cover seemingly anything that might need explanation, thereby diluting its original purpose. Regardless, this site almost assuredly has more information about how things work than any other single site on the Web. Its beautifully illustrated/animated descriptions of everyday technological devices are a tour-de-force in electronic education. Those who browse this site cannot help but come away with a much better understanding of the small piece of the technological world they chose to explore. For these reasons, technology teachers will continue to embrace it enthusiastically.

## **PORTALS FOR TECHNOLOGY EDUCATION SCHOLARS**

### E-Journal Portals

Electronic journals represent an enormous source of information for the profession. While most Web sites are developed at the whim of the sponsor, the content of academic journals is carefully reviewed, edited, and approved by editorial boards and academic reviewers. The content is therefore among the most carefully scrutinized on the entire Web.

While many portals point to an amorphous and almost random set of information content scattered about the Web, an e-journal URL pro-

vides access to a very specific type of information, perhaps hosted on a single server. Moreover, new information—articles and new issues—are constantly added to an e-journal portal, so users know the information base is continuously expanding. E-journal portals thus provide access to high quality information that is continuously growing in quantity and stature.

When the *Journal of Technology Education* (JTE) became accessible via the Internet in 1992, it was the first serial publication in the field, and one of the first half-dozen academic journals in history to benefit from electronic dissemination. The success of the E-JTE (see Tables 1 and 2 on page 100) led editors of other major journals in the field to contact the author, then Editor of the JTE, to discuss the technicalities of electronic dissemination. It wasn't long before the other two US-based academic journals in technology education—the *Journal of Technology Studies* and the *Journal of Industrial Teacher Education*—joined the JTE on the Virginia Tech library server (<http://scholar.lib.vt.edu/ejournals>). This portal, therefore, currently provides access to about 10,000 pages that have each been reviewed by scholars in the technology education profession. Few portals can boast the sort of “quality control” that refereed journal portals provide.

### *Dissertation Abstracts International and ERIC*

Dissertations Abstracts International (DAI) is a comprehensive index to all doctoral dissertations that TE scholars find indispensable. It is difficult to imagine any substantial study in education that would not benefit from a review of DAI very early in the process.

Similarly, the Education Resources Information Center (ERIC), funded by the US Department of Education, is an unparalleled information source for technology education researchers. ERIC a centralized bibliographic database of more than one million abstracts of education-related documents and journal articles, is the world's largest single source of education information. The database is enhanced with free full-text documents and links to commercial sources. Its powerful search engine allows technology education researchers to locate relevant literature with remarkable ease.

Table 1. Access Data for the *Journal of Technology Education*, 1996–2003

Request Type	1996	1997	1998	1999	2000	2001	2002	2003
Successful requests	99,533	157,511	306,325	470,149	649,192	1,073,360	1,129,260	1,351,663
Distinct files requested	123	265	552	3,436	1,408	2,886	3,590	16,559
Distinct hosts served	25,718	38,268	54,707	75,540	86,278	102,418	123,080	143,552
PDF files requested	342	9,004	34,116	75,143	106,847	160,137	172,981	274,118
HTML files requested	98,395	144,188	243,961	314,731	360,232	437,862	413,223	427,445

Table 2. International Domains Accessing the *Journal of Technology Education*, 1996–2003

Domain	1996	1997	1998	1999	2000	2001	2002	2003
Canada	3,350	4,795	7,262	7,655	11,335	20,522	20,357	18,195
Australia	2,682	3,715	7,243	9,934	14,722	24,276	25,275	26,133
United Kingdom	1,672	3,049	3,619	4,590	6,548	11,368	15,268	17,398
Malaysia	317	1,315	2,961	7,031	7,151	8,874	7,478	6,610
New Zealand	711	641	1,685	2,084	5,166	6,196	5,448	6,140
Finland	666	965	1,428	1,418	1,741	2,656	3,373	4,263
Israel	519	697	1,145	1,291	2,019	3,092	3,282	2,702
Japan	311	465	934	1,290	1,333	5,823	4,741	4,876
Singapore	232	665	898	1,020	1,391	2,347	3,516	2,790
Taiwan	180	197	863	2,692	4,450	5,827	4,627	5,158
Mexico	183	358	726	1,010	1,487	2,504	2,355	2,829
South Korea	491	691	719	409	233	95	232	56
Hong Kong	*	227	511	2,210	3,129	3,068	4,012	3,293
Russia	*	84	193	2,193	1,885	727	800	1,315
Netherlands	*	383	583	1,475	1,290	3,114	2,706	4,087

## **ADVANTAGES AND DISADVANTAGES OF PORTALS FOR INFORMATION ACCESS/DISSEMINATION**

In assessing any technology, it is imperative to consider both the benefits and tradeoffs associated with that technology. Portals have much to offer information seekers... but they have their shortcomings as well. The following paragraphs begin to address the advantages and disadvantages associated with portals and their use in technology education.

Web portals offer many benefits to technology education. In many cases, the information accessible from portals is filtered/selected by one or more professionals in the field. Search engines, in contrast, locate an endless array of unrelated content, along with relatively few really pertinent information sources on any given topic. Those who develop portals separate the wheat from the chaff, thereby saving the end user vast quantities of time. The end result is a better-informed profession.

The time savings portals provide individuals are multiplied with each use of the portal. Thus, portals allow the profession as a whole to be more productive. Moreover, portals make information infinitely more accessible than conventional print options. That is, the information is generally free to the end user, accessible all of the time throughout the world, and organized categorically, thus making it relatively easy to locate.

In addition to accessibility, Web-based information sources offer decided advantages over conventional text. These include full text searching, hypertext links, full color images, variable format output, and interactive learning experiences such as self-guided virtual tours and interactive tutorials.

Portals have much wider latitude than do conventional print sources in the length and format of the materials they may publish. Conventional publications are very expensive to print and distribute, E-publications are not. So while the length of an article is a concern in a printed journal, it is not an issue in an electronic publication or for the portal that might provide access. An e-monograph on biomedical technology might include a number of course syllabi and curriculum materials in the appendices, regardless of their length. This would likely not be the case if this monograph were printed conventionally.

Portals provide far greater visibility for the profession. In that light, Sanders (1995) suggested that technology education develop "a presence

on the Web.” Technology education portals are beginning to promote the field more effectively to students, other educators, administrators, political decision-makers, other disciplines such as engineering, parents, and corporate America. We do, however, have a long way to go in this regard.

Web portals, of course, are not without their disadvantages. For one thing, portal development requires considerable human resources and expertise. Posting a Web page or two is one thing; hosting a portal is quite another. Webworkers typically must know a wide range of software. Even more importantly, they must be able and willing to learn new applications and strategies constantly.

Portals are best served by longevity, which requires continuous fiscal support. Without adequate and ongoing support, a portal is likely to become stagnant in a highly dynamic environment and will eventually atrophy on the Web.

Technology education is not well understood by those outside the profession, so the field should expect the best vertical portals to be developed by those within the profession. The limited number of those within the profession with the time and resources to develop vertical portals will limit the number of portals developed by and for the field.

Vertical portals must constantly be promoted by the profession in order to maintain sufficient visibility. Ironically, printed publications are among the best portal “promoters,” particularly since teachers and students are still getting acclimated to the idea of the Web as a source for nearly all of their information needs. Most users “default” to a search engine when looking for information, not realizing that a well-developed portal may serve their purposes much more efficiently. In time, this may change. But for now, constant portal promotion seems to be necessary.

Web sites are constantly changing, moving, and vanishing from the Web. Portals with links to resources scattered about the Web must therefore continuously update broken links. This is not a trivial process. Finding the bad links is a simple matter with the aid of good server software, but finding the new URL for the old/broken portal links requires human decision-making, and is thus a very time consuming process.

Ideally, portals must provide a constant source of new content. E-journal portals are excellent sources of new content, since new issues of these serial publications are published regularly. But the development of new high-quality technology education content requires considerable time and expertise to produce, and is therefore in relatively short supply.

On whole, the advantages good portals provide are well worth the investment of time and expertise required for their development, maintenance, and growth. But given the significant resources required, new portal ventures should be approached the way one might approach a small business venture. The “market” should be carefully considered before undertaking the development process.

## **FUTURE ROLE AND IMPLICATIONS FOR PORTALS IN TECHNOLOGY EDUCATION**

Distributed learning and distance learning environments are rapidly changing the education landscape. Broadband networks will increasingly be used in the delivery of both synchronous and asynchronous instruction at all levels. Even more apparent is the impact of electronic publishing. Virtually all publications and most media are created digitally, which means it takes remarkably few additional resources to disseminate new publications electronically.

The volume of electronic information accessible through networks will continue to increase dramatically in the coming years. In time, nearly all access to published information will be electronic. Relative to e-publications, conventional books will be disdained as costly and clumsy, difficult to transport, store, and retrieve, inferior with respect to color imagery and interactivity, and sadly devoid of text searching, hypertext, and multimedia capabilities. Remarkably, books will once again—as they were centuries ago—be considered a luxury of sorts, rather than the standard means by which most people gather, consume, store, and retrieve information.

There is already so much information accessible through broadband networks—including all forms of media—that even the most sophisticated search engines are and will continue to be inadequate with respect to sorting and prioritizing this information to the satisfaction of the end user. “Smart” search engines that automatically identify the user through biometric information gathered from their eyes and/or fingertips, which then utilize “intelligent” search algorithms to customize searches for that individual user will vastly improve electronic search engines. But those refinements will take time, and will be subject to significant error rates.

Thus, in the foreseeable future, researchers and students will increasingly turn to vertical portals, developed by government agencies, acade-

mics directing funded projects, librarians, commercial publishers, and corporations. These portals, as described earlier, will provide researchers, teachers, students, and citizens with access to a relatively specific body of knowledge, filtered from the endless array of information sources accessible through networks. Some of these portals will be managed by publishers disseminating original works in these specific fields (e.g., journals, monographs, conference proceedings, etc.). Other portals will primarily provide hypertext links to information scattered across the networks.

Technology educators at all levels will find these portals a more efficient means of locating information sources than search engines or simply surfing the Web. As vertical portals become more ubiquitous, many/most users will prefer to let someone else spend the long hours to search the networks for information on their specific topic of interest. For example, someone looking for information relating to the history of aviation might first turn to the National Air and Space Museum portal, rather than Google.

While providing access to filtered information sources will remain the primary business of vertical portals, they will also strive to bring professional communities together by offering Listservs, threaded discussions, chats, electronic conferencing, and related services. Just as college students now routinely benefit from e-discussions with classmates, professionals will increasingly engage in virtual conversations facilitated by the vertical portal provider.

Technology teachers will increasingly seek portals that relate to their specific areas of instruction and interests. These will be enormously helpful to them and their students in locating information. Regardless of their technical interest—communication, design, manufacturing, construction, biomedical, energy, transportation, etc.—technology teachers and their students will find portals that are well-suited to their interests and needs.

As publishers continue to shift to electronic dissemination, e-textbooks will become the norm. Electronic publishing formats simplify the process of creating customized texts, as university faculty have long done with the readings they placed in the reserve reading section of their campus library. In 1994, Virginia Tech began offering electronic reserve, and it quickly became the preferred reserve reading option for many faculty and students. Graduate students in particular, who generally live off campus and often outside the university community, tend to prefer e-reserve to conventional reserve, since they may access the former without coming to



campus. The rapid growth of distributed and distance learning strategies in higher education has placed a premium on Web accessible documents.

For these reasons, publishers will increasingly publish their materials in electronic format, providing access through their portal. They will provide options for faculty to order custom “e-texts” that are pieced together from parts of various textbooks they publish. Many publishers already offer this option through more conventional print-on-demand technology—but the practice has not yet made its way to technology education, particularly with respect to e-publications. E-texts would be more cost-effective than conventional print in the small technology education market, which all but two publishers seem to have already abandoned. The move to e-texts in K–12 institutions will also occur, but much more slowly, since that will require state and local adoption agencies and local school divisions to operate in very different ways.

Nonetheless, e-texts will eventually become the norm at nearly all levels, because they provide the many advantages identified earlier, including lower production and distribution costs, easier transport, and global access. These advantages will be very attractive in the education sector. As electronic publishing evolves to become the primary publication mode, publishers will develop their own vertical portals providing access to key information and services to the field.

## **SUMMARY**

Broadband networks have forever changed the way we distribute and access information. The fact that so many individuals in industrialized nations have access to the tools and services required to provide global access to information they create, has resulted in unprecedented amounts of published information. Much of this information has not been validated by the review process traditionally provided by publishers and academic disciplines. As the database of accessible information continues to expand aggressively, sorting through the endless list of sources identified by a search engine will require more and more time. Individuals will, therefore, turn to vertical portals that provide relatively efficient access to filtered and categorized information.

For this reason, technology education faculty and students at all levels will increasingly seek portals for their information gathering. Technology education publishers, academics, associations, and corporate providers

will develop portals of various magnitudes and foci. These portals will facilitate small and large virtual communities for those within the profession who share common professional interests. The profession will become less engaged with conventional print materials and more comfortable with electronic information sources. Technology education students will expect to find technology education portals, publishers will find them economically viable, and faculty will—perhaps reluctantly—succumb to the inevitable.

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# Digital Portfolios: Enhancing the Distributed Learning Environment

## Chapter 6

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William L. Havice  
Angela M. Rogers  
Clemson University

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### INTRODUCTION

Technology plays an important role in our society, and we must understand, use, and manage it in our daily lives. Today, technology continues to evolve as a new and dynamic subject in our schools. The content is fast paced and as relevant as any general education curriculum that our children study (ITEA, n.d.). The publication *Standards for Technological Literacy: Content for the Study of Technology* was created by an NSF/NASA funded standards project to identify what students should know and be able to do to become technologically literate. The standards identify content related to the nature of technology, technology and society, design, abilities for a technological world and the designed world. In implementing these standards, technology educators can take a lead role in demonstrating the use of digital or electronic portfolios in documenting student progress towards technological literacy.

For decades the traditional portfolio has been a medium technology educators have used to display products like engineering drawings, architectural drawings and other graphic communication documentation. Today the traditional portfolio is a sampling of the breadth and depth of a person's work conveying the range of abilities, attitudes, experiences, and achievements. Portfolios have been housed in folders, boxes, and 3-ring binders to hold papers, pictures, cassette tapes, and more.

Technology educators can use digital or electronic portfolios to document and assess what students should know and be able to do in their journey to become technologically literate in the distributed learning environment. Information can be stored digitally on a computer hard drive or on a removable media (i.e., CD, DVD). This digital information takes up

very little physical space and is easily accessed. Digital or electronic portfolios are an effective vehicle for organizing, summarizing, and sharing artifacts, information, and ideas about teaching and/or learning, along with documenting personal and professional growth. The reflective process of portfolio development can be as important as the final product. Technology educators can use portfolios as part of their own personal development as well as a method of student assessment and evaluation.

## **PORTFOLIOS**

In his work *Democracy and Education*, educational philosopher John Dewey identifies the ultimate goal of any education system to be to promote growth in students. Dewey believes that it is only by experiencing this growth that students are able to achieve fulfilling lives as adults (Dewey, 1944).

Identifying the ways in which our students grow is a difficult task for educators. The standardized testing that our public school system relies so heavily upon does little to prepare incoming college freshmen to reflect on the ways that they change as they enter college, embark upon study in their chosen fields, and blossom into young professionals who are ready to begin careers. If we consider Dewey's emphasis on growth as a necessary part of learning, and its importance in preparing our students for work in the "real world" it is imperative that educators embrace the notion of a reflective learning process that provides our students with ample opportunities to experience growth. It is perhaps for this very reason that a recent focus on portfolio-enhanced instruction has become so widespread.

At the present, within the academy, are debates about how to help students create portfolios that not only help them find employment, but that also help them to reflect on their learning experiences. This chapter focuses on the necessity of modeling the portfolio creation process for our students. In other words, we will outline the steps that an instructor can use to create a "professional educator portfolio" to build an ethos as an expert in his/her subject area by displaying publications and other accomplishments. The instructor can also use the professional educator portfolio to effectively model the goals for the digital portfolio assignment. We believe that, by devising strategies that lead to effective implementation of portfolio-enhanced instruction in our nation's colleges and universities,

we can continue to define our role as leaders in the infusion of technology for instructional purposes in the classroom. The benefits of portfolios in technology education go well beyond assessment, particularly if the portfolio is conceived of and executed as a Web-based portfolio (Sanders, 2000).

### Digital (Electronic) Portfolios

The notion of the portfolio is hardly a new one. Print-based portfolios have been around for a number of years and are based on the same instructional goals as their digital (electronic) counterparts. The goal is to create a collection of a student's work over a period of time, whether that work is displayed electronically or is print-based. Most individuals are more proficient with the tools that are used to create print-based portfolios than writing hypertext markup language (HTML) code or using HTML editing programs, such as Netscape Composer or Dreamweaver. Therefore, the obvious question that arises is why make portfolios digital (electronic)? Some of the responses to this question are obvious. A digital portfolio is a computer readable electronic collection, displayed either on the World Wide Web or on some other device like an optical disc, of an individual's work. Portfolios can fit into one of two broad categories: 1) highlights an individual's best work or 2) documents the ways an individual has grown over a period of time, by providing examples of earlier work and comparing them to recent work, along with reflection on the growth that the individual has experienced over the elapsed time. It should be recognized, however, that these two categories are not mutually exclusive. A portfolio that demonstrates an individual's growth over a period of time can certainly help to prepare that individual to create a polished portfolio, highlighting only his or her best work.

A portfolio made available on the World Wide Web is much more accessible than a portfolio which must be copied and mailed to its audience. One can register a portfolio made live on the Web with search engines such as Yahoo or Google with minimal cost. Therefore, the audience for that portfolio is automatically increased. Making the portfolio available to a variety of audiences through this medium presents little additional cost for its creator. Digital portfolios are also much less cumbersome, even if they are not made available on the Web. Dealing with one optical disc/CD, for example, is much less taxing than carrying a bound,

paper portfolio. Furthermore an optical disc/CD is much cheaper to replicate for various audiences.

Today, a digitally literate person can almost instantaneously view a picture on the WWW, save it to a file for future use, print it out, or email it to a friend. The definition of the very word *literacy* is changing as we enter the new century. In his book *Digital Literacy*, Gilster (1997) defines digital literacy as “the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers” (p. 1). Being digitally literate requires us to be multidimensional and actively engaged in orchestrating activities facilitated by computer technology.

Computer audiences are becoming increasingly adept at reading hypertext documents, which allow them the power to jump from point A to points M or Z with the speed of a couple of clicks. When you use the World Wide Web (WWW), you are working in a hypertext or hypermedia environment. By using a Web browser (the computer software that lets you access the WWW, i.e., Netscape or Internet Explorer and associated search programs) you can find information on almost any topic in just a few clicks of your computer mouse button. You can move from item to item and back again without following a predefined path, following links according to your personal needs (attributes). The browser makes the connections to a specific WWW site, retrieves information from the site, and displays it on your computer screen.

The information displayed on the computer screen is normally shown in a multimedia format. It may contain text, images, video, and/or audio. You can navigate to other locations on the Internet to search, browse, and retrieve information. You use a mouse to move a browsing tool (a hand) to a link represented by an icon, menu item, region of a map or image, button, or underlined portion of the window, where you click the mouse button. These items are referred to as hyperlinks and sometimes are called hot spots (Roblyer, 2004). If you’ve clicked on a link in the document, the browser follows that link; the current display information is replaced by the new linked information.

For this linking system to work, information is exchanged on the WWW according to a specific protocol (set of rules) called Hypertext Transfer Protocol (HTTP). Each hyperlink has a particular format, or a Uniform Resource Locator (URL). Web pages are written using a language called Hypertext Markup Language (HTML).



The term hypertext is used to describe text that contains non-linear (non-sequential) links to other text. We use the term hypermedia when the hypertext and links are from a variety of media (e.g., text, movies, pictures and audio), as is the case in the WWW (Roblyer, 2004). On a WWW page or screen, some items are boldfaced, underlined, or colored differently. Each of these items represents a link to another part of the current document, file, page, screen, image, or other Internet resource. You can follow or jump to information the link represents by selecting one of the links or you can return to the previous link. There is a definite starting point, but the path you take after that is your choice. You are not constrained by having to go in a linear (sequential) order; you can think of being able to move in any non-linear (non-sequential) direction from any link. If a portfolio creator seeks to argue that his/her work is of high quality, then creating hyperlinks that aid in making an argument rhetorically is certainly a way for that author to effectively speak to and convince his/her audience.

The digital medium provides the portfolio creator with the means to add sound clips and video clips seamlessly. Using these same files in a print-based portfolio is possible, but it would require the audience to have a computer or other equipment available for viewing the materials, forcing him/her to toggle between paper and the equipment while viewing the portfolio.

Fortunately, at most educational institutions today, it is possible to make a digital educator portfolio available to students. Most universities and colleges provide instructors with some way to post information electronically, be it through a course management system like Blackboard™, WebCT™, eCollege™ or by providing the instructors with personal space on the institution's Web servers. The first step in creating a teacher portfolio is to contact the institution's computer technology support to determine where the portfolio can be stored so that students can easily access it. After determining where the portfolio will be stored, it is time to begin creating the hypertext document.

The following sections will provide steps that an instructor and/or students might follow if they wish to create digital portfolios. We recommend that instructors create their own digital portfolios before giving the assignment to their students. We believe that instructors who have their own digital portfolios on display for their students is a pedagogically sound approach for several reasons:

- It models the behavior that the students will be required to follow later when they complete their own portfolios;
- It helps the instructor foresee any computer technology challenges the students may encounter when completing the assignment; and
- It builds the credibility of the instructor by displaying information for audiences to see.

### **The Professional Educator Portfolio**

As a result of changing curriculum standards, many instructors are beginning to require that their students create digital portfolios to highlight their best work. Yet, only a small percentage of these instructors have a digital portfolio themselves. Unfortunately, these instructors are missing the opportunity to meet a variety of goals by not creating their own digital portfolios.

Campbell, et al. (2004) lists a variety of advantages to using a professional portfolio throughout one's teaching career. They believe that it can "assist you in taking charge of your professional development" and "help you engage in the process of self-reflection and assessment" (p.74). The portfolio can build an instructor's ethos in the professional community. Furthermore, if students see that the instructor has created a portfolio, it not only provides the students with meaningful examples of the instructors work and research interests, but the instructor is actually modeling the activity in which the students will engage.

If you create a Web-based portfolio, your students and colleagues can easily access it. Mark Sanders (2000) talks about the advantages of Web-based portfolios for technology educators. He states that,

. . . while the Web is indeed a global medium, the most important audiences are close to home: parents, fellow teachers, administrators, local education decision makers. We want them to know what technology education is, and there is no better way to share with them "authentic evidence" of what students are learning and doing in technology education classes (p. 74).

Of course, this same idea holds true for a professional educator portfolio, and one other important audience for an instructor to consider is his/her students.

The professional educator portfolio might look a little different than the student portfolio. For example, your students will likely not have a publications and/or conferences page. In addition, some teachers like to keep a response journal online to respond to activities that occur in class. These “teacher journals” can have a variety of benefits; Faridah Pawan (2003) writes about the benefits of sharing reflections with students in online classes. Her thoughts on the issue can be easily applied to traditional courses where a teacher has an online portfolio that students can access. Pawan states, “reflective teaching involves teachers’ self-evaluation of their practical theory by means of which they subject their personal beliefs of teaching . . . ” (p. 30). She talks about using both “reflection-on-action”—writing that happens after an activity takes place—and “reflection-in-action”—writing that takes place while an activity is actually occurring. Pawan writes that in the reflection that she shares online with her students, she shares not only reflections on “new thoughts and ‘awareness’” about her teaching, but “issues and struggles that [she has] teaching online” (2003, p. 32–33). These kinds of reflections on the part of the instructor help the students see the instructor as an individual who is committed to the work that he or she does, as well as helping them understand the kinds of thoughts that go into creating assignments. In other words, rather than creating a portfolio at the beginning of the term and forgetting about it, keeping a teacher journal provides the teacher with a dynamic medium that changes throughout the term, while you are working with your students.

### **The Student Portfolio**

Like the professional educator portfolio, the student portfolio should be seen as a dynamic document. In the best-case scenario, the portfolio students begin in one class would be added to in other classes. As you plan for the requirements of students’ portfolios, think primarily about the purpose of the portfolio. Should it be a portfolio that contains only samples of a student’s very best work? Or should it be a more chronological portfolio that highlights how a student has grown throughout the course of the semester? As you think of how the final version of the student portfolio will look, consider what best helps the student to realize the ways that he/she has grown. Campbell, et al. (2004) states that,

. . . many interviewers look to the portfolio for the attributes that make you different from other candidates. They are interested in documents that reflect, among other things: creativity, positive attitude, professionalism, organizational skills, writing ability, computer skills, potential to succeed, goal setting, leadership, efforts, achievements, honors, awards . . . (p. 58).

Therefore, a focus of the portfolio should be for the student to show what makes him/her unique.

One of the most important items to immediately consider when creating a portfolio assignment is ensuring that students feel comfortable with the technology they will be using to create the portfolio. It is important they meet the technology standards required for the course. It is essential that adequate time with computers be given to students so they are not intimidated by the assignment and can focus on the work samples and reflections they are including in the portfolio. In discussing the Web-based portfolio assignment that Sanders (2000) gave to his own students, he describes having them share their portfolios with the class at different stages. The class would provide feedback; the students would then reflect on that feedback and make changes to the portfolio. Therefore, rather than tacking the portfolio requirement on at the end of a class, just to meet technology standards, we advocate the following approach to portfolio creation.

An online journal of reflections is also a good idea for students who have an online portfolio. Vonderwell (2004) shares the following possible writing prompts for online journals:

1. What are the most important things you learned this week?
2. What are the points still remaining that you would like to learn after this week's activities?
3. Do you have any suggestions or ideas with respect to the class activities, documents, assignments? (p. 30)

The professional digital portfolio is a document containing professional performance and growth over time. The process of creating professional portfolios facilitates communication between learners and learners, learners and faculty, and other professionals. This provides an opportunity to reflect on growth and change throughout the program of study or throughout a professional career. This process can help students become

more articulate and self confident about their profession during an interview or in conversation about their professional accomplishments.

A professional portfolio is a sample of artifacts and reflective entries that is a representation of an individual's experiences and competencies that documents professional growth. While some portfolios show a person's best work, others may be used to document the quality of change that a student has experienced as a result of learning or teaching experience. The type of portfolio used should be based upon individual student needs.

### *Steps in Creating a Digital Portfolio*

There is no right or wrong way to develop a professional portfolio. However, for students, the portfolio should demonstrate what the student has learned and values as a result of learning. By the same token, the teacher portfolio should reflect similar accomplishments and values.

#### **Identifying Audience and Purpose**

Before deciding what documents will go into a portfolio, the first considerations that must be identified are the audience and purpose of the digital document. In the case of an educator portfolio, the audience may vary from semester to semester. For example, if you are teaching an Exploring Technology class, then the portfolio might look quite different than it would if you are teaching an English composition class. It is also important to remember that your students are not the sole audience for your portfolio. Colleagues and potential employers may also make up part of the audience to visit your site. By identifying the target audience, you can pinpoint exactly what you wish to accomplish by creating the portfolio. Here are some questions you might consider in reflecting on the purpose of your portfolio. How can you use the digital portfolio to:

- build your students' confidence in your abilities as an instructor;
- develop confidence in your information technology expertise;
- model examples of projects your students will be creating in the class;
- build your ethos with your colleagues; and
- demonstrate that the pedagogies employed in your classroom reflect the goals of your institution (i.e., by highlighting service learning projects, etc.)?

### **How should the portfolio look?**

When developing a portfolio, visual elements become very important. Before you begin building HTML pages, it is important to consider the following items:

- Organization of material
- Lettering, spacing, and arrangement
- Photographs
- Graphic organizers
- Use of computer graphics
- Captions
- Charts
- Variety (color, type, and visual impression)

### **What to include in your professional digital portfolio**

The portfolio should be viewed as a production that is created through a process of careful and deliberate work. The portfolio should contain a collection of artifacts related to educational experiences. Additionally, this collection of material should be organized into a logical presentation format.

Materials for the portfolio should be gathered prior to beginning to build the portfolio. Without knowing exactly what you will and will not include, it is impossible to gauge how many pages and links you are going to need. Therefore, by gathering the materials you would like to use before actually beginning the process, you will save yourself some valuable time.

A sample table of contents might include:

#### Academic

- Course syllabi
- Lesson plans
- Digital photos of artifacts (i.e. technical projects, drawings)
- Artifacts demonstrating individual communication skills—term papers, article summaries, presentations, etc.
- Examples of research or problem solving skills

### Personal

- Statement of professional or educational philosophy
- A five year professional development plan (goals and objectives to attain the plan)
- Reflective entries which address learning and professional growth
- Reflective statements, write about: personal accomplishments, content strengths, personal growth as a result of learning (in and out of school experiences)
- Hobbies

### Professional

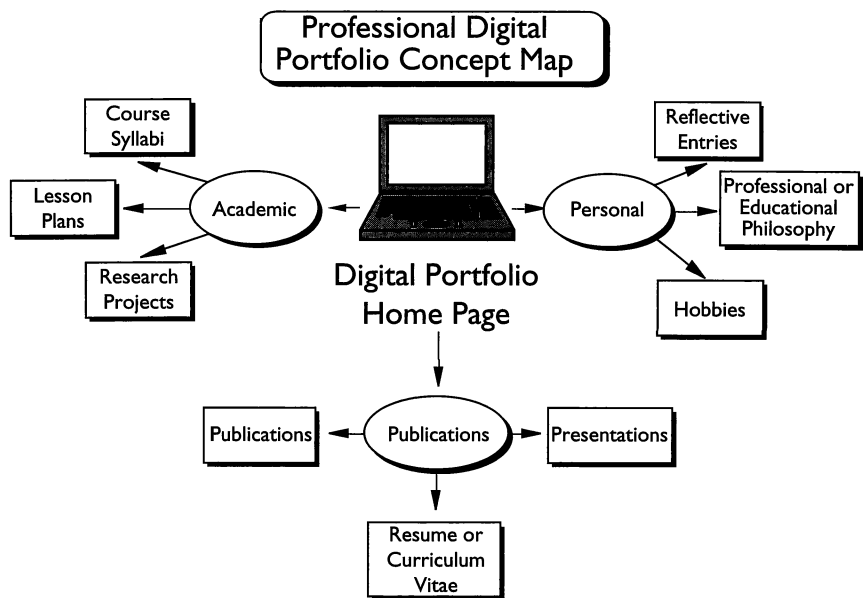
- Publications
- Professional presentations
- Documented participation in courses, workshops, study groups, or staff development activities
- A professional resume or vitae
- Evidence of computer/technical skills
- Examples of group work

### **Storyboarding or Concept Mapping**

One of the most important ideas to model for your students is the importance of planning a portfolio before you begin to actually create it. Inexperienced designers frequently make the mistake of “jumping the gun” in their excitement to try Dreamweaver or Composer. They begin creating HTML pages before they know how their portfolio will be structured. Because hypertext does not follow the linear line of logic to which they are accustomed when creating traditional, print documents, designers suddenly find themselves with a disorganized set of documents that are almost impossible to link together. Taking the time to create a storyboard or concept map before you begin the entire process will actually save you and your students a great deal of time.

The figure below represents an example of how you could map out a portfolio. The computer represents the home page, from which all other pages in the portfolio may be reached via linear links or possibly hypertext links that are created there. If you have already gathered the materials that you feel are important to include in your portfolio, you should be able to divide the documents into different categories. Ellipses in the diagram below represent potential categories for which you might see a need. Note: These categories can change based on your specific audience.

Figure 1. Professional Digital Portfolio Concept Map



A variety of HTML editing programs are available to help you build your digital portfolio. It is recommended that you begin with a simple design; you can make your portfolio more elaborate as you garner more skills with the software. The following is a list of programs you might consider using, if you opt for the home page version of the portfolio.

- Netscape Composer or Mozilla—These are free and have a relatively low learning curve.
- Microsoft Front Page
- Macromedia Dreamweaver



### Assessment

Portfolios can be used to assess the individual student, a course, an instructor, or even a new curriculum. Well-known writing theorist Peter Elbow (2003) believes that portfolios give us a better idea of how students have progressed in their work than traditional methods of assessment. He states, “portfolios give us a much more accurate and trustworthy picture of strengths and weaknesses than we get from looking at single papers from a classroom or an examination” (p. 41). In designing what you will have your students include in their portfolios, it is important to already have a plan for assessment in mind. Rogers and Chow (2003) list the following questions as important considerations when planning a portfolio assignment for students to be used in the assessment process:

- What is the primary purpose of data collection? . . . . To assess the growth of a student or . . . a showcase approach . . .
- Will you assess everything in a student’s portfolio?
- Are you going to assess every goal and performance criterion every year or every semester?
- What resources do you have available? (p. 22–23)

Rogers and Chow (2003) also recommend multiple methods of assessment be considered. Multiple methods include such items as grading random samples from the portfolio throughout the term, peer evaluations, and self-evaluations. Rubrics are also an invaluable tool in portfolio assessment. The following Web sites offer samples of rubrics designed to evaluate student portfolios and could be helpful to you as you create your own.

- <http://school.discovery.com/schrockguide/assess.html>
- <http://www.uvm.edu/~jmorris/rubricep.html>
- <http://www.essdack.org/port/rubric.html>
- [http://www.ruraledu.org/rtportfolio/main\\_rubric\\_index.htm](http://www.ruraledu.org/rtportfolio/main_rubric_index.htm)
- [http://www.asdk12.org/staff/lloyd\\_pam/pages/Electronic\\_Portfolio/Pages/EP\\_Assess.html](http://www.asdk12.org/staff/lloyd_pam/pages/Electronic_Portfolio/Pages/EP_Assess.html)

The main thing to remember as you decide how you will assess your student portfolio is that you should refer back to the learner objectives you have for your course. The assessment strategies you use should reflect the ways your students have or have not met these objectives.

## **SUMMARY**

Distance and distributed learning environments are enhanced through the use of digital or electronic portfolios. Portfolios allow technology educators to be more reflective about what it is they do. By examining their own practices, those practices are likely to improve. By sampling the breadth and depth of a person's work, conveying the range of abilities, attitudes, experiences, and achievements, the digital portfolio allows us to document the practices we would like to preserve and even pass on to others.

Additionally, technology educators can use portfolios as part of their personal development as well as a method of student assessment and evaluation. The examples of accomplished practice that portfolios provide also can be studied and adapted for use in other classrooms. Using portfolios is more than just a good idea. Students, teachers, and administrators can use portfolios to document their careers.

## **DISCUSSION QUESTIONS**

1. What are the advantages/disadvantages to creating a digital portfolio vs. creating a print-based portfolio?
2. How would a professional portfolio change based on different audiences? For example, how would an individual applying for positions both with a local school district and with a technical college adjust the portfolio?
3. How important are links to outside sources in a portfolio? For example, should an individual include links to other schools where he/she has taught, etc.?
4. How would presenting his/her own digital portfolio at the beginning of the term help an instructor to build his/her students' confidence in creating their own digital portfolios?
5. How often should an individual update his/her digital portfolio?
6. Do you think that digital portfolios will become an expected part of a job interview in the near future, much like a resume or curriculum vitae?

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### **Additional resources available or in production:**

- Aurbach & Associates, [www.aurbach.com/](http://www.aurbach.com/)
- Epsilen Portfolios, Indiana University-Purdue University Indianapolis (IUPUI), [www.epsilen.com](http://www.epsilen.com)
- The Collaboratory Project, Northwestern University, <http://collaboratory.nunet.net>
- Folio Thinking: Personal Learning Portfolios, Stanford Center for Innovations in Learning, <http://scil.stanford.edu/research/projects/folio.html>
- Catalyst Portfolio Tool, University of Washington, [www.catalyst.washington.edu](http://www.catalyst.washington.edu)
- Minnesota State Colleges and Universities e-Folio, [www.efoliomn.com](http://www.efoliomn.com)
- Carnegie Knowledge Media Lab, The Carnegie Foundation for the Advancement of Teaching, [www.carnegiefoundation.org/kml/](http://www.carnegiefoundation.org/kml/)

- Learning Record Online (LRO) Project, The Computer Writing and Research Lab at the University of Texas at Austin, [www.cwrl.utexas.edu/~syverson/olr/contents.html](http://www.cwrl.utexas.edu/~syverson/olr/contents.html)
- Electronic Portfolio, Johns Hopkins University Center for Technology in Education, [www.cte.jhu.edu/epweb](http://www.cte.jhu.edu/epweb)
- CLU Webfoil, California Lutheran University, [www.folioworld.com](http://www.folioworld.com)
- Technology Portfolio, Wake Forest University Department of Education, [www.wfu.edu/~cunninac/edtech/technologyportfolio.htm](http://www.wfu.edu/~cunninac/edtech/technologyportfolio.htm)
- PASS-PORT (Professional Accountability Support System) University of Louisiana at Lafayette and Xavier University of Louisiana, <http://pass-port.org/>
- The Connecticut College e-Portfolio Development Consortium, [www.union.edu/PUBLIC/ECODEPT/kleind/conncoll/](http://www.union.edu/PUBLIC/ECODEPT/kleind/conncoll/)
- The Kalamazoo College Portfolio, Kalamazoo College, Kalamazoo, MI, [www.kzoo.edu/pfolio](http://www.kzoo.edu/pfolio)
- Web Portfolio, St. Olaf College, [www.stolaf.edu/depts/cis/web\\_portfolios.htm](http://www.stolaf.edu/depts/cis/web_portfolios.htm)
- The Electronic Portfolio, Wesleyan University, <https://wesep.wesleyan.edu/cgi-perl/session.cgi>
- The Diagnostic Digital Portfolio (DDP), Alverno College, [www.ddp.alverno.edu/](http://www.ddp.alverno.edu/)
- E-Portfolio Portal, University of Wisconsin–Madison, <http://portfolios.education.wisc.edu/>
- Web Folio Builder, TaskStream Tools of Engagement, [www.taskstream.com](http://www.taskstream.com)
- FolioLive, McGraw-Hill Higher Education, [www.foliolive.com](http://www.foliolive.com)
- Outcomes Assessment Solutions, TrueOutcomes, [www.trueoutcomes.com/index.html](http://www.trueoutcomes.com/index.html)
- Chalk & Wire, Communications Research Centre of Canada, [www.chalkandwire.com](http://www.chalkandwire.com)
- LiveText, LiveText Inc., [www.livetext.com](http://www.livetext.com)
- Learning Quest Professional Development Planner, Learning Quest Inc. [www.learning-quest.com/](http://www.learning-quest.com/)
- Folio by eportaro, [www.eportaro.com/](http://www.eportaro.com/)
- Concord's Masterfile ePortfolio Manager (EPM), <http://www.concord-usa.com/epm.htm>
- Nuventive—iWebfolio, <http://www.nuventive.com/index2.htm>
- The University of Denver Portfolio Community, Center for Teaching & Learning, <https://portfolio.du.edu/pc/index>

# Enhancing Distributed Learning through Electronic Collaboration and Group Interaction

## Chapter 7

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Clint H. Isbell  
Clemson University

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### INTRODUCTION

Collaboration and group interaction among students has played an important and effective role in the technology education classroom and laboratory for decades. However, teachers have experienced varying degrees of success, finding that just simply placing students into groups does not necessarily guarantee a successful learning experience (Reeve & Shumway, 2003). As distributed learning technology begins to play a greater role in the classroom and teachers become more active as facilitators of the group interaction, collaboration will become a much more effective and powerful instructional tool.

Collaboration is becoming a vital component of communication in the virtual community by providing cost effective meetings and delivering services in business and education (Carter, 2002). The increasing availability of computer access through wired and wireless technology is creating and expanding opportunities for enhancing collaboration and interaction between individuals and groups, both in business and education. While collaboration is becoming a common tool in the workplace, new demands are placed on the worker to collaborate in a virtual environment (Emelo & Francis, 2002).

Collaboration and cooperative learning have been used effectively in the technology education classroom as a means to enhance team problem solving skills, critical thinking and social interaction among students. According to Dyrili (2002), Web-based projects such as those that require collaboration among students and teachers in different locations can be some of the most powerful education tools. Cooperative learning activities that allow students to build on personal interaction and teamwork are becoming increasingly more important in the work force (Strommen, 1995).

This chapter explores the benefits of enhancing learning for individuals and groups in the traditional and distributed learning classroom envi-

ronment that exist through collaboration and group interaction utilizing distributed learning technology. In addition to the strategies for developing collaborative activities, this chapter looks at the barriers and challenges of various forms of electronic collaboration with emphasis on the use of Web-based technology.

## **ADVANTAGES OF COLLABORATION AND GROUP INTERACTION**

As often cited, “two minds are better than one” is found to be true more often than not. Utilizing the skills and knowledge of more than one individual in any learning situation increases the effectiveness of the group or team whether in a face-to-face classroom setting or meeting at a distance. Bringing individuals together increases the knowledge base of not only the entire group, but has shown to accelerate the knowledge level of individuals within the group. Collaborative problem solving provides students the opportunity for a much more interactive learning environment. Numerous studies have shown that well planned collaborative or “cooperative learning” activities have a positive impact on the development of children in increasing self-esteem, development of leadership abilities and increased teamwork (Strommen, 1995).

In almost any learning or problem solving situation, individuals feel much more comfortable when they are able to work with others. This is especially true in areas that are new to the individual, where there is a high level of uncertainty and anxiety. Working with others in unknown territories often helps to reduce these uncertainties, but also helps individuals as well as teams to build confidence. This may be compared to taking a hike on a nice fall afternoon into a picturesque and unknown forest, and after hiking several miles wandering off the trail to become disoriented. As the sun and temperatures begin to fall, the picturesque forest becomes much less picturesque. The level of apprehension starts to rise as you realize that there is not much time till dark and you have not really prepared for an overnight hike. This is one of those situations where having another person as support in finding a way out would relieve that apprehension, even though suddenly without warning you walk back onto the trail with a sign pointing the way out of the forest. We often find ourselves in situations whether it is hiking or problem solving in a class that we would like to have someone else to help us find our way. Thus, collaboration works much the

same in helping us toward a common goal or in solving problems.

Cooperative learning activities give students a much broader knowledge base regardless of the problems or situations they might encounter. Not only are students able to share the wealth of knowledge among each other, they are also able to increase the number of resources available when solving problems. Increasing the knowledge base and resources provides the opportunity to build the number of ideas that are generated through interaction. The expanded use of distributed learning technology in both the face-to-face technology education classroom and the virtual classroom provides new and exciting opportunities for group interaction.

The technology education classroom has played an important role in helping students to achieve many of the goals of the Secretary's Commission on Achieving Necessary Skills (SCANS). Of the skills reported, SCANS lists collaborative skills (such as negotiating, teaching, and leading projects) among the most critical for the 21st century workplace (Strommen, 1995). According to Strommen (1995), a number of studies support the idea that cooperative learning fosters improved self-esteem, a sense of teamwork, and assists in developing leadership skills.

Within the last decade there have been numerous initiatives to foster collaboration among students using distributed learning technology. As early as 1993, MIT was conducting research in developing a virtual electronic classroom where interaction among students and teachers across campus would be enhanced. Through the NEOS (Networked Educational Online System) developed at MIT, researchers found that a fully distributed computing environment can support unlimited insights and foster re-combinations of information that lead to new ways of looking at all kinds of subjects (Barrett, 1993).

Internet activities, such as Space Day 2000, provided students and teachers a virtual environment for pooling their knowledge and strengths in solving the challenges of living and working in space. Students in grades 4-6 were given Design Challenges where students could exchange ideas with other students throughout North America as well as having the opportunity to dialog with experts (Dyrili, 2002). Another such collaborative activity was the Triple Crown Challenge sponsored by the 3Com Corporation where high school students from New York and San Francisco collaborated cross-country to encourage online learning. Students were given questions on geography, science, art, technology and baseball history and challenged to work together to find answers as quickly

as possible to win the Triple Crown (Business Wire, 1996).

## **EFFECTIVE STRATEGIES FOR COLLABORATION AND PROBLEM SOLVING**

There are numerous collaboration strategies that can be used by the technology education teacher to support problem solving in a distributed learning environment. It is important to remember that regardless of the activity, planning and structured implementation is important to the success of the activity. Three such strategies that range from informal to formal processes are brainstorming, the Nominal Group Technique and the Delphi Technique (Siegenthaler & Riley, 2002).

Collaboration and group interaction is common in the popular problem solving and decision making method of “brainstorming”. Whether it is in small or large group collaboration, “brainstorming” sessions can be highly effective methods of generating large amounts of quality information. Brainstorming can range from the very informal generation of ideas, such as a “break room” setting to a more formal approach whereby a facilitator and note taker is used to compile ideas to gain consensus among the group. As with most other idea generating processes, brainstorming should be open to all ideas regardless of how “crazy” they may seem. It is not unusual for good ideas to evolve from such nonsensical ideas. Brainstorming can also serve as a valuable tool in bringing students together where they can get to know one another while working toward a common solution.

Similar to “brainstorming”, more structured collaborative problem solving processes include the “Nominal Group Technique” and the “Delphi Technique”. The Nominal Group Technique (NGT) is a process where a group of 5-9 individuals gather together to generate ideas and come to a consensus or ranking of the top ideas. The NGT is a structured process whereby a facilitator leads the group in identifying ideas through a round robin format culminating with the ranking of the ideas. It is important through the NGT process that there is not any criticism of individual ideas (Siegenthaler & Riley, 2002).

The Delphi Technique is a process that was developed by the Rand Corporation and used in the early 1950's as a problem solving method whereby panels of experts were used to gain consensus on high level military problems. The Delphi Technique differs from the NGT in that the



participants are identified as experts to the field for which the problem is occurring and the generation of ideas is anonymous to help avoid any bias from the individuals, which often occurs in a face to face interaction. The Delphi is usually more time consuming due to the fact that the experts are possibly geographically separated. For years, regular mail service provided the primary means of communication for the compilation of ideas when utilizing the Delphi. With the expanded use of the Internet, the time for conducting a Delphi study has been reduced considerably. However, with the participants geographically separated, it is necessary that the written instructions to the participants for the Delphi process be very clear. Without face to face interaction, clarification of statements can often be a concern in the process (Linstone & Turoff, 1975). In the case of the NGT, communication issues related to body language and tone become critical particularly in issues of crisis. It is therefore important for the facilitator to keep the session on track and structured.

## **GENERATING QUALITY IDEAS THROUGH GROUP INTERACTION**

Regardless of the problem solving process, the primary focus of a collaborative or group interaction should be the generation of quality ideas. As previously mentioned, just putting individuals into groups does not necessarily guarantee quality ideas. Often, ideas for solutions to problems are influenced and biased by individual experiences, which may or may not provide the best solution (Gallupe, et al., 1992). The way that individuals have traditionally done things in the past may or may not necessarily be the best. There are times when individuals may feel they are experts just because they have experienced a particular situation. Having several automobile accidents does not necessarily make a person an expert on driver safety nor does going through several marriages make a person the expert in marital relations. Gaining feedback from others from different backgrounds and experiences, however, does help to increase the number of quality ideas. It is important to keep in mind the make-up of the group from where the ideas are being generated (Strommen, 1995). It can almost be as detrimental to have ideas generated by a group of individuals that are unknowledgeable or biased toward a solution as having only one knowledgeable individual with non-biased ideas. Therefore, it is important to put together a group of individuals that have an interest in the problem

and also are open minded for solutions.

Building trust among the group or team is also an important aspect of generating quality ideas. When dealing with issues of a critical nature, it is important that there is trust among the individuals who are sharing ideas. Without a feeling of trust among the participants, there is difficulty in generating quality ideas.

## **COMMUNICATION CHALLENGES OF COLLABORATION AND GROUP INTERACTION**

It is obvious there are numerous strengths to collaboration whether in a traditional classroom setting or utilizing distributed learning methodology. However, communication is one of the major challenges of quality collaboration. Whether communication is written, oral or graphical, it is important to take all of these into consideration when conducting a collaborative activity. Other communication concerns of collaboration involve language, reading levels, cultural differences and in distance learning environments, geographical and time zone issues.

Computer technology and the use of the Internet have brought written communication to new levels and is becoming a more important part of any distributed learning environment. With the speed of e-mail and “Instant Messenger”, communication ranges from slang and icon driven comments to complete grammatical sentences. Advances in word processing programs have helped improve communication through the utilization of features such as spell check, grammar check, and even language interpretation. Even with support from computer programs, effective writing skills continue to play a major role in communication. Voice recognition and word recognition software has also made it possible for individuals with various physical limitations, e.g. blind, loss of limbs, to work effectively on computers.

The use of the telephone, cell phones, teleconferences, etc. has also increased the level of effective collaboration within the distributed learning environment. However, additional challenges present themselves with oral communication in a distributed learning environment. Within face-to-face meetings, individuals are able to clarify points of an oral discussion with voice tone and body language that often cannot be achieved through distance oral communication. Dede (1995) noted that:

. . . virtual communities that provide support from people who share common joys and trials are a second capability for enhancing distributed learning. We are accustomed to face-to-face interaction as a means of getting to know people, sharing ideas and experiences, enjoying others' humor and fellowship, and finding solace. In a different manner, distributed learning via information infrastructures can satisfy these needs at any time, any place (pg. 1).

However, effective collaboration can be achieved through oral communication utilizing a variety of media and graphical communication tools.

The use of graphical and presentation software continues to support and enhance the effectiveness of collaboration communication in the classroom. The use of computer graphics utilizing color, various fonts, graphs, photographs, and clip art has given participants a more powerful tool for use in the distributed learning environment. Whether the graphic presentation is used for instruction in the onsite classroom or in a distance learning environment, the level of effectiveness of the graphics is dependant upon the quality of the presentation media that is created by the designer. For effective communication, it is important to follow the guidelines for use of graphics in developing instructional media.

Video communication is becoming a much more effective tool in collaboration due to the advances that have been made in the area of desktop video instruction. "Desktop video conferencing (DVC), provides an opportunity for collaborators at different locations to interact with one another on various types of projects in meaningful ways" (Jennings, 2001 pg. 2). As more and more individuals gain access to broad-band Internet services, streaming video and the use of real time two-way desktop video, these video communication technologies will become increasingly more popular and effective for collaboration activities. Training of the instructors and end users in the use of desktop video conferencing and advanced video tools will be an important part of professional development activities in education (Jennings, 2001).

One of the most often overlooked areas of concern for instructional program designers is language skills. Typically, reading levels have always been a concern with English being the primary language. However, with the influx of various non-English speaking nationalities into the United States, language is becoming a much more critical issue in the development of educational programs. This is not only an issue for the onsite classroom, but an important concern for the distance instructor who may

be engaging non-English speaking students in a distance learning environment. As with language and readability, cultural differences are also important concerns in developing sound instruction utilized in distance learning technology. It is extremely important for the instructor and the students to be sensitive to other cultures when involved in any educational activity.

In planning collaborative activities when individuals or team members are geographically separated, scheduling for time differences can prove to be a major challenge. It is important that schedules are planned accordingly as not to interfere with school, work or family activities.

When using technology as a tool to support collaboration and group activities it is essential that all participants have a thorough understanding of the technology and feel comfortable with its use. What is referred to as the “technology frustration factor” or TFF, has shown to be a real impediment to effective use of technology and ultimately learning. Without a level of comfort with technology it is difficult for the user to make the most effective use of the technology and therefore be a productive member of a collaborative activity.

## **PLANNING AND IMPLEMENTING COLLABORATIVE ACTIVITIES**

As with any distributed learning activity it is important to understand how the activity is to be used within the technology education curriculum to achieve the stated objectives. As previously mentioned collaborative activities have proven to be valuable and effective for learning in support of the technology education curriculum. It is therefore important that the type of collaborative activities utilized be planned appropriately.

Using the ADDIE model is an effective approach for designing and implementing a distributed learning collaboration project. This model is a general instructional design model that includes Analysis, Design, Development, and Implementation and Evaluation (ADDIE). The ADDIE Model was used as an effective tool in the 21st Century Teachers Network project where teachers and students from different colleges across the country collaborated via e-mail and an asynchronous Web-based communication tool (Reinhart, Anderson & Slowinski, 2000).

The students participating in the 21st Century Teachers Network Project were members of educational technology classes in three separate universities who were given different articles to read and responsibilities to summarize the content of the article for their group members. Following the summary of each article, each group collaborated to submit a shared summary on that issue. Students were to place themselves in a problem based learning environment as a participatory member of the 21st Century Teachers Network ([www.21ct.org](http://www.21ct.org)). According to Reinhart, Anderson, and Slowinski (2000), students were given responsibilities to:

. . . build their own expertise and experience in using new learning technologies; to share their expertise and experience with colleagues; to use their expertise with students as part of the daily learning process; and to work to make classroom technology available to all students and teachers (p. 2).

## **ANALYSIS OF THE PROJECT**

The ADDIE model proved to be a valuable tool in the development and implementation of virtual collaboration projects. As demonstrated with the 21st Century Teachers Network Project, the analysis of the project began with an understanding of the learners' current level of understanding of the topic and the technology literacy levels of the students. Furthermore, it is also important to have a thorough understanding of the level of support for the technology that is to be utilized.

Some of the major concerns of distributed learning technology include compatibility and security issues which are discussed in other sections of this chapter. The analysis should also include an understanding of the content to be covered, course objectives, expectations, grading and scheduling issues within the class. Since this was a virtual project with participants communicating at a distance utilizing various technologies, the analysis phase was a very important aspect of the project. As technology changes, it is important that instructors have a clear understanding of the level of technology that students are using as well as the computer literacy level of the student. A simple survey at the beginning of the course can help to alleviate many of the questions that may arise or identify potential problems that could occur during the collaboration activities.

## **DESIGN OF THE PROJECT**

Once a thorough analysis of the project is completed, then the design of the project should begin. In the 21st Century Teachers Project, designing the activities centered around the use of instructional technology and a focus on the content areas. In developing a collaborative activity for a distributed learning or distance environment it is recommended to begin a collaborative project with colleagues that you know and possibly have worked with in the past. This will allow for a better understanding of each other and development of a level of trust that will be necessary in completing a collaborative project. As previously mentioned it is extremely important to conduct a thorough analysis of the project prior to beginning. It is also important to keep lines of communication open at all times to make sure that any issues may be addressed at the beginning. Poor communication is often the single most common reason that projects such as this fail. It is essential to provide for specific instructions and guidance before and during the project to assure that all participants have a clear understanding of the expectations of the activity.

As previously mentioned, students must be provided with guidance on how to effectively collaborate with each other, whether in a face-to-face or virtual classroom environment (Reinhart, Anderson, & Slowinski, 2000). It was found in the design stage that the most effective way to facilitate discussion during the project would be the use of small groups. The groups consisted of three to four students with at least one student from each class led by a class member identified as an 'expert' on that particular topic. Planning for collaborative learning activities included when and how the activity is to be used. If the collaborative activity is not relevant to the content of the curriculum then the activity will be no more than just time filler for the teacher.

It is also important to plan the number of students that may be collaborating. If the number of participants is too large, then there will be those students who may feel left out of any discussion, and the discussion may be less effective. It is found that smaller groups normally work more effectively together than larger numbers. Smaller groups often encourage more participation by all members in discussion and problem solving than groups with larger numbers. Keeping the number of participants small seems to generate more focused discussion among the members and is often a more effective strategy.

As with any large class, whether face-to-face or online, some students often are hesitant to contribute. Students who may have limited “keyboarding” skills often have difficulty in participating in synchronous online discussion where keyboarding is the primary method of communication. Therefore, keeping groups small will assist these students with limited keyboarding skills to participate.

Establishing meeting times that are convenient for all members is important in helping to ensure that all group members feel a part of the process. Often group members may be inadvertently excluded from the activity due to scheduling issues. This is particularly true of face-to-face meetings or synchronous Internet meetings such as online chat discussions. The use of bulletin board postings, threaded discussion, and e-mail have been shown to be effective in helping to overcome time issues in an asynchronous learning environment.

As collaborative activities are planned for distributed learning environments, it is important for the students to understand the various aspects of asynchronous or synchronous activities. Web-based synchronous conferencing tools are offering exciting and new possibilities for enhancing distributed learning activities within technology education. The facilitator of the online discussion should be aware of student abilities and make accommodations for input based on the flow of the discussion. Often in a Web-based discussion, participants may have trouble following the pace of the discussion. Again, it may be the responsibility of the facilitator to guide the discussion to allow for the most effective feedback. Many Web-based conferencing tools provide for recording or log of the discussion, which allows for students and teachers to refer back to the conference and review the discussion. This allows for more in-depth tracking of the discussion as well as allowing the teacher to assess student participation in the discussion.

Designing assessment of student performance for any distributed learning collaboration activity is an important element of the project. It is important to tie the assessment to the objectives of the course and student expectations. Grading rubrics have been found to be an important and valuable tool for assessing student performance (Havice, Havice, & Isbell, 2000). Rubrics offer specific criteria whereby student expectations can be presented and measured. Rubrics are also an effective means to use a common spreadsheet template that all students and teachers can use that will automatically compile scores. The spreadsheet can then be e-mailed as

an attachment to other participants and to the instructor for self and peer evaluations. Requiring students to become involved in the assessment process both as a self evaluator and as a peer evaluator is an important learning component of the activity.

## **DEVELOPMENT OF AN EFFECTIVE COLLABORATION ACTIVITY**

The *development* phase of the ADDIE model provides the opportunity to finalize the planning prior to implementation. The details of the activity are written up and shared with all the participants for review. This phase can also include a small pilot of the activity to ensure that everyone is able to use the technology and that the technology to be used during the activity is working effectively.

The development phase also allows for reviewing content, session plans and schedules for discussion groups ensuring that all participants will be able to participate. Often scheduling for a common discussion time is one of the most difficult aspects of online distance conferencing activity. Even though the conference session may be scheduled as a part of the regular class time, it is unlikely that all of the participants will be in the same class at the same time. If all participants have computer access, scheduling of conferences may take place during times outside of the school schedule. Students who may not have a computer or computer access at home may be encouraged to use computers at their local library or other technology resource centers. However, for a successful virtual conference session, it is important that all members of the group make every effort to participate in the activity.

## **IMPLEMENTING AN EFFECTIVE COLLABORATION ACTIVITY**

The *implementation* stage of the project involves introducing the students to the project through a thorough orientation to the activity. The orientation may include an overview of Web etiquette and introduction of Web-based conferencing through the use of a tutorial. The orientation would also be an important time and opportunity to provide students with instruction for collaboration and the various aspects of working effectively in teams.



Prior to the actual virtual activity, teachers will often have students post digital photos and short bios as a means to introduce themselves to each other. However, caution should be taken posting photos and bios as this may be an issue with students under the age of eighteen. Even if posting of photos and bios is not an option, students should be encouraged during the online conferencing to exchange information about themselves to build trust and respect prior to the collaboration activity.

Throughout the activity, teachers should maintain contact and interaction with each of the groups. If the teacher is not able to actually participate in the discussion group, then a regular review of the recorded sessions is essential in maintaining direction of the discussion. It may be necessary for the instructor to play a more active role in the discussion or at times to shift members of one group to another. As pointed out in the 21st Century Teachers Network project, members of excellent collaborative groups were moved into groups that needed members who could more effectively demonstrate the use of the virtual conferencing (Reinhart, Anderson, & Slowinski, 2000).

Whether collaboration activities are used in the classroom or for distance programs, the Internet has proven to be an extremely valuable tool in support of, and enhancing the effectiveness of these types of activities. The most commonly used Internet tools include e-mail, Web-based chat, discussion boards, automatic survey generation, document sharing and Web cam. The use of e-mail continues to grow and has become a popular and regular means of written communication for most people. Several studies have shown that the use of e-mail has enhanced the effectiveness of collaboration by enhancing networking opportunities, promoting teamwork, and contributing to the continuing education of professionals (Davis & Resta, 2002). In a study examining the influence of using electronic mail to support novice teachers, Davis & Resta (2002) found that electronic collaborations provide an effective method of supporting novice teachers in their research efforts.

The use of e-mail continues to grow and has become a popular and regular means of written communication for most people. Within a distributed learning environment, whether in a traditional classroom or distance program, e-mail has become an invaluable communication tool. It has become the primary tool of choice for communication between parents and teachers, teachers and students, teachers and administrators and

so forth. Electronic mail provides communication that is available 24 hours a day, 7 days a week, and 365 days a year. With the availability to share files, e-mail has become an even more useful tool for education. In providing collaboration support, e-mail allows individuals and groups, whether on the same school campus or whether separated by hundreds of miles the opportunity to share information almost instantaneously. Electronic-mail has proven to be a very effective and successful tool for enhancing collaboration in the classroom and has opened up a new world of communication between students and teachers around the world, allowing students to share ideas and projects with other students (Dyrli, 1995).

The Internet has allowed for an almost instantaneous sharing of ideas among individuals as well as large groups. The use of list serves enables individuals or large groups to share documents and other information over a broad geographical area in a matter of seconds. However, as with any means of communication it is important that participants use and practice proper etiquette and respect with the use of e-mail. The use of Web-based chats has also opened up new avenues for distributed learning in the technology education classroom. It is not uncommon for students to conduct chat discussions in large groups at any time of day or night. However, studies have shown that the effectiveness of groups or teams depend upon several factors that include size of the group, membership diversity and group design (Guzzo, 1996).

Galupe, et al. (1992) found that large groups generated more unique and quality ideas as well as members feeling more satisfied with electronic vs. verbal brainstorming. Furthermore, I have witnessed that the most effective chat sessions are those that have 3–5 participants. As with a conference call, the larger number of participants allows for limited discussions. Smaller group size seems to provide more valuable discussion.

In a collaboration activity, the Web-based chat can be a very valuable tool. The Web-based chat allows participants to be geographically separated and still contribute to the activity. To be an effective tool in distributed learning, the planning and timing of the chat discussion is essential. Without proper planning and an agenda, participants in a chat session may stray off of the topic. It is also important to have a facilitator to ensure that the group stays on task. The facilitator's role is not only to make sure the agenda is followed, but also to expand and clarify any questions that

arise. It is important the facilitator be an active member of the collaboration team.

As effective as the Web-based chat can be in technology education, the Web-based chat discussion also has its weaknesses. With chat discussions it is important that participants have strong keyboarding skills. Otherwise participants may feel left out and begin to withdraw from the group.

The strength of any type of collaborative activity relies on the building of ideas from all the individuals involved. In detailing the online Master of Arts in Career and Technical Education at Ball State University, Flowers & Cotton (2003) noted that advantages to the online program were improved communication among students and between students and faculty. Often the improved communication in the online program encouraged expanded discussion beyond what would normally take place in a traditional classroom. It was also noted "online interaction seemed to be more equitable encouraging students who might be relatively quiet in a face to face class to participate more frequently" (Flowers & Cotton, 2003 pg. 23). It is also important that the Web based chat be used on a regular basis when applicable for the activity. It is obvious that the more comfortable individuals feel with the use of technology in any form the more productive and effective they will be. "In other words, given technology availability and requisite skills and knowledge to use it, performance may not occur without positive attitudes about computers, particularly high computer self-efficacy and low computer anxiety" (Rovai, 2002, pg. 1). This is true with the use of Web-based communication as well.

Another Web-based tool that has become valuable for supporting collaboration within the distributed learning environment is threaded discussion. Basically, threaded discussion is often referred to as a discussion board, bulletin board depending upon the Web-management program that is used. The basic premise is that a topic or question is posted soliciting responses from anyone who has access to that board. Participants may respond to the topic or question at anytime and may also respond to other responses within the board. The threaded discussion is an excellent tool to gain feedback from the group and allows those who may not have strong keyboarding skills to spend more time generating responses. Threaded asynchronous discussion also allows more time for editing and accuracy of responses than an open synchronous chat discussion. However, often the larger number of responses to a threaded discussion question may dis-

courage students from reading through all of the responses.

The use of automatic survey generation tools is becoming more common for use in the distributed learning environment to gain valuable information as to how groups and individuals may feel toward a particular issue. Survey tools are basically an expansion of the online testing tools that are commonly used in Web-based course management programs. Utilizing survey tools, participants can create questions based on current discussion content and receive almost immediate responses. The results of the survey can be reported almost instantaneous giving statistical analysis of the data to the group or facilitator. Based on the feedback from the survey, discussion may take a different direction or may continue on the same path.

## **EVALUATING A COLLABORATIVE LEARNING ACTIVITY**

One of the most important aspects of the ADDIE model is the evaluation component, which should be built into, and planned prior to the implementation of the activity. As with any evaluation plan, the main focus should be on the improvement of the project. It is important to assess the effectiveness of the overall project as it relates to the goals and objectives of the course and the project itself. It is necessary to measure the success of the project throughout in order to make necessary adjustments to ensure success.

In order to improve the use of collaborative activities in future learning situations it is extremely important to plan for evaluating the activities both during and after the activities have taken place. Not only is a summative evaluation critical to the project in helping to plan for future activities, it is important for formative evaluation to be built into the project as well. Most important is whether the activity has helped to achieve the goals and objectives of the curriculum.

Evaluation of collaborative activities could involve several evaluation methods. Observation of the process and of the participants is one of the most common, and as a structured form of evaluation, can be one of the most effective. As with the activity itself, it is essential that the evaluation process be thoroughly planned. Use of observation may range from informal note taking to development of an observation check sheet that will

provide more uniform and detailed data. An observation check sheet is recommended if the collaborative activities are going to be used as a regular component of the curriculum.

Questioning and interviewing of participants can also provide effective and valuable feedback in evaluating the activity. It is important that students do not feel threatened or intimidated by the types of questions in order to gain honest feedback. An evaluation sheet given to the participants during and after the activity could provide information for improving on the effectiveness of the activity. It is also important to plan for the timing of the evaluation to gain the most effective information. Evaluating too early in the activity or waiting too long after the activity may not provide the information that may be the most useful. However, use of pre and post evaluation instruments can provide valuable information related to the success or failure of the program.

## **SUMMARY**

Cooperative and group interaction within the distributed learning environment continues to offer exciting and effective educational opportunities for the technology education classroom. However, it is important that to achieve the results from these types of activities, structured planning and evaluation is essential to the success of any program.

## **DISCUSSION QUESTIONS**

1. How can collaboration among students be used to enhance problem solving in the classroom?
2. What evaluation techniques could be used in evaluating a distributed learning activity where students are involved in both synchronous and asynchronous activities?
3. How do the Delphi and Nominal Group techniques differ?
4. How can the ADDIE model be useful in developing a distributed learning environment?
5. What are the advantages and disadvantages of using asynchronous activities over synchronous activities in a distributed learning activity?

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# New Ventures in Technology Teacher Certification: Perspectives and Strategies

## Chapter 8

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Wally S. Holmes Bouchillon  
University of West Florida

Don Mugan  
Valley City State University

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### **INTRODUCTION**

For the past decade or more it has been clear that the number of technology teacher education graduates has been declining nationally as well as the number of programs offering preparation in technology education. Improvements in communications technology in a similar period and more recently the rise of the Internet have caused a dramatic increase in the number of courses and programs offered online by universities. However, technology education poses numerous challenges not easily addressed through distance or distributed learning programs. These challenges as well as the needs of a rural state such as North Dakota and an urban state such as Florida will be discussed by the authors as well as the mentorship and collaboration under development designed to address these needs and challenges.

### **TECHNOLOGY TEACHER EDUCATION IN NORTH DAKOTA**

North Dakota is a state with a small and declining population. In the mid eighties there were approximately 200 technology teachers. In the mid nineties, the number had dropped to 140. Today, there are 119, and of these, 22 are provisionally certified. It became clear by the late nineties that technology education, as we know it would cease to exist in the state, not due to population decline, but due to lack of teachers. Small size has many disadvantages, but there are advantages as well. One advantage is the numerous working relationships among state agencies, higher education

and the K–12 community; often key members are on a first name basis. When consensus is reached, action often follows. Another advantage is that technology education has been given strong leadership and support by the State Board for Career and Technical Education (CTE). This leadership includes the funding of a fulltime technology education supervisor and a budget to support curriculum initiatives at both the state and local level.

### *North Dakota's Response to the Challenge*

In 1997, the technology education supervisor met with university representatives to discuss what could be done to address the problem. While the combined teacher production of the two university programs in the state could theoretically meet the demand, graduates were attracted elsewhere. With an aging teacher workforce approaching 60% retirement eligibility over a 3-year period, the need was not likely to be met. The key to a solution appeared to be program accessibility. School administrators had little difficulty attracting the interest of community members and other teachers in filling positions, but an accessible program was not available to enable willing individuals to become qualified. In addition, state law prohibits student teaching while teaching under emergency or provisional certification. This meant that even if an accessible technology education program were developed, candidates would have to leave their teaching job and student teach, elsewhere usually, since most small schools do not have a technology teacher qualified to act as a student teaching supervisor. So, the problem of accessibility was not limited to program accessibility, but professional preparation as well. The State CTE Board offered support to the universities in every way possible to develop a solution to the problem. In addition, CTE offered to work with the certification board to jointly address professional preparation and to jointly seek funding to establish a clinical practice program that would enable support for all provisionally certified teachers.

Valley City State University (VCSU) was motivated to seriously consider the CTE Board's offer of assistance for a variety of reasons. One reason was that the Industrial Technology program and the Technology Education program had been allowed to decline to the point that neither was financially viable. The informal partnership offer might permit program revitalization and avoid program closure. A second reason was that

VCSU was given a mission by the university system in 1990 to exercise a leadership role in enhancing the teaching and learning process through technology. Major initiatives already underway included universal computer access through notebook computers, universal digital portfolio assessment, faculty development and a K–12 technology service and support organization. Development of a truly accessible program might be a way for the university to push the envelope of its mission of technology mediated instruction, develop faculty expertise and position itself to make other programs accessible. Other factors which encouraged the university to move forward were the *Technology for All Americans Project* (TfAAP) and the Center for the Advancement of Teaching Technology and Science (CATTS) as these efforts provided a level of consensus and support not seen previously. The negative side of the balance sheet was that development of an accessible program would be expensive and the North Dakota potential market was much too small to justify the expense of a completely new program and delivery system.

### The Program at VCSU

With assurances of support and assistance with identifying consultants, VCSU decided to seek funding to create a solution to the problem. The funding would be used to create an infrastructure in support of online learning, develop faculty and staff expertise and create a complete online program in technology education. A \$1.7 million Title III institutional improvement grant from the Department of Education was received in the fall of 1998. Some early realizations and decisions that were made during the writing phase of the grant proposal or soon after included the following:

We must:

1. Model the curriculum we wish our graduates to create;
2. Involve the staff of TfAAP as soon as possible and place the *Standards for Technological Literacy* as highest priority in the mix of tradeoffs;
3. Involve and be involved in curriculum efforts at the national level (CATTS);
4. Involve the best K–12 teachers in curriculum decisions;
5. Provide the maximum support for online learners through use of many methods and technologies;

6. Emphasize elementary technology much more than in the past, as the *Standards for Technological Literacy* are K–12 in scope; technological literacy efforts must begin early;
7. Involve experts in e-learning as soon as possible;
8. Model the learning environment we wish our graduates to create;
9. Build laboratory experiences around design challenges and emphasize materials and equipment practical for the K–12 environment;
10. Build a comprehensive assessment plan to minimize risk, enhance quality and ensure accreditation;
11. Emphasize continuous improvement;
12. Provide a mechanism for learners to document their learning and safety experiences;
13. Integrate content and methods in courses;
14. Create partnerships as needed to provide desired program character; and
15. Market the program vigorously and involve university partners as needed in the growing distributed learning environment.

The above decisions have served us well, even though they were made without the assistance of resources now available such as the 51st and 52nd CTTE yearbooks on standards and strategies and subsequent resources from TfAPP and CATTs. The recommendations of the summary chapter of the 51st CTTE yearbook (Dugger, Ritz and Israel, 2002, pp. 240–44) bear repeating:

1. Orient technology education faculty to *Standards for Technological Literacy*;
2. Work to gain consensus on *Standards for Technological Literacy* by the faculty;
3. Convert the technology teacher education program to be based on *Standards for Technological Literacy*;
4. Gain college/university support of the new technology teacher education program;
5. Implement the new program;
6. Recruit new majors;

7. Market this new program to key stakeholders;
8. Evaluate the program; and
9. Revise on a regular basis.

By starting over with a completely new curriculum and delivery system, the above recommendations were for us almost unavoidable. They were not easy to accomplish, but worth every effort. This “cold turkey” approach is not for everyone. However, if one is considering a program accessible through distributed learning, the constraints imposed by the various mediums as well as time and place will force many changes, some quite dramatic.

## THE CHALLENGES OF DISTRIBUTED LEARNING ENVIRONMENTS

It may be worth pointing out the distinction between distance and distributed learning. (Oblinger, Barone, and Hawkins, 2001, p.1)

*Distance learning* is a subset of distributed learning, focusing on students who may be separated in time and space from their peers and the instructor. *Distributed learning* can occur either on or off campus, providing students with greater flexibility and eliminating time as a barrier to learning. A common feature of both distance and distributed learning is technology. Regardless of whether students are on campus or online, there are many implications of integrating technology into education, i.e., in making learning distributed. As a result, much of our discussion focuses on the broader issue of distributed learning. Distance education and on-campus instruction are converging, with online delivery systems and approaches being employed for distant, commuting, and residential students. This convergence of “clicks and mortar” in the form of technology-mediated education is distributed learning.

The challenges of distributed learning are many, and much can be learned from the literature before attempting to engage in a distributed learning or distance learning endeavor. However, the environment is changing so rapidly there is simply no guarantee of success. Furthermore, few disciplines share the many difficulties associated with delivery of laboratory instruction. As a result, few involved in distributed learning can

provide advice of value for technology educators. Following are some observations from experiences over the past six years as VCSU began the process of simultaneously creating a new curriculum based on the *Standards for Technology Literacy*, and designing a distributed learning environment. To begin, one should not underestimate the overhead required to administer a distributed learning environment. There are many dimensions to these costs, for example time spent evaluating transcripts for students who “swirl”, that is students who take classes at many universities, often several at the same time (Johnstone, Ewell, and Paulson, 2002, p.3). Adult student populations have many distractions in their lives and must often be re-recruited each semester. Another cost is time spent trying to adapt policies and systems designed for traditional instruction to meet the needs of online students. This will be a problem until such time as these students are a majority or a very sizeable minority. Because few disciplines have to contend with the development costs of delivering laboratory instruction at a distance, many administrators underestimate these development costs as well. Accrediting agencies are struggling to adapt to distributed learning environments in the same way institutions are struggling, and these relationships represent additional time investment. (Eaton, 2002)

Perhaps the greatest question in many minds is: “Can universities deliver technical laboratory courses through a virtual means? Safety and liability issues and access to equipment and materials continue to be factors that keep most universities away from teaching these courses in a virtual environment” (Ritz & Copeland, 2002, p.136).

As noted above, by Oblinger, et al., “this convergence of ‘clicks and mortar’ in the form of technology-mediated education is distributed learning”. Signs of this convergence are everywhere, and students are more and more demanding convenience of time and place, regardless of the effort and expense required to make convergence happen. It seems unlikely that any such convergence could happen in a traditional setting in which technical courses are drawn from a variety of disciplines, the “imbedded model”. However, if all courses are redesigned from the ground up, methods and technologies can be deployed, altered and combined to meet almost any purpose. Following are a few of the many methods and technologies that are currently being utilized to deliver laboratory instruction effectively:

- Saturday workshops;
- Summer workshops;
- Prepackaged materials kits;
- Online instruction through course management software and email;
- Remote general purpose laboratories in schools and universities;
- Trained remote lab facilitators;
- IP video conferencing demonstrations and support for lab facilitators and students (h.323 standard);
- One-on-one video conferencing and demonstrations including remote control and sharing of computer applications (Microsoft NetMeeting, ophoneX Mac, and others);
- Video streaming;
- Remote monitoring and control of experiments (LabVIEW, Robolab);
- Portal access to electronic library;
- Key server software access;
- Digital portfolio documentation and assessment;
- and more.

The upfront investment in all this is considerable, and cannot be accomplished without faculty totally committed to implementing the *Standards for Technology Literacy*, and serving the needs of students.

## **DISTRIBUTED LEARNING ENVIRONMENT PARTNERSHIPS**

There are compelling reasons to engage in partnerships. Most traditional institutions simply do not possess all the expertise to function without help in a distributed learning environment. Secondly, many ventures simply do not make financial sense based on investment versus return. Through partnerships institutions can also complement one another's skill set and balance risk. Partnerships involving an instate university may be the only way to meet teacher certification requirements in a given state. Recently EDUCAUSE and the American Council on Education Center for Policy Analysis joined forces to produce a series of six documents on distributed learning. In the fifth document in the series on partnerships, the

keys to success as well as roadblocks were identified (Katz, Ferrara, and Napier, 2002).

The keys to any successful partnership can be boiled down to five essential principles:

1. The partnership is a top priority for all entities involved in it;
2. All partners recognize speed (in decision making, in action, and in market delivery) as a core value;
3. The partnership agreement incorporates and memorializes elements that originate from the different partners. The agreement truly captures the consensus of the partners and serves as a touchstone for numerous downstream implementation decisions and actions;
4. Personnel are well-prepared, and membership in the core project team is stable. Customer and employee impact drive decision making; and
5. Efforts to integrate operations, marketing, and processes are aligned with the broader partnership intentions, expectations, and motivations.

Roadblocks to successful partnerships include:

- **Loss of champions.** When a dynamic leader moves on, a partnership can be left floundering without vision or energy. Eventually, inertia gets the best of it. Higher education institutions need to have strong people in place who can assume the mantle of leadership should a champion move on;
- **Disagreement over the distribution of returns (or losses).** Assuming a distributed learning partnership is successful, the allocation of assets that the partnership returns is a potential sticking point. Assets from these partnerships will include not only financial profits, but also intellectual property. Rights to returns need to be explicitly defined as the contract is negotiated;
- **Inadequate financial due diligence.** The U.S. economy began a notable downturn in 2000, mowing down countless high-flying dot.com darlings in its wake. Partners of these casualties often were left with nothing to show for their significant investments. Institutions need to scrutinize the viability of their potential partners or risk being left holding the bag if a partner goes out of business;
- **Clash of organizational cultures.** Failure results when organizations are not truthful about their tolerance of each other's differences. If part-



ners cannot smooth over disagreements based on organizational style, real animosity can develop and eventually derail the whole partnership;

- **Clash of leadership vision and style.** When two distinctly different organizations are brought together on equal footing to work toward a common objective, clashes between the leaders of those organizations are bound to occur. Egos come into play, and the situation can be aggravated when the leaders have different styles. Particularly in a university culture, in which one dissenting voice may carry significant weight, a clash between individuals may spell doom for a partnership. Clarifying roles and responsibilities at the onset of a partnership will mitigate this risk;
- **Inadequate information technology infrastructure.** It is not clear which technology will emerge as the most successful solution for implementing distributed learning, so a number of organizations are avoiding reliance on any single technological solution. We recommend a flexible architecture built on current products. However, the real issue is how well information and services are integrated from the consumer's viewpoint, not the nature of the underlying technologies themselves. The ability to maintain programmatic coherence in the face of rapid technological development is essential;
- **Operational integration failures.** A distributed learning partnership will comprise many elements contributed by different partners and suppliers. Failure to integrate these discrete components into a cohesive, seamless, and transparent operation will result in the initiative's failure;
- **Shift in strategic direction.** Changes in strategic intention or scope will derail all but the most nimble of partners. Because so much of a partnership's success depends on laying elaborate groundwork, sudden shifts in direction are unlikely to succeed; and
- **Staff retention/morale.** The people who manage the day-to-day aspects of a partnership will, to a large extent, determine its success. These are the people who run the systems that keep the program operational, who design and teach the curriculum, and who provide student services. Ongoing communication about changes in the program and their impact on staff is crucial for ensuring that these key personnel not only remain at the institution, but also stay committed to its distributed learning.

After work on several partnerships, we have accumulated some practical experience. One recommendation is: be patient. Very little happens quickly in higher education, the culture is not suited for rapid change, at least at the present. When two institutions partner, the cultures may be different, requiring time for more change. In addition, there may be many offices involved, and many staff members and even organizations beyond the campus proper that will have to modify procedures to accommodate the partnership. This takes time. The legal staffs of partner institutions may know the law, but likely have little experience in making partnerships work. In addition, campus lawyers may not see the need to rush. Be prepared to exercise due diligence as practiced in business, because it is likely no one in the organization is positioned to do it for you. Educators must try to move out of their comfort zone, and think of a potential partnership as a business with a plan complete with exit strategy. A final suggestion is to get to know potential partners well enough to be very comfortable. Trust is a great asset when discussing the many issues that will arise.

## **TECHNOLOGY TEACHER EDUCATION IN FLORIDA**

For the past 11 years, technology education has been on the critical shortage teacher certification list in Florida. Most of the universities that offered technology education programs in the past, have allowed their programs to become inactive. Low enrollment, faculty retirement, and the lack of need for teachers in the university service area have been identified as reasons for program elimination. University service area had previously been defined as an approximate radius of 150 miles from the main campus of a university. With the advent of distributed learning environments, the distance a course or program is offered from a university is no longer an issue.

### *Florida's Certification Challenges*

Certification rules in Florida have changed during the last two years. Therefore, the initial collaborative agreement with VCSU has had to be revised. Alternative certification in Florida currently allows a person with a bachelor's degree to take and pass the technology education subject area test to become eligible for certification without content coursework. In

technology education, the legal and safety risks associated with hiring an unqualified teacher for the technology education classroom are present. In 2002, there were 245 openings in technology education statewide. Most of these openings resulted in closing programs rather than risking putting unqualified and uncertified individuals in the classrooms. Implementation of the University of West Florida (UWF) program will help to keep many of the programs open that may otherwise be closed for lack of a certified and qualified instructor.

When looking at the need for technology education teachers in Florida, one needs only look at the numbers. From 2000 to 2002, technology education programs and student enrollments have vastly fluctuated. Table 1 provides data from the Florida Division of Workforce Education which describes the changes through 2002.

Table 1. Technology Education Programs and Student Enrollments in Florida: 2000–2002

Year	2000	2001	2002
Middle School Participants	162,861	177,086	173,086
Middle School Programs	998	950	986
High School Participants	65,987	62,800	59,277
High School Programs	861	719	703

In 2002, the UWF's Career and Technical Education (CTE) advisory committee charged the faculty and administration at UWF to establish a technical education program to address the teacher certification shortage in technology education for the northwest region of Florida. The advisory committee cited faculty retirement, new programs, and increased middle school and high school enrollments in their districts as reasons to again offer a technology teacher education program. Since 2002, the career and technical teacher education courses offered at UWF have utilized a distributed learning environment. The program has grown from a regional to

a state service area for initial teacher certification since the online format has been implemented.

## **VCSU AND UWF INITIAL PARTNERSHIP PLAN**

Initially, the UWF advisory committee could not envision an online teacher certification program for technology education. However in the spring of 2002, the state supervisor for technology education attended a special interest session at the ITEA conference in Columbus, Ohio, a professional conference sponsored by the International Technology Education Association (ITEA). She met the chairperson of technology teacher education at Valley City State University (VCSU) in Valley City, North Dakota. The VCSU program was the first online technology teacher education program to achieve NCATE certification as well as certification as an online program by the North Central Association of the Higher Learning Commission. The program was designed from the ground up to address the *Standards for Technological Literacy* (STL) published by ITEA and meets the requirements of ITEA for a standards driven curriculum based on the international standards for technology education. After meeting with the state supervisor advisor and the chairperson of VCSU's program, UWF's advisory committee conceded that an online program was appropriate and was worth investigating. UWF's career and technical education faculty wrote a mini-proposal and submitted the proposal to administrators. The proposal requested permission to pursue a collaborative agreement with VCSU to offer their program at the University of West Florida.

After the initial presentation about the VCSU program, several teleconferences occurred. In the summer of 2002, the chairperson of technology education visited UWF and presented information on the technology teacher education program at VCSU. Faculty who would be in charge of implementation of the program met with the team of faculty from VCSU at the 2003 ITEA conference. The teams discussed implementation details and various cost factors. VCSU faculty members again visited UWF in the summer of 2003 to provide training for the various technology projects that would be completed during the initial year of course implementation. The visiting VCSU faculty also provided selected equipment and materials to ensure the technology education laboratory was equipped with the appropriate equipment and materials.

### Key Elements of the Partnership Plan

The UWF agreement with VCSU outlined several aspects of the collaborative program. It included beginning with a cohort group 12–15 of bachelor and/or master degree seeking students. The technology education students were expected to enroll in 6 semester hours per semester for up to 6 consecutive semesters to complete the 36 semester hours of content courses in technology education. In the 36 semester hours, elementary education, middle level, and secondary education courses were included.

*The Standards for Technological Literacy* (STL) are K–12 in scope and are integrated into the courses in this program. The technology education courses could be counted as an area of specialization in the career and technical education degree. UWF would lease the courses from VCSU, and the courses would be taught by VCSU technology education faculty at the agreed upon rate per student enrollee. A laboratory component would be required in which the student had the option of coming to UWF for up to 4 Saturdays per semester for technical assistance and guidance on all related projects for the course. The Saturday sessions would be conducted in a distance learning classroom on campus and in the Technology Education Laboratory. A current career and technical education faculty member would be assigned as oversight person for this program. The faculty member would work with VCSU on implementation and growth of the program. The teacher education division chair would be the direct supervisor for the new technology teacher education program. UWF would provide a half time coordinator for the program or release time for a faculty member. The coordinator's responsibilities would include marketing, troubleshooting, student recruitment and advisement, co-supervision of Saturday laboratory sessions with a VCSU trained facilitator and data collection for evaluation and improvement of the program. Trained technology education lab facilitators would be hired as needed.

In the "partnership plan" the expenses for delivery of this program would be recovered through a Continuing Education Pilot model in which student fees are based on the cost of tuition and materials fees paid to VCSU plus 15 percent. The 15 percent would be used for further investment in the technology teacher education program's expansion and development of a future budget for travel, scholarships, equipment, resources, consultants, and evaluation.

None of the planning team members involved in the partnership plan anticipated the roadblock that would assail the partnership. In the summer of 2004, changes in administrative leadership at UWF revamped all continuing education initiatives and policies. In doing so, they closed the door to the partnership that had been planned with VCSU. After reflecting on the severe blow to the progress of the planned technology education program, both VCSU and UWF had to take another look at how we could continue to work together to provide teachers for the field of technology education.

### *VCSU as UWF Mentor*

The relationship of VCSU and UWF has changed from one of partnership to one of mentorship in designing a stand alone technology education program. The program at UWF will model many of the best practices of the VCSU program. The program will be offered in the distributed learning environment model. The management format for UWF will be Desire2Learn (D2L). D2L is the course management system adopted by UWF for the Web-based learning environment. The program will be based on the *Standards for Technological Literacy*. The technology program will include 36 semester hours with selected techniques and learning strategies recognized by ITEA incorporated into the content areas. The UWF program will also have optional laboratory class days to solve technology challenges that are presented during the semester. Some of the differences between the partnership and mentorship include: designing our own courses; hiring our own instructors; and some limitations in distance interaction with VCSU's courses.

UWF will follow as many of the initial decisions that VCSU made in designing their curriculum as possible. UWF will continue to involve VCSU in an advisory role and seek additional funding to secure the formal continuation of a partnership.

The state director of technology education has committed to supporting the promotion of an online technology education program at UWF modeled after VCSU's technology education program. Upon examination of the coursework, she felt it reflected the full spectrum of information age technologies.

The components that will transition to UWF will include those components that VCSU found most effective. The portion of the curriculum

that would typically be lecture is to be delivered online in a D2L course container environment. Unit reading assignments, online Web Quest research assignments, and online discussions will form the basis of most course material. Special methods of teaching and learning strategies will be integrated throughout the curriculum. Technological career areas and opportunities for students will also be embedded in the various courses.

Laboratory instruction for distance learners was a serious challenge to VCSU, but the VCSU faculty found ways to make it effective. For example, many of the VCSU students are emergency certified teachers and can function with a minimum level of support since they have a lab facility available. VCSU has been very innovative in providing the level of support required for even an elementary teacher working at home on the kitchen table to be successful. UWF faculty anticipates many of the same types of challenges.

The technology education program at VCSU combines a low and high tech environment that provides the practical application of reality based education through project based learning activities. The curriculum incorporates technology and science standards into the activities in the classroom. The program provides students with the answers to “Why do I have to learn this?” that apply across the curriculum. The UWF program will follow the model that has been developed by VCSU. The VCSU/UWF model stresses design and problem solving abilities and provides to the student career awareness and information about a wide variety of technology related careers and non-traditional opportunities.

## **SUMMARY**

At a time when programs are downsizing and restructuring themselves, technology education via online Web-based instruction is a relatively new way to deliver teacher education. The VCSU technology teacher education design requires forward thinking and a new vision for teaching and learning. It also requires a commitment to continuous exploration of technologies available for teaching and learning. Finally, the VCSU program requires teamwork, communications, innovative thinking, and belief that this program will work to deliver high quality instruction for future technology teachers. UWF plans to follow that vision and to be engaged as a team member in furthering the future of technology educators through partnerships or mentoring that is offered by VCSU.

## **DISCUSSION QUESTIONS**

1. Is distributed learning an option to increase the number of technology teachers in your area?
2. Is distributed learning an option to improve teacher in-service in your area?
3. Are there universities in your area that possess complementary skill sets with which a partnership would be beneficial?
4. Are there K–12 districts in your area that would be potential partners in creating remote laboratories with lab facilitators?



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# Lessons to Consider: Distance and Distributed Learning Environments from Student and Faculty Perspectives

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## Chapter 9

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Jim Flowers  
Ball State University

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### INTRODUCTION

This chapter examines students' and faculty's perspectives about distance learning and distributed learning environments. "Perspectives" are seen here to include self-reported beliefs, attitudes, opinions, and judgments, although these terms will be used somewhat interchangeably. The chapter begins with a look at attitudes toward distance learning and distributed learning environments in general, and conclude with what has been learned about attitudes toward distributed learning environments in technology education.

### PERCEPTIONS RESEARCH

With the recent growth of distributed learning environments and the relative ease of conducting opinion surveys, it is not surprising that there are many research studies that attempt to describe the attitudes of a sample of students, faculty, or administrators regarding distributed learning, or some aspect therein. To some, this attention on "perceptions research" may seem shallow: what the field needs is answers about what actually works, not vague reports about the preferences or perceptions of a select group of respondents from a particular distributed learning class. However, if distributed learning is to evolve as an increasingly effective means of instruction that is both learner-centered and instructor-friendly, then overlooking the attitudes, values, and beliefs of stakeholders clearly would be a mistake. Furthermore, perceptions research can uncover conflicting viewpoints of different stakeholder groups, as illustrated by Carnevale's (2000) findings:

When students rate the online courses, they look for some of the same things found in traditional courses—like a knowledgeable professor

who interacts with the students—plus additional features that help create a sense of community among those taking the course. But when administrators judge the quality of an online program, they look at either the number of students involved or the number of courses created . . . (§4–5).

Still, the reader is cautioned against using perceptions research alone to direct current efforts, as perceptions research may be subject to validity threats relating to: delays in reporting; changing perceptions; the difference between a reported perception and the true basis for individual action; often self-selected perception research samples containing individuals who likely feel differently than nonrespondents; and differences among perceptions of people in different fields, different geographical regions, different cultures, etc. For example, Nasser and Abouchdid (2000) noted a tendency among school directors and researchers in the West to promote the use of instructional technology, but they found a different perception among directors in Lebanon, marked by “an overriding caution [by] school directors who thought that education might keep teachers from performing their daily duties” (Discussion, ¶8). The variety of perceptions in particular makes it difficult to make sound instructional decisions based on a single generalization. As Peters (2001) cautions, “individual situations impact students’ perceptions of computer-based learning, and students’ individual characteristics make it difficult to define their perceptions conclusively” (§4). This is especially problematic if a distributed learning environment is designed based on rigid assumptions that characterize all learners in a single way. For example, one might require synchronous discussions in an online class, but “students who take an online course for its flexibility may dislike online chats or other synchronous activities that occur at fixed times” (Peters, 2001, *Factors that Influence Student Attitudes Toward Online Learning*, ¶2).

### *Attitudes Within Definitions*

Before examining perceptions of distributed learning environments by students and teachers, it should be noted that those who offer definitions or descriptions of these environments sometimes include their own beliefs about what the environments could or should be, rather than what they are. For example, Fleischman (1999) defines “distributed learning environment” in a way that stipulates a student-centered, rather than

instructor-centered approach: “an integrated approach to education combining interactive capabilities of networking and multimedia with learner-centered instruction” (¶1). Going even farther, Halliday (2002) synthesized definitions of “distributed learning environment” to characterize it in a necessarily positive way:

Distributed learning is an educational model that integrates characteristics of campus-based, open learning, distance education, and instructional support systems with appropriate technology and resources, in the development and delivery of flexible, customizable, high-quality, cost-effective curriculum and support methods that are interactive and learner centered in order to meet the diverse needs of learners. (p. 6)

Is it possible for learning that is not student-centered to occur in a distributed learning environment, or for distributed learning to ever be less than high-quality? Yes. Thus, in examining attitudes toward distributed learning environments, it may be invalid to begin by assuming the environment to be student-centered, customizable, or to necessarily have other positive or negative traits that only some distributed learning environments possess.

## **STAKEHOLDERS**

It may seem like a new framework to many in technology education, but much has been written about the design and creation of distributed learning environments by instructional designers and by teachers (Boger, 2001; Cholmsky, 2001; Havice and Chang, 2002), providing guidance on the selection of technology (Fleischman, 1999) and other instructional design decisions, even on such specifics as the use of images (Lockee, Moore, & Moore, 1999). Decisions regarding the design of these environments should be informed by the perspectives of critical stakeholders, and it is logical to conclude that the primary individuals within distributed learning environments are the students and the teachers.

However, the roles of individuals and the emphasis taken may be different than in traditional learning environments; Allison, Lawson, McKechnan and Ruddle (2001) suggest that the end users of distributed learning environments “fall into one of two major roles: student and tutor” (p. 33), not the student and teacher. In light of possibly new roles

and a different student-centered emphasis in many distributed learning environments, it seems increasingly important to consider the perspective of these two stakeholder groups on distributed learning environments, and more specifically, on the distance or distributed learning that occurs within these environments.

### Students' Perspectives

Gibson (2003) reminds us that “learners and learning are at the heart of the distance education enterprise” (p. 147). In this section, the literature on students’ perceptions will be discussed. It may not be best for a teacher or instructional designer to give students precisely what they want, or what they think they want, but it is wise to listen to students’ voices and to make distributed education responsive to their perceived needs and preferences.

Learners may be first drawn to distributed learning because of its perceived convenience and the flexibility in terms of both time commitments and geography (Flowers, 2001; Northrup, 2002). O’Malley and McCraw (1999) surveyed 128 college business students to determine their perceptions about online learning and found that students perceived asynchronous learning as having “a significant relative advantage to traditional methodologies” (Conclusions, ¶2), but these advantages have to do with convenience, flexibility, and other issues not directly related to learning outcomes. The same study uncovered more negative student beliefs regarding synchronous distributed learning, which were generally felt to be less effective than traditional instruction.

Peters (2001) contends that the shift in power from the face-to-face teacher to now online students influences those students’ satisfaction: “With online learning, students control when, where, and what they learn, as well as how often and how quickly—and this level of control is what creates satisfied students” (Conclusion, ¶1). Online students have been found to value self-regulated learning and timely feedback from an instructor (Northrup, 2002).

Are students’ perspectives linked to their characteristics? One train of thought is that the perceptions of a distributed learner toward a particular learning environment may be influenced by that individual’s goals, values, and abilities. A study of students in the Virtual School of Business (VBUS) at Teasek Polytechnic in Singapore found that:

Different user groups interacting with the system perceive the useful-



ness of the system differently. The more-hardworking students appear to leverage VBUS to their advantage and satisfaction, while the weaker students are not able to utilize fully the benefits of VBUS and may even find it burdensome (Peh & Foo, 2001, Conclusion, ¶1).

Student perceptions may be linked to their learning style preferences. In comparing learning style differences (specifically: cognitive processing habits) between online and face-to-face students, Aragon, Johnson and Shaik (2002) found that online students reported a significantly higher preference for abstract conceptualization, and for learning through reflective observations; in addition, face-to-face students had significantly higher preferences for learning through active experimentation, involving learning-by-doing. Although these differences were no longer found to be significant when controlling for success in the course, it does have implications for any field with a strong tradition of hands-on learning, as is the case with technology education. First, the general appeal of online education to teachers or learners in such a field may be less than to those in other fields. Second, instructional designers and educators in the field are challenged to provide distributed learning environments that make good use of learning-by-doing; meaningful, guided hands-on learning takes on a new meaning when the instructor's eyes and hands are in a different environment than the student's.

However, others have concluded that student characteristics are not closely tied to their level of satisfaction. One study (Thurmond, Wambach, Connors, and Frey, 2002) that controlled for student characteristics found that:

. . . specific student characteristics were not correlated with either the outcome or environmental variables. When students' input variables were controlled, the findings supported that the environmental variables were highly predictive of students' level of satisfaction. The results of this finding could indicate that the level of satisfaction with the course was due to what occurred in the Web-based classroom – and not because of the student characteristics (p. 185).

Two variables that may be related to a student's perception of distributed learning are the student's current setting (distributed or traditional education) and the student's prior distributed learning experience. An individual's perceptions about distributed education seem to evolve as their experience increases. Irani (2000) found that strength and certainty

of perspectives about distributed education increase with experience in distributed education, and for those with no direct experience, peer influences were critical to their likelihood of taking a distance education course. However, regarding setting, Cramer, Havice, and Havice (2002) found there to be no significant difference between the attitudes of trainees who were in a face-to-face setting and the attitudes of those who received instruction through audiographics (using Microsoft NetMeeting with voice over a speakerphone.) Dillon and Greene (2003) suggest that differences between traditional and distributed learners are beginning to blur, because “resident learners are being required to learn in much more independent environments than they have in the past” (p. 235).

Conrad (2002) looked at students in their first online course, specifically looking for strategies to lesson the initial anxiety felt by these students. She concluded that most of these students preferred to be able to access course materials weeks in advance so they could be adequately prepared for learning using this new mode of instruction. She also noted that learners seemed to feel engaged when they first encountered instructional materials, not when they first communicated with an instructor or with fellow learners. Similar research on instructors new to distributed education found anxiety to be common (Kanuka, Collett, and Caswell, 2002).

Research that attempts to uncover perceptions typically has narrow geographic and time frame parameters, and where student and faculty perceptions are involved, the context is often a single course or institution. Thus, a variety of possibly contradictory findings may emerge from the body of literature. Synthesizing this work, Allen, Bourhis, Burrell and Mabry (2002) performed a meta-analysis to compare student satisfaction between distributed learning and face-to-face classes in higher education. Although they found “a slight student preference for a traditional education format” (p. 83), “in general, the replacement of traditional face-to-face education with distance education technology should demonstrate little decline in student satisfaction with the quality of the educational process” (p. 92).

In one of the larger multi-class studies, Swan, Shea, Fredericksen, Pickett, Pelz, and Maher (2000) asked 3800 students in 264 courses to fill out opinion surveys, and evaluated 1108 returned surveys from distance education courses meeting their selection criteria. Students’ motivation for taking a course was found to affect their satisfaction and perceived

learning, but surprisingly, previous level of computer skills was not found to be a factor. They also found higher levels of satisfaction and higher levels of perceived learning were reported from students who also reported high perceived levels of interaction with their instructor and classmates, high levels of activity in their courses, greater consistency among course modules, and a greater percentage of the course grade based on discussion. But even though discussion was seen to accompany reports of greater learning, “the greater the percentage of the course grade that was based on cooperative or group work, the less students thought they learned from the course” (Correlations Between Course Design Features and Student Perceptions, ¶4). These findings can lead to recommendations for instruction. For example, an instructional designer may attempt to increase the levels of student activity, student-student interaction, and student-instructor interaction in order to effect a corresponding increase in both learning and student satisfaction.

While much of the recent literature regarding students’ perceptions of distributed learning environments involves online courses, it should be noted that other forms of distributed learning exist, and it is critical to evaluate student perceptions in these programs as well. Bisciglia and Monk-Turner (2002) compared student attitudes between face-to-face and distance-site teleconference settings through Old Dominion University’s Teletechnet system. Among their findings is the conclusion that “students who attend a class off campus and who work full time generally have a more positive attitude toward distance education when compared with on-site students” (p. 48). They found them to be more motivated, though less positive about grading.

Ory, Bullock, and Burnaska (1997) examined gender differences in attitudes about asynchronous learning networks, finding “few significant differences between genders” (p. 49). Notably, “there was no significant difference between male and female responses with both genders reporting positive experiences” (p. 45). This finding was disputed by the results of Swan, Shea, Fredericksen, Pickett, Pelz, and Maher (2000): “Women were more likely than men to be satisfied with the [distance] courses they took and to report higher levels of learning from them” (Relationships Among Survey Variables, ¶11). Bisciglia and Monk-Turner (2002) also found female students to be more positive about distance education than male students, and they suggest that in this case the finding may be due to

the technical nature of many of the classes in the sample, which may pose a problem for distance delivery and which may have higher proportions of male students. If males are generally less positive about distributed learning, a male-dominated field may find greater difficulties with acceptance of distributed learning environments, and technology education seems to be in this situation.

In examining students' perceptions of distributed learning environments, it is important to realize that the student is a critical part of their own learning environment. The freedom some of these environments offer learners regarding time and geographical flexibility may carry an extra burden on the learner to make more decisions, or to organize their learning – areas that may have been the task of a teacher in a traditional class. It is not surprising, therefore, that some learners express their own lack of interest, short attention span, or tendency to procrastinate as a disadvantage of distributed learning environments (Lim, 2002). Those designing distributed learning systems for institutions have been cognizant of the ability to impact that learning environment either by helping potential students select this option only if they feel it to be appropriate, or by helping those newly enrolled to change some of their less-effective personal habits, such as procrastination (e.g., Brigham Young University–Idaho, n.d.; Jamestown Community College, 2003; Nashville State Community College, n.d.).

## **PERCEPTIONS HELD BY FACULTY, ADMINISTRATORS, AND STAFF**

This author has worked as a Director of Online Education in a university department where eight faculty members put fifteen courses online as part of two online master's degrees. The variety of perceptions, attitudes, and experiences among faculty, and the change in perceptions seen with increasing experience provide caution for any generalization about faculty perceptions. Anxiety, fear and anticipation are just some of the emotions a faculty member might experience as they prepare to teach in a distributed learning environment. Some faculty exhibit great reluctance, while others bravely learn the new technology and pedagogy of their form of distributed learning.

Too often, faculty at any institution may have a tendency to repackage

their face-to-face instruction for a medium, such as the Internet, without an appreciation for both the advantages and limitations of that medium (“shovelware”). For a faculty member to rethink their course plans requires courage, open-mindedness, and resources. Providing sufficient resources may have positive impacts on faculty attitudes; in a study of faculty perceptions of instructional support for distance education, Lee (2001) concluded, “Faculty motivation and commitment were higher in the institutions with well-provided instructional support” (p. 153).

The increased time requirements alone (Yates, 2000) may make the task of teaching in a distributed learning environment seem daunting. Yet, many prevail. Stein (2001) suggests an institution’s intellectual property rights policies could be designed to encourage faculty members to invest the time and effort in the instructional development required for distributed learning.

Educators in a distributed learning environment may see their role differently than when in a face-to-face class. Easton (2003) looked at instructors’ roles in online courses. Among the themes that emerged were: alternative course management systems; virtual communication issues; a need to redefine class time; and reassessing one’s personal pedagogy. Kanuka, Collett and Caswell (2002) interviewed instructors who were using threaded (text) discussions in their classes, and analyzed the results for the views of an instructor’s role that emerged. Four distinct instructor roles were seen. The technical role included the productivity skills needed to effectively communicate in this Internet-mediated text-based environment, and the ability to model this for their students. A second role was managerial, including organizational skills, but with both flexibility and structure. A third role was social, involving the forging of trust and respect among online participants. A fourth role was pedagogical, and in this study, “one main theme emerged: feedback” (p. 162). This is surprising, since feedback is seen as more of a reactive than proactive task, and since pedagogy may be generally seen as the primary function of any teacher. One explanation could be that online instructors may need additional education in meaningful proactive online pedagogical techniques.

Research into teachers’ perspectives has uncovered perceived difficulties. Distributed learning environments often hinge on a system of educational technology, and Czerniak, Lumpe, Haney, and Beck (1999) studied attitudes of K–12 teachers toward the adoption of educational technology:

. . . it is becomingly increasingly clear that teachers’ attitudes towards

the reform and their perceptions of the presence of needed support structures and/or barriers to reform are strongly related to their intentions to implement these ideas. Specifically, teachers in this study share the belief that educational technology enhances student learning and that the integration of technology into their teaching is both desirable and needed. Yet, they do not perceive that sufficient support structures are in place to enable them to achieve the outlined technology education standards (Discussion, ¶1).

A more effective educational technology support structure may decrease this perceived barrier.

School administrators are key stakeholders in distributed learning environments. Husmann and Miller (2001) studied the perceptions of 26 distributed learning administrators using a three-round Delphi survey, and found that these administrators saw their job as facilitating the program, rather than owning the responsibility for a program's success, seeing quality to be directly related to faculty performance. In addition, they found the following perceptions among administrators to items using a 5-point Likert scale, ranging from "no agreement" (1) to "very high agreement" (5):

Administrators rated most strongly the need to provide additional support for faculty development of course materials (mean 4.615), make programmatic quality a high priority (mean 4.577), and being customer-focused by offering programs concentrated on potential client needs (mean 4.500). There was high agreement with providing a reward system which acknowledges faculty participation in distance education (mean 4.462), promoting the involvement of quality faculty who are enthusiastic about distance education (mean 4.423), and creating a reward system which allows for faculty to be involved in distance education (mean 4.308) (Husmann & Miller, 2001, Results, ¶3).

This corroborates the findings of Shea, Motiwalla, and Lewis (2001) whose survey of distance education administrators uncovered the perceived need for more staffing and technical support.

Distributed learning environments involve additional players other than the teachers, students, and administrators. With the rapid growth of distributed learning technologies, it is increasingly important to have the support of sufficient and competent technical staff to provide for the set up, maintenance, training, and troubleshooting of networks, course management software, computer hardware, and other technical aspects of dis-

tributed education. For example, in a study at the University of Texas (Cheurprakobkit, Hale, & Olson, 2002) technical staff surveyed overwhelmingly agreed that “the quality of education students receive in a Web-based course is just as good as that in the traditional classroom” (p. 250). While it is no surprise that this same group saw themselves as “well qualified and competent to provide a good level of technical support for the faculty” (p. 251), it is surprising that they seemed to be “more confident of the students’ basic competence than of the faculty members” (p. 251), though they believed the faculty’s computer skills to be more advanced than the students’. They also believed that support from the institution could be improved.

To summarize, the faculty want more help from the staff, the staff want more support from the institution, and the administrators place the responsibility on the faculty, with few attributing much empowerment to the distance student in shaping their learning environment. Still, the views from these stakeholders may not be as different one might guess. Dooley and Murphrey (2000) compared perceptions of various groups of university stakeholders in distance education, and concluded:

The perspectives of administrators, faculty and support units were not found to be dramatically different, in fact many of the perspectives were the same. While each group recognized the potential for DE, intervention strategies are necessary to alter how people perceive and react to distance education technologies. Through the eyes of an administrator, faculty member, or support employee, it is apparent that steps must be taken to increase the rate of adoption. The results of this study indicate three major areas that require consideration: 1) administrative support, 2) training, and 3) incentives (Summary, ¶2).

Ideally, distributed learning environments will evolve to better meet the needs of learners, while improving conditions for instructors and staff, and meeting the goals of administration.

## **PERSPECTIVES REGARDING K–12 DISTRIBUTED LEARNING**

Most recent studies of distributed learning environments target higher education. While some K–12 initiatives began within school districts, other inroads into K–12 distributed learning environments have been

made with assistance from higher education institutions. Clark (2003) reports that “Over 30 regionally accredited colleges and universities provided high schools courses via independent study in 2000–2001. . . . By 2001, at least five offered all essential courses in their high school diploma program online through a virtual school . . . .” (p. 673). Clark also notes that “the attitudes of parents and community members play an important role in determining K–12 student participation in distance and virtual learning” (p. 683). However, as he notes, the results of Rose and Gallup’s (2001) research seem to indicate that the public may not be ready to embrace Internet-based instruction at the K–12 level.

Downs and Moller (1999) looked at the attitudes of students, teachers, and administrators involved in secondary school distributed learning using two-way audio and video. They found:

- 1) according to participants, teacher’s characteristics are important in the success of distance education;
- 2) students believed that the lack of socializing with distance students had a negative effect on their ability to relate in class;
- 3) findings suggest that teenagers in particular may have difficulty in adjusting to the lack of privacy due to the ever-present microphones and television monitors (Abstract, ¶3).

A different characterization of perceptions of distributed learning environments emerged in Downs and Moller’s study than were seen in some studies of older distributed learning students, where the socialization issues involved may have been different.

Online K–12 teachers’ attitudes in Alberta were the subject of Muirhead’s (2000) dissertation:

Online teachers reported evolving professional responsibilities in authoring online courses, providing technological support to students and parents, and continually enhancing technological skills, while teaching full-time. Consequently, workloads were substantially increased. The complexity of the content development process, instructional design philosophies, content development tools, and rapid adoption of integrated online delivery tools created time pressures among teachers. Online education in Alberta is characterized by more extensive interaction with parents than in traditional classrooms (Abstract).

This seems in keeping with research on perspectives of higher education distance teachers, except for the contact with parents, which is missing in



post secondary education. Still, the reader is cautioned against applying the wealth of information about adult learners in distributed learning to K–12 distributed learning. Additional research on this sector is warranted as distributed learning becomes more prevalent.

## **TECHNOLOGY EDUCATION**

The field of technology education does not at first seem to be a good fit for distributed learning. It is typically characterized as action-based, hands-on, and often collaborative. Because it is commonly seen as a secondary school subject, and most secondary schools are face-to-face brick-and-mortar institutions, there seems little need to explore K–12 distributed learning in technology education. Ironically, there are numerous opportunities for both formal and informal distributed learning in technological subjects.

Undergraduate teacher education in technology education is charged with providing instruction that helps new teachers (who supervise students in laboratory settings). However, a survey of 91 post secondary institutions found that while 60% offered courses or degrees through distributed learning, only one offered a degree in technology education through distributed learning and this at the master's level (Ndahi and Ritz, 2002). Thus, distributed learning advocates are challenged with providing both substantive guided instruction in much hands-on manipulation of materials and tools, and in the validation of the competencies of teachers-in-training.

Burgess (2003) compared technology education majors to those from other majors in the same face-to-face Graphic Communications course. WebCT™ was gradually introduced to supplement face-to-face instruction, and for 94% of these undergraduates, it was their first experience with such a tool.

Technology education undergraduate majors had a strong positive response to the question of the usefulness of WebCT as a course tool. When considering reported technical problems with the software, technology education as a group had fewer problems than many other undergraduate majors. Additionally, technology education majors responded that they would enroll in a distance education course using only WebCT as their only contact with the instructor (pp. 12–13).

Although this study's sample was rather limited (i.e., 57 undergraduate students in 2 sections of a single class at a single institution), the author concluded that technology education students may be at a relative advantage regarding their willingness to use this and other tools typical of distributed learning environments:

technology education majors indicated their acceptance of this mode of information access in greater degrees than their classmates in other majors. It could be inferred that technology education majors are more willing than other student majors to embrace new or emerging electronic formatted text-based or graphics-enhanced media (Burgess, 2003, p. 13).

Graduate education in technology education, however, typically does not have as strong a hands-on component as either K–12 or undergraduate technology teacher education. Furthermore, K–12 students and undergraduates are typically full-time students, so residence near a school is not often as critical an issue as it may become after they have established families, jobs, and homes. Potential graduate students in technology education, on the other hand, may have full-time teaching jobs, homes, and families, all limiting their ability to relocate to pursue graduate studies, and making distributed learning more attractive. Yet, the intense studies and mentorship typical at the doctoral level may present more of a challenge to distributed learning providers than shorter master's level programs without these aspects. Thus, it is not surprising that a degree in technology education was first offered online at the master's level.

Prior to the complete online offering of a Master of Arts in Technology Education from Ball State University in the Fall of 2002, this author (Flowers, 2001) conducted a survey in 2000 to determine perceived needs for online education. The self-selected respondents were members of the International technology education Association. As reported in the original account of this research, overall, the respondents felt there was a need for online technology education, both at the K–12 and post secondary levels, with courses at the master's level and continuing education credit receiving the most interest. They found the idea of taking an online course appealing (more than taking a traditional course). The appeal was linked to their perception that online courses offer more flexibility and convenience, specifically regarding time and geography.

However, this same study uncovered some serious misgivings about online education in technology education, specifically regarding the belief

that it entails comparatively low levels of human contact and regarding quality issues. Many respondents were not aware of where to find distributed learning opportunities, and their general lack of awareness was seen as a critical obstacle. A few seemed to have a narrow or even misguided understanding, as when one commented that it does not make sense for distributed learning courses to cost so much since there is no teacher. Recommendations stemming from this research included the offering of online education with sufficient quality and interpersonal contact to meet this perceived need. It was also recommended that these online opportunities be promoted or advertised, since lack of awareness was found to be an obstacle.

Although most of the “perceptions research” discussed previously has concerned determining attitudes toward distributed learning environments, there is a different level of research concerning perceptions, with an example in technology education. Perceptions research of online students in a technology education class has been reported as one facet of a larger study by Rose (2002), who looked at graduate students in an online technology education course. She looked at two psychological constructs, students’ perceptions of intersubjectivity and students’ perceptions of interdependence, while they were working cooperatively and collaboratively on a problem-based learning activity. The learners exhibited “high and consistent perceptions of interdependence,” (p. 117) where they felt reliance among teammates. Perceptions of intersubjectivity, or shared understanding, were effected by the group structure, with the more structured cooperative learning groups having perceptions of greater intersubjectivity early in the activity compared to the looser structured collaborative learning groups. In a follow-up study with the same online technology education course a year later, Rose and Flowers (2003) found that assigning cognitive roles to members of online cooperative learning groups using a Jigsaw scaffolding strategy helped the learners focus on cognitive learning issues to a greater degree, which is evidence of a different perception of the distributed learning environment, and their role within that environment. Although this research was narrowly focused, it is mentioned here because it illustrates both that perceptions can be influenced by instructional design and that research using “perceptions” may uncover more critical cognitive constructs than course satisfaction, preference, or perceived learning.

## **SUMMARY**

Judgments about distributed learning environments invariably involve comparisons with traditional face-to-face instruction. However, for many, the choice is not between face-to-face and distributed learning; because of geographic and other barriers, the choice is between distributed learning and no education. Thompson, Orr, and Thompson (2001) found very favorable perceptions among students toward distributed education at the undergraduate level that used interactive audio and video: “Because of their rural locations throughout Arkansas, this was their first opportunity to complete a degree without long travel time or relocation. These students recognized the value of the program for themselves and the positive future use of distance education” (p. 20). Future research involving perceptions of distributed learning might be better served by breaking free of a mandatory comparison with face-to-face instruction, just as one would not judge the usefulness of PowerPoint by comparing it only to an overhead projector.

There are many measures and perceptions of the effectiveness, comfort, and value of distributed learning in its many forms and locales, and much research remains to be done. Still, the reader is cautioned once more about the distinction between research on perceptions and research on actual effectiveness, such as that by Swan and Jackman (2000) or Haynie (2003); conversely, the reader is cautioned against overlooking perceptions of stakeholders in making instructional decisions.

This chapter has looked at perceptions of formal distributed learning environments by students and faculty, especially in technology education. However, there are many informal distributed learning environments where each of us regularly learns about our technological world. Burns and Schaefer (2003) discussed the importance of informal education for trade and industrial education teachers, concluding: “Because informal learning is an unstructured and often subliminal accumulation of knowledge, methods must be provided to bring into focus the wisdom gained and lessons learned through it” (p. 21). Maybe the challenge to technology educators extends to the inquiry about, the use of, and even the development of these informal environments, and to aid their technology students in the creation of their own customized learning environments. The environments could include informal networks of people, information sources, organizational tools, and other elements, some of which would

likely be found in a typical formal learning environment, and others likely would not. In the end, it is the learners who, through the power of their perception, cognition, and actions, craft their individual learning environments to meet their own learning objectives.

## DISCUSSION QUESTIONS

1. There are many elements within a distributed learning environment, some determined by the institution's infrastructure, but others determined by the participants. In the design of a course, how much control should be exerted by teachers, tutors, or instructional designers, and how much control should distributed learning students have in the elements within this environment?
2. Many factors influence one's perceptions of and success within any educational environment. Among these are characteristics of the individual. As distributed learning environments evolve, and as today's learners have different characteristics than learners in the past, what research studies should be devised to examine the appropriateness of a distributed learning environment for a particular learner, given their characteristics?
3. A learner's interaction with elements in a distributed learning environment can influence their success and their attitudes. However, must these elements be real instead of virtual? That is, consider a typical learner who appreciates questions and feedback from other students and who gains from providing similar feedback and questions for other students. Can a distributed learning environment be created where the learner is interacting with a number of other participants, some real and some virtual, possibly without even knowing which is which? If a learner responds to a survey indicating that they appreciated it when they interacted with other students, or when they knew the instructor cared about their learning, would the learning outcomes have been the same if those other students had been virtual and if the instructor did not care as deeply, but the environment led the student to believe the instructor cared, and is this ethical? Is the learner's perception of the distributed learning environment more important than the actual characteristics of this environment?
4. Distributed learning is not confined to the same geographic and time

constraints as typical face-to-face classes. Rather than trying to repackage face-to-face instruction with often poorer substitutes that can easily fit into a distributed learning environment, how can teachers and instructional designers reconceptualize their roles as designing learning environments without the limitations of face-to-face classes? For example, might it be possible for each learner to have different learning objectives and different paths, some of these non-linear? Could it be that validation of learning could occur at any time, and no instruction or activities would be included after this point (for each objective)? If some instructors have been teaching face-to-face in the same way for years, how can they be helped to realize the advantages of designing new instructional interventions that are appropriate for a distributed learning environment, rather than repackaging face-to-face materials for alternate distribution? How can instructors' perceptions about distributed learning environments be broadened so as to empower them with a greater diversity of instructional options, models, and research findings that could inform their decisions?

5. Technology education is a diverse field, and there are powerful resources available through distributed learning environments. How should technology teachers and technology teacher educators, even in face-to-face classes, make use of this capability of distributed learning environments to help their students explore this diverse field, to globalize their curriculum, to include areas omitted from standards, or to partner with others?
6. What systems can an instructor use to become better informed about students' perceptions of their distributed learning environment? What mechanisms can help these instructors share their own perspectives with others in similar situations and with those in a position to make positive recommendations or changes?

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# Distance and Distributed Learning Environments: Assessment Strategies

## Chapter 10

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Pamela A. Havice and William L. Havice  
Clemson University

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### INTRODUCTION

The changes brought about by innovative technology offer new and exciting learning environments within technology education. Along with these opportunities are challenges for improved interactivity and communication between the participants in the learning process. These opportunities will necessitate changes in paradigms from the traditional modes of instruction to distributed delivery for all involved. Moreover, this paradigm shift will be most evident in the areas of delivery methods and assessment strategies. In this chapter, we have an overview of the changing paradigms of teaching and learning including assessment strategies and delivery methods that are emerging in distance and distributed learning environments.

### CHANGING PARADIGMS OF TEACHING AND LEARNING

The concept of distributed learning integrates the interactive capabilities of networking, computing, multimedia, and hypermedia with teaching approaches such as collaboration, discovery learning, problem solving, and active learning. Hirschbuhl and Bishop (1996) stress the importance of the two kinds of interaction with regard to learning. Within a technology-driven distributed learning environment, a student interacts with the content as well as with others about the content. “Both types of interaction are important for efficient, effective, and affective learning.” (Hirschbuhl & Bishop, 1996, p. 202).

Distance education is a part of the distributed learning model. The terms distance education, remote learning, and distance learning all refer to learning environments whereby place and/or time separate the student and instructor; thus, the student learns independent of contact with the instructor and, often, other students. Moore and Kearsley (1996) defined

distance learning and education as “planned learning that normally occurs in a different place from teaching” (p. 2).

Distributed learning has proven to be a cost-effective mode of instructional delivery that increases learner access by accommodating the schedules of nontraditional students and therefore is rapidly increasing in higher education (Anglin, 1995). Additional benefits of distributed learning to higher education include enhanced learning experiences, improved access to education, greater learner flexibility, expansion of education to new groups, and increased interaction and collaboration (Oblinger, et al., 2001).

The traditional learning environment has been defined by a number of people. Kim and Kellough (1987) defined the traditional learning environment as “a didactic mode where knowledge is passed on to the learners via the teacher, or from content reading in a textbook, or both” (p. 202). Zenger and Zenger (1990) defined the traditional lecture as “an oral presentation given to a class by the teacher” (p. 31). Ericson (1960) on the other hand stated that the lecture or “telling” method is the method of teaching outside of manipulative work.

Teachers are comfortable with the traditional method because they remain in control of content and time and student learning is predictable and manageable (Kim and Kellough, 1987). These strengths are also looked at as being the weaknesses of the traditional mode. The weaknesses are: (1) the stifling of creative thinking; (2) student’s self concepts are not addressed; (3) little student involvement in decision-making; and (4) there is a lack of intrinsic sources for student motivation.

Learning theories and instructional media have changed a great deal during the recent past. For example, learning has been redefined by Cobb (1997) as, “a highly interactive set of events shared between a learner and various human/nonhuman agents, tools, and media. . . .” (pg.24). With the development of more interactive learning opportunities, educators are experimenting with constructivism theory and distributed learning concepts. These concepts beg for different approaches/strategies in assessment methodologies to appropriately assess learning outcomes.

Many institutions around the country are integrating and delivering content from a traditional classroom environment into a distributed learning environment. Through the use of course management tools, i.e., Blackboard™, WebCT™, as well as Internet home pages, many faculty

members at Clemson University are moving the content and delivery of instruction for a variety of courses from the traditional classroom. Faculty are enhancing traditional courses with online threaded discussion, online testing, video/teleconferencing, online worksheets, team and group assignments, chat rooms, etc. However, for the past decade, “traditional” distance learning courses have been offered by way of satellite technology and the use of video taped lectures either mailed to the student or offered through local television networks. In all of these methods of delivery, the assessment of learning has been most “traditional”.

## **ASSESSMENT STRATEGIES**

According to Gordon (1987) and Airasian (1991), assessment involves collecting, synthesizing, and interpreting information. The assessment process might also include labeling the characteristics the information describes.

Numerous issues (accretion, negotiation and interaction) involving individual learning and active participation in group discussions and conferencing will become more important considerations in the assessment process with online courses. Gunawardena, Lowe and Anderson (1997) describe the analysis of group interaction as a gradual evolution in the construction of knowledge. The “Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing” (Gunawardena, et al., 1997) is a model that addresses these issues. For example, when assessing group or individual interaction, the assessment process could include individual assignments, dialogue, and collaborative teamwork. Each student may be evaluated using multiple sources of data, including both quantity and quality of student participation in online activities to determine the levels of learning.

For educators to develop a successful distributed learning environment, multiple forms for assessing student work and/or performance must be created. These forms for assessment must take into account this paradigm shift to a distributed learning environment. This paradigm shift increases the accountability for learning upon the student (Roblyer, 2004). To facilitate this shift of accountability, educators must continue to develop and refine assessment methods such as rubrics. Rubrics can provide students with a sense of empowerment for meeting learning objectives. The following describes several alternative assessment approaches.

### Using the Dialogue Approach

Distributed learning environments utilizing discussion tools, such as chat rooms, threaded discussions, bulletin boards and list serves, have become more common for both individual and group interaction, dialogue has developed into a more valid learning assessment approach. These distributed learning environment discussion tools can be used to encourage student participation in critiquing journal articles, facilitating team discussions, debating posted issues, and responding to online reference material.

It has been observed that through the use of structured Web-based dialogue many students who would not ordinarily participate in a traditional class discussion become more willing to participate through a technology-based learning environment. As faculty and students become increasingly interactive within the distributed learning environment interactive dialogue will become a more important component of the instructional process.

### Collaborative Assessment—Teams

Within the distributive learning environment collaborative activities involving teams and groups can be effective strategies for enhancing the learning process. In our experience we have found that the interaction of geographically dispersed teams was enhanced when provided with the availability of technology-based communication, e.g., e-mail, Web discussion areas, etc. The following is a sample of a real-time team discussion using an online course management program (WebCT™). (See Figure 1.)

An example of developing new assessment strategies to support integrating course delivery and content from a traditional classroom environment into a distributed learning environment will be shared below. This faculty person chose to use WebCT™ as the course creation and management tool to support and deliver a graduate course during the fall of 2000. The delivery of the graduate level course was revised integrating the use of Web-based technology in an effort to apply adult learning theory to enhance the graduate learning experience. The goal was to provide greater learning flexibility that was sensitive to time and place for students in the course. The majority of students taking the course were working full time, with varying job schedules that affected their ability to participate in the traditional class. Furthermore, half of the students would have had to



Figure 1. Sample WebCT™ Transcript

Monday, June 21, 2004 9:21 pm

Ivy T-(towi)>>I have a question I would like for you all to discuss a little. What have you thought about the use of technology for this course so far? By this I mean, the course site on WebCT, the chat discussions, etc.

John D-(jdoe)>>I think it's been helpful. It was nice to read everyone's page and then be able to put a face with a name during the chats.

Suzu S-(sstudy)>>I really liked seeing everyone's pictures on their home pages and getting a few details about everyone.

Marie M-(mmast)>>I admit, I'm still a little technologically challenged. But this has been a good experience using a general Web site.

Dottie D-(ddoc)>>I think that WebCT is great. I have had courses here at XX use it and it is a great resource! I feel the same way about having a face to put with a name when we chat.

Suzu S-(sstudy)>>I have only had asynchronous courses online before; it has been good to chat all at the same time, a great experience for me.

John D-(jdoe)>>I think the WebCT site is great! It's nice to be able to get on anytime and find info if you need it.

Ivy T-(towi)>>How many of you have taken a course before where you used things like chat discussions, homepages, etc.

Dottie D-(ddoc)>>We use Blackboard for a lot of our courses and I really like it. It is a lot like WebCT.

Marie M-(mmast)>>I have not had a course with an online component before this.

John D-(jdoe)>>This was a first for me. I do use Instant Messenger with my friends but had not used chats for a class.

Ivy T-(towi)>>I appreciate you each being willing to share your thoughts about using this distributed learning format with this course. Let's plan to have our next chat discussion next Tuesday at 10 pm.

Suzu S-(sstudy)>>Works for me. See you. Bye!!!

Dottie D-(ddoc)>>I'll "talk" with you next week. Have a great weekend everybody.

John D-(jdoe)>>Bye everybody. Until next time...:

Marie M-(mmast)>>Thanks everybody for this chat. I enjoyed it. Chat with you next week!

Ivy T-(towi)>>Great chat discussion everyone! See you in our chat room next Tuesday, at 10 pm.

travel some distance in order to participate in the on-campus course.

The faculty person designed this course using a combination of different strategies to support a distributed learning environment that not only maximized the interactive capabilities of the students and instructor, but also minimized the amount of travel time required for this course. By designing the course delivery so that half of the classes were offered via two-way videoconferencing, the instructor was able to reduce the amount of travel time for the students. The weeks when the students were not in a videoconferenced class session they were assigned to small process groups for highly structured online group discussions in a WebCT™ chat room. The faculty person found through experience that it was best to keep the number of process group members to 3–5. Transcripts of the process group chat discussions were recorded and submitted throughout the course as a means of documentation and evaluation of this course activity.

In addition to the chat discussions a number of course management tools, available on WebCT™, were utilized by the faculty person to support this course. The faculty person loaded the course syllabus onto WebCT™, provided lecture notes and additional resource materials, as well as developed a calendar/schedule. Having these materials on WebCT™ not only reduced the amount of paper being used in this course, but also provided a means for students to access materials and information when they needed or wanted the information. In addition to these strategies, the faculty person utilized team projects, created an online resources link, and online worksheets and evaluation forms. Through team projects, students were encouraged to use online discussion groups, teleconference, fax, and e-mail for communication during the course.

Even though “traditional” assessment approaches (exams, projects, etc.) were utilized to evaluate student assignments, the required chat discussions within the process groups required a different approach to assessment. Students were required to evaluate their preparation and performance in the chat discussions at different points in the semester as prescribed by the instructor. The following evaluation form was designed by the instructor whereby the student conducts a self-evaluation and emails the form to the instructor for instructor feedback. This electronic evaluation process worked quite well in getting immediate feedback and allowing the students to use the feedback before experiencing another process group chat discussion. (See Figure 2.)

## Figure 2. Process Group Evaluation

**Instructions:** The process groups are designed to encourage students to examine the XXXXXXXXX, as well as increase knowledge of XXXXXXXXX. Your interaction within your process group will be evaluated, by the instructor and by you, at least four (4) times throughout the semester. Please write in the coordinating score – 0 (none), 1 (sometimes), 2 (most of the time) – for each of the following criterion.

After completing this evaluation, save as a Word document and email as an attachment to your instructor for feedback.

Name: \_\_\_\_\_ Group Members: \_\_\_\_\_

Discussion Topic: \_\_\_\_\_ Date of Discussion: \_\_\_\_\_

### CRITERION

1. Is actively involved with the discussion topic–keeps on topic.

	_____ Student Score	_____ Instructor Score
Comments:		

2. Evidence of using the assigned readings and/or research to participate in discussion.

	_____ Student Score	_____ Instructor Score
Comments:		

### TOTAL

	_____ Student Score	_____ Instructor Score
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### Student Views

To assist faculty in the on-going improvement and future development of a specific distributed learning environment, a survey instrument was developed and administered as a pretest/posttest to 43 graduate students. These students were enrolled in a course that used a variety of distributed learning methods, including WebCT™ and two-way audio-video instruction or WebCT™ and traditional face-to-face instruction. The survey was designed to collect students' attitudes regarding the use of WebCT™ and two-way audio-video instruction in a specific course when compared to the use of WebCT™ and traditional face-to-face instruction.

In this study it was found that using technology-based instruction not only allowed for students to become more interactive with each other and the faculty during the course, but that students enjoyed the flexibility of being able to interact within small groups via WebCT™ anytime they chose. In other words, the students favored WebCT™ as part of their learning process. The study results also offered little difference in satisfaction with the course between students being taught via two-way audio-video instruction and those being taught with traditional face-to-face instruction.

## **FUTURE IMPLICATIONS FOR ASSESSMENT**

### Rubrics

As educators we are constantly making judgments about students and student performance. One of the major concerns for both faculty and students, when using Web-based resources is the integrity of the course. This includes integrity of both content and student participation. When a course has been well designed, is learner-centered, and promotes learner empowerment and self-reflection, course integrity is not an issue.

Rubrics provide an alternative to assessing or evaluating student work and performance while fostering a sense of learner empowerment in the distributed learning environment. Rubrics are simply a set of formal guidelines, scoring guides or rating tools used to rate examples of student work or performance. The use of rubrics allows the educator to clarify the assessment criteria by which the student's work or performance will be judged. Furthermore, rubrics are designed to provide a fair and reliable

means of scoring products, behaviors, assignments, etc., which are subjective in nature. These guidelines can be extremely helpful in scoring everything from student activities, writing samples, collaborative team activities, dialogue samples, as well as multimedia projects in Web-based courses.

Rubrics provide a number of important advantages in the assessment process. Not only do rubrics allow the assessment process to be more objective and consistent, but they also help the educator focus attention on important learning outcomes. This forces the educator to clarify the assessment criteria in specific terms. Rubrics help to demystify or take the “guesswork” out of the expectations for a project, therefore empowering the student to focus on weak areas while emphasizing the strengths in his/her own work. Rubrics encourage students to develop a consciousness about the criteria they use to assess their own abilities and performances, as well as assess the performance of their peers. Rubrics also provide benchmarks against which to measure and document progress. In other words, rubrics emphasize the use of formative as well as summative evaluations.

Typically, rubrics consist of guideline grids or matrices with performance levels in the top row and performance dimensions along the left column. Each cell holds specific and objective criteria against which the selected performance standards can be assessed, resulting in a given score in a given dimension. Rubrics characteristically provide for two to five performance levels.

In developing a useful rubric, there are several tips to keep in mind. The first tip is to create a more general rubric, not task-specific, which can be used in more than one application or project. To develop a sound rubric takes a lot of thought and work. Therefore, a general rubric is a more efficient use of time and makes it possible to track student improvement on successive projects. While being careful to avoid developing a task-specific rubric, the educator must be careful in not being too general.

The dimensions of the rubric tell us “where to look”. When creating a rubric, it is important to focus on a limited number of dimensions. Limiting the number of dimensions will allow the evaluator to do a more thorough job of developing each dimension, thereby setting priorities for what is really important.

Criteria tell us “what to look for” in a rubric. The criteria used needs

to specify those things that matter most for each dimension. The criteria must be concrete, measurable and teachable. It is questionable as to whether one can teach a student to be creative, imaginative, or inventive. Furthermore, try to choose criteria that can be counted or marked as “present” or “not present”. In striving to make criteria measurable, the educator needs to be careful in selecting descriptors. Try to avoid relative terms such as *poor*, *fair*, *good*, and *excellent*. To avoid discouraging students with value-laden terms such as *boring* or *poorly presented*, provide specific feedback on the actual traits that constitute a good versus poor performance.

In developing the rating scale in a rubric it is important to keep the “distance” between the different levels equal. In other words the difference between a “1” and a “2” should represent the same amount of improvement as the difference between a “2” and a “3.” Statisticians call this type of scale an interval scale. In the real world of the classroom, this type of perfection in a rating system is often not possible. Educators are often creating *ordinal scales* whereby one ranks one project or performance better than another. The bottom line is to create a rubric scale that is as “interval-like” as possible. This will provide a stronger, sounder rubric.

Finally, in developing a rubric it is often helpful to include students in creating or adapting the rubric. This will accomplish several things. First, by involving students in the construction process the students will have an advance on understanding the expectations of the project. They will also be more likely to “buy in” to the work. Furthermore, the students’ good ideas will only add to the quality of the rubric. The following is a sample of a rubric created for evaluating presentations. (See Figure 3.)

### *Emerging Technology*

As bandwidth and technology improves, new opportunities will be provided for simulation and videoconferencing to be used as means of assessment. For example, videoconferencing allows students and instructors at different locations to communicate through live/audio, thus creating very rich two-way communication. (Kemp & Smellie, 1994). With this technology, educators and students are able to reach beyond their classrooms to interact with people and material resources in other parts of the world.

Figure 3. Sample of Rubric Created for Evaluating Presentations

**Presentation Evaluation Rubric**

This activity has been established to challenge the student to develop, deliver and evaluate topic-appropriate presentations.

	Acceptable: 1 point	Exemplary: 2 points	Self Evaluation	Teacher Evaluation
<b>Presentation Content and Delivery</b>				
Topic Content	Presentation focuses on appropriate content for the topic. Identifies appropriate objectives for presentation.	Presentation focuses on appropriate content for the topic. Identifies and states appropriate objectives for presentation to meet the class needs.		
Organization	Meets time specifications. Is prepared and organized. Able to follow presentation.	Meets time specifications. Is prepared and organized. Able to follow presentation. Logical flow. Smooth transitions between content areas. Provides a summary of the presentation.		
Subject Knowledge	Demonstrates knowledge of topic by answering class questions.	Demonstrates knowledge of the topic by answering class questions with explanations and elaboration.		
Instructional Media	Uses two different types of instructional media to deliver presentation. Is prepared and familiar with use of media.	Demonstrates awareness of appropriate media for presentation. Is prepared and familiar with at least two different types of instructional media in delivering presentation.		
Mechanics	The presentation has no misspellings or grammatical errors.	The presentation has no misspellings or grammatical errors. Text is clear, logical and promotes viewer understanding. Followed the "6X6" rule for visual aids.		
Eye Contact	Presenter does not read from notes. Returns to notes frequently, moderate eye contact with audience.	Presenter does not read from notes. Maintains eye contact with audience, seldom returning to notes.		
Poise and Appearance	Presenter is poised and appropriately dressed for the presentation.	Presenter is poised and appropriately dressed for the presentation. Demonstrates self-confidence and promotes comfort of audience.		
Voice	Minimal use of fluctuation in voice. Some noticeable distractions.	Presenter uses a firm, clear, sincere voice. Varies pitch and pace. Avoids distractions ("uh," "oh," "ok").		
SCALE 16-13=Exemplary 12-8=Acceptable 7-0=Not Acceptable		TOTAL		

## **SUMMARY**

As educators and trainers, we must be willing to continually assess the strategies being used to evaluate students. As student assignments and expectations change as a result of innovative distributed learning strategies, the assessment methods and strategies will need to change as well. Class assignments such as the development of online projects by students, team evaluation, and presentations, and individual participation requirements will require innovative assessment strategies to effectively and efficiently evaluate student performance and competencies.

## **DISCUSSION QUESTIONS**

1. What challenges do you perceive with assessing student learning via a distributed learning environment? Why?
2. Compare and contrast the assessment strategies used in the traditional face-to-face technology education class with a distributed learning environment.
3. How can the use of rubrics enhance the assessment of student learning?
4. Design a rubric for use in a technology education course, i.e. a class participation, project, or teamwork rubric.



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G. Eugene Martin  
Texas State University–San Marcos

## INTRODUCTION

The arrival of the Digital Age has significantly impacted the technology education profession. Many of the traditions the profession had held for decades as being sacred were all at once disrupted, and it's likely the disruptions will continue throughout the first decade of the 21st century.

The disruptions brought forth many new challenges, and many new opportunities. Whether the disruptions are considered individually or collectively, they often will cause technology educators to pause and reassess what they have long considered to be the central core of their programs. At the same time, some of the disruptions may even cause technology educators to map new instructional strategies that address the enhancement of the teaching-learning process through the use of technology mediated instruction. Today, technology educators who give special attention to the use of technology to deliver instructional content are faced with many issues, including the issues of ownership and copyright. Today, technology educators who distribute instructional content electronically are faced with many issues including ownership, copyright, intellectual property, fair use, and public domain. This chapter focuses on these issues while addressing the following questions:

- What are the standards of quality that are applied to courses and programs distributed electronically?
- Section 110(2) of the US Copyright Act as revised applies to which type of institutions?
- The TEACH Act places requirements on educational institutions that distribute instruction electronically. What are the requirements?
- What is the difference between copyright and patent?
- How might a work that was created by you not actually belong to you?
- Under what conditions may a copyright work become fair use?
- Why is intellectual property not tangible?
- Why is it important for educational institutions to have ownership and copyright policies?

## **PRECURSOR TO CHANGE**

Technology education did not operate in a vacuum during this time period as all segments of education were impacted by the arrival of the Digital Age. For example, disruptions were experienced throughout all of higher education when the US Congress set a goal to facilitate the use of digital technologies in distributed learning environments. Disruptions further underscored the critical need to create a delicate balance and sometimes even a tension between the perceived rights of the public to access information and protecting the rights of owners who created information. Today, the delicate balance is evident in the instructional materials a technology educator is permitted to show in a traditional face-to-face classroom delivery system and what the same educator is permitted to distribute electronically to students. The tension may get worse before it gets better and the implications for technology education are immense.

## **DISTRIBUTED LEARNING ISSUES**

As technology educators address threats and opportunities brought about by the Digital Age, they must be mindful of a host of issues related to the electronic distribution of instructional materials. The issues include ownership and copyright, which includes intellectual property, fair use, and public domain; as well as patents, trademarks, royalties, student's rights, and even infringement on academic freedom and academic governance. Individually, each issue has the potential to elicit a host of reactions, sometimes very emotional reactions, from faculty, students, administrators and other key stakeholders. Collectively, they provide a cumbersome network of topics to negotiate in the development of electronically mediated instructional materials. Regardless of the specific issue and any accompanying reaction, when technology educators use electronically mediated instructional materials prudently, wisely, and effectively, they stand ready to capitalize on opportunities to make quantum advances in the enhancement and enrichment of the teaching-learning process.

The purpose of this chapter is not to provide a treatise on the legal aspects of engaging in the electronic distribution of instructional materials nor is the purpose to provide definitive responses to a collection of "what if" questions in the use of these materials. Those questions and appropriate responses shall be left to the community of legal scholars. This chapter, however, does provide an overview of several key issues and concludes with some scenarios that are important to efficient and effective

practices in the electronic distribution of instructional materials. The chapter's goal, therefore, is to heighten the technology education community's awareness to the importance of staying abreast of distributed learning issues in the Digital Age and, ultimately, to create a more delicate balance and ease tensions.

Why are issues such as copyright and ownership, including public domain, intellectual property, and fair use, so important in an electronically distributed learning environment today? What has occurred in the past few years that underscore the importance of these issues? Today, more than at any previous time in history, the very nature of higher education encourages faculty to develop and offer courses and programs that incorporate electronically mediated instructional materials. At the same time, they are challenged with ensuring that their instructional materials are equal to or greater than the quality of the instructional materials they use in their courses offered entirely in the traditional face-to-face classroom format. Faculty engagement in the instructional materials development and distribution process runs the spectrum from their using distributed technologies to enhance selected instructional activities within a specific course to delivering a course or program in its entirety using one or more technologies (e.g., Internet, ITV). Regardless of the method used to employ technology in any particular instructional activity, it is imperative that faculty follow best practices in the use of instructional materials in courses and programs that emphasize distributed learning environments. Equally imperative, is that as faculty develop and revise their technology education programs, courses, and instructional activities, their rights and the rights of others be protected in the process.

## PRINCIPLES OF GOOD PRACTICE

One widely acclaimed effort to foster an environment that encourages the electronic provision of quality higher education programs across state lines was the funding of a project by the United States Department of Education Fund for the Improvement of Postsecondary Education (FIPSE). This FIPSE project, entitled, *Balancing Quality and Access: Reducing State Policy Barriers to Electronically Delivered Higher Education Programs* (FIPSE, 1993), was awarded to the Western Cooperative for Educational Telecommunications in 1993. One outcome of this project was the identification of *Principles of Good Practice for Electronically Offered Academic Degree and Certificate Programs* (Western Interstate

Commission for Higher Education, n.d.). The “Principles of Good Practice” has become the generally accepted quality standard used by higher education’s regional accrediting agencies (e.g., Southern Association of Colleges and Schools [The Commission on Colleges, 2000]; North Central Association of Colleges and Schools [The Higher Learning Commission, n.d.]; Western Association of Schools and Colleges [The Senior College Commission, n.d.]) in the United States as well as state higher education coordinating boards. (It is noteworthy that the emphasis throughout all the Principles is on quality.) Universities throughout the United States have adopted and adapted the Principles of Good Practice to fit their local educational environments.

The Principles of Good Practice are divided into three categories: (a) curriculum and instruction; (b) institutional context and commitment including its role and mission, faculty support, resources for learning, students and student services, and commitment to support, and (c) evaluation and assessment (Western Interstate Commission for Higher Education, n.d.). For example, within the category of curriculum and instruction, the emphasis is on quality as it may relate to faculty qualifications, faculty and student interaction, and course standards. Attention to evaluation and assessment helps to ensure quality assessments of student learning outcomes, student retention, student achievement, and student and faculty satisfaction.

Several assumptions underscore the basis for the Principles of Good Practice:

1. The electronically offered program is provided by or through an institution that is accredited by a nationally recognized accrediting body;
2. The institution’s programs holding specialized accreditation meet the same requirements when offered electronically;
3. The “institution” may be a traditional higher education institution, a consortium of such institutions, or another type of organization or entity;
4. These Principles address programs rather than individual courses; and
5. It is the institution’s responsibility to review educational programs it provides via technology in terms of its own internally applied definitions of these Principles. (Western Interstate Commission for Higher Education, n.d., ¶3)

## TEACH ACT

November 2, 2002 became a landmark day in the history of distance education in the United States. President George W. Bush signed into law the “Technology, Education and Copyright Harmonization Act” (also known as the TEACH Act) which revised Section 110(2) of the US Copyright Act governing the lawful uses of copyrighted materials. Any benefits associated with the TEACH Act apply only to accredited nonprofit educational institutions and governmental bodies.

The American Library Association (2002) noted the TEACH Act redefines the terms and conditions on which accredited, nonprofit educational institutions throughout the U.S. may use copyright protected materials in distance education—including on websites and by other digital means—without permission from the copyright owner and without payment of royalties (§1). Furthermore, the library association noted that the TEACH Act “establishes new opportunities for educators to use copyrighted works without permission and without payment of royalties, but those opportunities are subject to new limits and conditions” (§2).

Crews (2002) stated that the “TEACH Act is a clear signal that Congress recognizes the importance of distance education, the significance of digital media, and the need to resolve copyright clashes” (p. 3). He identified four benefits of the TEACH Act: (1) the display and performance of nearly all types of works; (2) distance students may now be reached at any location; (3) record and retain copies of transmissions even if it includes copyrighted content owned by others; and (4) digitization of some analog works (p. 4).

Finally, and maybe most important, the TEACH Act addresses specific requirements for instructors and institutions including their chief policy-makers and information technologists. For example, the TEACH Act underscores the importance of the role of the instructor as the person responsible for the use of copyrighted materials that serve one or more educational objectives. The TEACH Act also instructs educational institutions to: (a) develop policies regarding copyright and the use of copyrighted materials in distributed learning environments; (b) notify students that materials used in a distance education course may be copyright protected; and (c) transmit content only to students officially enrolled in a course for which the transmission is made. Information technologists

must ensure that only registered students in distance education classes are allowed to receive a transmission; limit student accessibility to transmitted materials to the length of the course (e.g., semester); and apply technological controls that prevent students from downloading and sharing copyrighted materials.

## TERMINOLOGY

Central to the creation of electronically distributed instructional materials are four terms that deserve special attention for this chapter—copyright, fair use, public domain, and intellectual property. It is literally impossible to discuss one term without giving attention to the interplay of the other terms.

### Copyright

Article 1, Section 8, Clause 8 of the United States Constitution serves as the genesis for copyright law in the United States. It states the following:

“The Congress shall have the Power . . . To promote the Progress of Science and Useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries” (United States Constitution, Article 1, Section 8, Clause 8).

When a technology educator creates an original work of authorship that is fixed in any tangible medium of expression, then the legal protection of copyright is vested immediately upon its creation. Examples of original work might include creating a video on a manufacturing technology process that will serve as an instructional activity in a classroom; authoring a manuscript for a professional journal such as *The Technology Teacher*; and creating a personal website and mounting it on the World Wide Web. Generally, Gasaway (2001) indicated that ownership of a copyrighted work lasts the life of the author, plus 70 years, unless the copyrighted work is the result of a corporate authorship. However, not all works that we create may belong to us. For example, if a technology educator creates software for his/her school as part of the requirements of employment, then the software may belong to the school as part of the work-made-for-hire doctrine (see Scenarios 1–5 for specific examples). Finally, copyright does not necessarily apply to all works that are created including works created by the United States government.

Although a novice may speak of copyright and patent as being one and the same, they differ in many ways. One notable difference is in the



application of protection. Whereas copyright protection is applied at the moment of creation, an inventor must request protection through the patent system by filing a formal application. In other words, the patent system encourages inventors to publicly disclose their inventions in exchange for preventing others from commercializing their invention. The copyright process does not necessarily encourage or require public disclosure at the time of creation.

### Fair Use

Closely related to the term copyright is the term fair use. Fair Use is codified in Title 17, Chapter 1, Section 107 of the US Copyright Law. Specifically, it states that when a copyrighted work is used for the following purposes—“criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research”—it is not an infringement of copyright. Section 17 further states that when determining whether the use made of a copyrighted work is a fair use, the factors to consider are the following:

- The purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes;
- The nature of the copyrighted work;
- The amount and substantiality of the portion used in relation to the copyrighted work as a whole; and
- The effect upon the use of the potential market for or value of the copyrighted work. (United States Government, 2003, p. 18)

How might a technology educator know if the intended use of a copyrighted work is fair use? Minow (n.d.) identified several conditions in which a copyrighted work may be inclined to be judged as fair use. These conditions are the following:

- Use is for nonprofit educational purposes;
- Use is to create a new work with a different purpose;
- The work has a thin or weak copyright;
- The work has already been published;
- The smaller the amount copied the better;
- Portion used is not “the heart of the work;” and
- There isn’t a significant effect (including potential effect) on the market for the original work. (§10)

As technology educators go through the process of determining whether to use a copyrighted work in a technology mediated instructional activity, it would behoove them to consider the previously identified four factors of fair use and the seven conditions that may lean toward a judgment of fair use.

### *Public Domain*

Prior to the establishment of the first Copyright Act in the US in 1790, all works were considered to be in the public domain. An individual could use a tangible item (e.g., book) of its creator for their commercial gain. With the passage of the Copyright Act in 1790, protection of the creator was formally established. Once copyright protection expired, however, works then entered the public domain.

Today, the importance of public domain is widely recognized both within and outside of education. For example, Bollier (2002) stated that “the public domain is critical to the progress of creativity, innovation science, culture, higher education, the Internet, democratic governance and business” (p. 10). Without it, he states, “it would become exceedingly difficult for creators to create anything new because the very act of creativity would infringe upon someone else’s intellectual property” (p. 6). Public domain includes tangible items, such as publications, processes, and inventions, which are not protected by copyrights or patents.

Public domain is vitally important to technology educators and their role in the teaching-learning process. In their everyday role as teachers-scholars, technology educators build upon the research results of other scholars, both within and outside the field of technology. Their work has been placed in the public domain and they use it to make improvements in the teaching-learning process.

### *Intellectual Property*

Lange (1981) stated that “the chief attribute of intellectual property is that apart from its recognition in law it has no existence of its own” (p. 147). Unlike copyright, intellectual property is not tangible and its boundaries are difficult to fix. It has been described as ideas or lacking real property commonly associated with tangible qualities. Lange (1981) stated that “the subject matter of intellectual property is unlike the subject matter of

more conventional forms of property which have in common an underlying attribute of tangibility and are in consequence susceptible to some form of sensory perception” (p. 147). Intellectual property is important to technology educators because as scholars we use foundation knowledge to create ideas that may lead to the development of a solution to a technological problem.

## **APPLICATIONS OF TERMINOLOGY**

As part of the process by which faculty exercise their academic freedom including selecting content of their choice—a tradition of academia for centuries—faculty often choose to use some instructional materials in their programs that were created by others. The TEACH Act, however, does place limits on what copyrighted works faculty are allowed to use without permission from the copyright owner. For example, the Act addresses works of “reasonable and limited portions” and “an amount comparable to that which is typically displayed in the course of a live classroom” that may be distributed via distance education (United States Government, 2002, Section 13301). It excludes works that are “primarily for performance or display as part of mediated instructional activities transmitted via digital networks” such as commercially available materials (United States Government, 2002, Section 13301).

The TEACH Act also places requirements on faculty to ensure that copyrighted materials are being used for educational purposes and that the instructor of record is in charge of the use of these materials. Faculty who wish to use copyrighted materials need to ensure that electronically transmitted materials are “an integral part of a class session offered as a regular part of the systematic, mediated instructional activities” and are “directly related and of material assistance to the teaching content of the transmission” (United States Government, 2002, Section 13301).

One may assume that a technology educator owns the copyright in electronically published scholarly works in which the technology educator is the creator, particularly if the work is created on the faculty member’s own initiative and own time. Examples of these works include videotapes, tape recordings, PowerPoint presentations, course syllabi, homepages, etc. However, if a university commissions the works and it is a works-made-for-hire, then the faculty member may or may not be the sole owner of the

copyright. For example, the university and faculty member may jointly own the works. It is important to establish who secures the copyright registration and who is responsible for enforcing the copyright. It is also important to establish the responsibility of course materials revision. It is generally understood that technology educators should retain the right and have the responsibility to update, edit, or revise their electronically distributed materials. Terms (e.g., written contract) of revision should always be negotiated in advance of the creation of the materials.

## **OWNERSHIP SCENARIOS**

When using electronically distributed materials for instructional purposes, there is typically no one specific answer to ownership that fits all situations. The following five scenarios are used at Texas State University–San Marcos (2000) to provide a framework for addressing the issues of ownership, compensation (including royalties), and distribution rights. Technology educators should check with their employers for specific policies and procedures that apply to the creation and use of electronically distributed instructional materials.

Scenario 1. A technology education faculty member works with a major publishing company to create a Web-based technology course. The company plans to sell the course to make a profit. The faculty member's contributions to the creation of the course are on her/his own time without any direct support from her/his university other than an occasional use of the faculty member's office computer on weekends. The company provides 1000 hours of technical labor (instructional design, production, programming, etc.) in order to get the course mounted on the company's server.

Another technology educator works with the International Technology Education Association (ITEA) to create a CD containing 1,000 images of best practices the professor has photographed through his/her lifetime of teaching. The professor took the photographs on weekends and used his/her own camera and film. ITEA creates and markets the CD without using any resources of the technology educator's university.

In these two examples, and as far as the university is concerned, the faculty member owns all intellectual property, retains distribution rights, and may receive compensation from the company for the works she/he created on her/his own time. There is minimal, if any, direct support from

the university in the creation of the technology education course.

Scenario 2. A technology education faculty member, who teaches a course at his/her university entitled “Seminar in Technology Education,” volunteers to post his/her course on the Web. The university provides the faculty member some professional development time in the use of Blackboard—the university’s course management platform system. The university agrees to also assist the faculty member in the development of a PowerPoint presentation that will be an integral part of the course. The technology educator spends 200+ hours creating the course on his/her own time. The university mounts the course on a university owned server.

In this scenario, the technology faculty member owns intellectual property and the right to distribute the work. He/she may receive compensation for any distribution outside the university course delivery as minimal university resources were used. The university would have non-exclusive educational license to use the work as part of the university’s course delivery.

Scenario 3. A technology educator volunteers to make her/his department’s “Practicum in Technology Education for the Elementary Grades” course available totally on the Web. The university provides the technology educator one course release time in the fall semester and compensates her/him the equivalent of a course release time in the summer as additional compensation to develop the course. The technology educator also volunteers to use some of her/his own time to develop the course. Since this is a practicum course, the university provides the faculty member audio and video equipment to develop the course. In addition, the university provides technical assistance in the form of instructional design, production, and programming. Once completed, the course is mounted on a university owned server.

In this scenario, the technology educator owns the intellectual property, has the right to distribute it, and receives compensation for any distribution outside the university’s course delivery system. However, substantial university resources have been invested in this course development project. The university would have a non-exclusive educational license to use the work as part of its course delivery system and the faculty member is compensated at a rate agreed to by the university and the faculty member. The university would also have non-exclusive commercial license to market the course outside the university in which case both the

university and the faculty member would receive a percentage of the royalty.

Scenario 4. The Chair of the Department of Technology Education assigns a faculty member to teach a graduate course that will first be videotaped and then broadcast the following semester to 10 different regional sites. The graduate course is part of the newly approved distance education Ph.D. program. As part of the teaching load, the faculty member receives course release time for both fall and spring semesters. The instructional support office on campus contributes 300 hours in the design and production of the videotapes. The faculty member's work in the design and production is completed during normal working hours at the university.

In this scenario, the university owns all intellectual property, and has an exclusive educational and commercial ownership and license authority. The technology educator receives no royalty payment, as this was a work made for hire, i.e., the faculty member was contracted with the university to develop the graduate distance education course.

Scenario 5. A technology educator works with a Web course publishing company to place his/her course, "History and Philosophy of Technology Education," totally on the Web. The university provides funds to purchase time from the university's instructional technology support office to videotape two hours of lecture that will be streamed as part of the course. In addition, the faculty member checks out digital recording workstations for three weeks. The Web course publishing company spends 300+ hours recording materials provided by the faculty member and creating the Web course. The company also mounts the course on its server. Now that the course is completed and made available by the company, the faculty member decides that he/she would like to use the course at the university. The university would pay a fee to the Web course company for access to the course materials but would not compensate the faculty member above that which he/she is being compensated to teach the course. Ownership is determined by following the guidelines in Scenarios 1-4.

Regardless of ownership, compensation, and distribution rights and the method by which one or more of the previously described five scenarios may apply in a given environment, technology educators (including faculty and chairs) must accept several important responsibilities in the creation and delivery of electronically mediated instructional materials. Included among the responsibilities are the following: (a) ensure the technology used is appropriate to the nature and objectives of the course and

program; (b) ensure currency of materials, courses, and programs; (c) negotiate appropriate workload adjustments in accordance with a faculty member's full professional responsibilities; (d) inform potential students of the technology and other resources required to successfully complete the course or program; and (e) ensure that evaluation of the electronically distributed courses and programs examines effectiveness and the course or program is comparable to campus-based courses and programs (Texas State University–San Marcos, 2000). The importance of these responsibilities is underscored in the Western Interstate Commission for Higher Education's Principles of Good Practice for Electronically Offered Academic Degree and Certificate Programs (Western Interstate Commission for Higher Education, n.d.).

## SUMMARY

Ownership and copyright issues, including public domain, intellectual property, and fair use are topics that deserve the special attention of technology educators today as they design, develop, and use electronically mediated instructional materials. The TEACH Act is but one piece of federal legislation that technology educators should become familiar as they distribute instructional materials electronically to student audiences both on and away from their main campuses. Just as important, the World Wide Web is a valuable resource for assisting faculty in following current discussions on the important issues of ownership and copyright.

Inherent within any discussion of copyright and ownership issues is the need to address the development of quality electronically mediated instructional materials. The "Principles of Good Practice" is a statement of nationally recognized quality standards that all technology educators should follow when developing or revising their courses, programs, and instructional activities. Whether it is federal legislation, rules and regulations of state agencies, or policies and procedures of higher education governing boards, university chief policymakers, information technologists, and faculty have many important responsibilities. One primary responsibility is to perform to ensure that recognized standards of quality are met in the electronic distribution of instructional materials.

*Valuable Websites*

A discussion of ownership and copyright, including intellectual property, public domain, and fair use issues, may be found on many websites. The following list is a representative sample of Uniform Resource Locators that are available on the World Wide Web, and which deserve attention by scholars who study and debate issues covered in this chapter.

- <http://www.educause.edu/ir/library/pdf/NLI0362.pdf>  
(EDUCAUSE, Wendy Rickard, Garret Sern and Vicki Suter, 2003))
- <http://libres.curtin.edu.au/libres13n1/index.htm>  
(Curtin University of Technology, Dr. Robert N. Diotalevi, 2003)
- <http://ericit.org/digests/EDO-IR-2002-10.pdf>  
(ERIC Clearinghouse on Information & Technology, Carrie Russell, 2003)
- <http://chronicle.com/free/v49/i29/29a02901.htm>  
(The Chronicle of Higher Education, Dan Carnevale, 2003)
- [http://www.ala.org/Content/NavigationMenu/Our\\_Association/Offices/ALA\\_Washington/Issues2/Copyright1/Distance\\_Education\\_and\\_the\\_TEACH\\_Act/teachdrm.pdf](http://www.ala.org/Content/NavigationMenu/Our_Association/Offices/ALA_Washington/Issues2/Copyright1/Distance_Education_and_the_TEACH_Act/teachdrm.pdf) (ACM- Association for Computing Machinery, American Library Association, EDUCAUSE, 2003)
- [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=107\\_cong\\_bills&docid=f:h2215eas.txt.pdf](http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=107_cong_bills&docid=f:h2215eas.txt.pdf) (United States Congress, 2002)
- <http://www.utsystem.edu/ogc/intellectualproperty/teachact.htm>  
(University of Texas System, Georgia Harper)
- <http://www.unc.edu/~unclng/public-d.htm> (Lolly Gassaway, 2001)
- <http://www.law.duke.edu/pd/> (Duke Law School, 2001)
- <http://www.copyright.cornell.edu/> (Cornell University, 2003)
- <http://fairuse.stanford.edu/> (Stanford University Libraries, 2003)
- [http://www.eff.org/IP/eff\\_fair\\_use\\_faq.php](http://www.eff.org/IP/eff_fair_use_faq.php)  
(Electronic Frontier Foundation, 2002)
- <http://www.eff.org/IP/> (Electronic Frontier Foundation, 2003)
- <http://www.loc.gov/copyright/> (the Library of Congress, 2003)
- <http://www.arl.org/info/frn/copy/copytoc.html> (Association of Research Libraries, 2003)



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# Expanding Distance and Distributed Learning Environments: The Digitally Integrated Learning Experience

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## Chapter 12

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James A. Dias  
Sonic Foundry, Inc.

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### INTRODUCTION

Emily settles into her seat and prepares for her Exploring Technology class. She turns on her wireless tablet personal computer (PC) and places it into *Class Mode*. Instantly the course notes for the current session appear on her screen. While she waits, she uses her stylus to highlight some of the text and tag a paragraph for later review. Dr. Simms walks in and begins his presentation. Immediately his video along with the visuals he is using in the class show up on Emily's tablet. She listens and interacts with him and the other students during class—her tablet records everything. Occasionally she taps the “K” button on the screen to index a key point that she would like to find later. In the front of the class, Dr. Simms shows the students a three-view orthographic projection of an engineering drawing and points out different aspects of the front view of a machine part on a high resolution, large screen display. A student in the third row asks a question by pointing to the same view on his tablet—the entire class sees what he is asking. The class session and discussion are recorded and preserved.

Emily is supremely connected all the time. Emily's very own customized ‘university’ links everyone that interacts with her; with all the information that Emily needs, and more importantly everything that Emily does. Her university is shaped entirely by her experiences. She is an active node in the digital fabric of an advanced distributed learning environment designed to shape and manage all of her learning experiences. Every learning interaction—with people and with content—becomes a recorded experience element that is instantly indexed, chronologically ordered, linked with other elements and readily available for her retrieval and playback. The environment fluidly spans across all her courses; across all her physical and virtual learning spaces; and across hundreds of

resource centers available to her. All of this is occurring in precise orbit around Emily's learning goals and aspirations. EmilyU is now online.

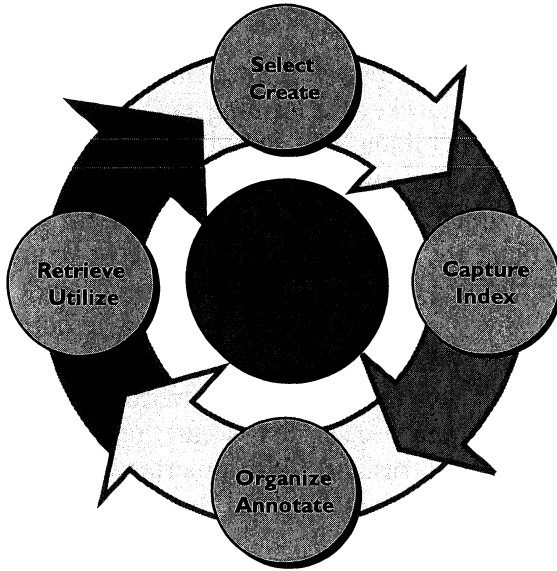
## **THE EXPERIENCE SYSTEM**

The scenario above describes a near-futuristic distributed learning environment which I have called the Experience System (ES). The ES, like the Internet, is a vast fabric of information and communications applications and abundant content drawn together and organized in the moment that Emily needs to find or know or learn anything. Like the Internet, the system has an evolving set of sources that constantly contribute, accumulate, and make amounts of information accessible as courses roll forward but does it through a lens organized as experiences. The ES records and turns each learning experience into a digital asset that can be linked, managed, found and used when Emily needs to. Just in case, just in time, and just for Emily.

To digitally integrate Emily's learning experiences, the ES has four strengths: it enables instructors and students to select or create their tools, places, times, and communications for the optimal learning experience; it automatically captures, records, indexes, and preserves everything in each and every one of these experiences; it enables the user to organize and annotate the recorded experiences; and it allows the user to retrieve, share and utilize those experiences. This system supports all data types; static and dynamic, and in real-time. Text, graphics, video, Hypertext Markup Language (HTML), rich media, are now all uniformly part of the same creation, management, and distribution fabric.

The Experience System model shifts the focus from the class as the organizing unit to the learner as centerpiece. Unlike a course management system where everything is "course-driven" by the instructor, the new model is more granular, much more adaptive, and designed to be "experience" driven. The Experience System for distributed learning is based on a simple premise that the creation, preservation, connection, and reutilization of personal learning experiences can improve efficacy and learning performance. It aims to unify the most diverse set of practices of learning through the creation of a common methodology and platform that allows the student to map, record, and retrieve their elemental learning experiences to all the resources and courses with which they are involved.

Figure 1. The Experience System Model



A system built to support learning experiences must first be transparent to learning. The applications enable without interfering. There is a vast amount of automation and intelligence at play, all in the facilitation of the learning experience. Systems designed to create, capture, and manage learning experiences must be smart, very smart. They must be transparent and not get in the way; they must become the background. So many tools force the learner to learn the tool, to work through the tool, to manage the tool. The Experience System has no such expectations.

Emily is skilled with computers, with a variety of communication systems, and can manage a variety of digital services and data types. For 15 years she has worked with digital technology ranging from networked games and simulations to video messaging and mail, to advanced user interfaces in her phone and personal digital assistants (PDA). The system she uses at EmilyU is familiar and comfortable because it is integrated and uniform. She uses a tablet device to drive all of her inputs and outputs from the ES. The tablet computer, with its pen-based Graphic User Interface (GUI) provides the best interface for viewing, pointing, and annotating directly on the screen. The single, simple dashboard design of

the ES is context-specific and driven entirely from a handful of standardized experience modes. Emily's tablet computer identifies the experience and the ES does the rest.

Emily's tablet is also wirelessly connected, all the time. Emily is mobile, free to learn where and when the learning happens. The computer is now as much a communications tool linked through the vast high-speed, broadband network to hundreds of private and public digital resources and millions of others. Digital voice and video move as ubiquitously as data. Connections are made anywhere. The network makes the digital integration of learning experiences possible. The network is a global fabric connecting a vast number of learning 'nodes' 'resources', and 'experiences'. Its dial tone is fast, reliable, accessible, and always on. The network is intelligent; capable of prioritizing and delivering all kinds of digital data wherever and whenever needed. It is secure; protected from malicious users and disruptive intrusions. Most importantly the network is completely transparent. Like the faucet and the phone, the "plumbing" and "wiring" are invisible.

A large part of the learning will continue to take place in a classroom but the definition of a classroom is clearly shifting. Virtual or physical, the classroom at EmilyU remains the focal place for many of our learning experiences and structures the modes and conditions for learning. The classroom brings instructor and student together and provides space, time, and tools for learning to take place. It shapes the presentation of information, the interaction between learners and instructors, and even the social dynamics between participants. Designers of the 'original' tech classroom experience—architects, technologists, instructors—codified a series of physical models (seating plans, stage areas and blackboard sizes, projection sight lines) to accommodate different delivery methods. The lecture hall, clinical lab, studio, and seminar room for example, are all physically sized, structured, and enabled with equipment and infrastructure to facilitate the room's primary purpose to the audience in attendance. The technology in the room has become much more pervasive and much more powerful; providing new ways to illustrate ideas, to interact

with information, and to improve the class discourse. More importantly the physical classroom with all these rich capabilities has become connected to resources on the network enabling a new dimension of learning interaction and content sharing.

### The Library Experience

Emily visits the library from her table in the cafeteria. She puts her tablet in *Library Mode*. She sees that one of her agents—the Technology Agent—has three new nanotechnology documents from a search she initiated that morning. Emily browses one of them and clicks for assistance. The reference librarian opens an active message channel and shares the document on Emily’s screen. They discuss the topic and collaborate to refine subjects, databases and keywords. Emily is able to view search screens as the librarian conducts them. All findings are tagged and instantly deposited in Emily’s personal library for future recall. Emily also sees new resource postings from her Advanced Literature Class. The two clips of scenes from Hamlet are required for viewing. She tags them into her task manager and resumes her reading of the articles from her search.

The library at EmilyU is a vast and endless supply of digital resources at her fingertips. More than a grand repository, this worldwide library is now mapped precisely to Emily’s learning perspective by using programmable views and a cadre of personal search agents. The search agents watch the journals, the press, news groups, and even monitor chat streams and class forums, flagging and connecting information and insights from Emily’s instructions. Emily’s search agents have worked with her for three years where she has continued to train and refine their algorithms. Working across dozens of databases, search engines, communication channels and information services, the search agents have become superb at tracking down certain kinds of information, making discoveries and connections. Emily now organizes resources like she manages her MP3 music files—licensing content; using it at will. Emily also subscribes to the reference service. She gets first call backs on her inquiries. She can view, print, play, share, and tag anything she pays for. EmilyU will manage it all.

### The Collaboration Experience

Emily consults with her study group for their class project. She places her tablet into *Collaborate Mode* and selects “Chemistry 104”. The list of 27 students in the class appears and she sees that three of them are online. John, seven miles away working at a ski lodge, indicates that he can share a few minutes and instantly links their systems to share a view of the project notes. They review slides from the class and see the professor’s comments in a frequently asked question embedded in the presentation. They hyperlink to an online journal to review an abstract of a recent study then choose to reference that data in their own charts. Another student joins and John leaves the group. Everything is recorded and shared. Later in the day, John will go back to the group’s work and see what was completed.

Emily enjoys collaborating. The collaboration chatter across EmilyU is a vibrant, constant, and surprising source of revelation and discovery. So many different voices, so many interesting ideas, so much to learn from. There are almost always experts available to consult. The learning is endless and fun. Collaboration at EmilyU is easy, spontaneous and comes in a dozen different formats. It carries structured and unstructured discourse; from Blogs, to IM, to threaded forums. The directories are always active, always on. Scheduled and unscheduled, the conversations are tireless. Set the mode and connect with anyone ready and willing to join. Share anything, everything. Draw, markup, annotate. Argue if you prefer. Someone is listening—each experience is uniquely preserved.

### The Remote Class Experience

Emily walks across campus to her “*Science, Technology, and Society*” course to participate in a field trip. She enters a small seminar room where 8 other students and a teaching assistant (TA) are seated around a high resolution display. She puts her tablet in *Remote Course Mode*. The display comes on with video of a robot in an automobile assembly plant along with class links to a briefing paper. Dr. Ruad is on a field visit with the other 5 students meeting with the human resource person from this automobile assembly plant. They proceed through a briefing and then observe as a robot welds a seam on the frame of a small truck. Video and real-time-telemetry are shared on the display. The professor comments on the procedures. The TA facilitates a dialog among the students and periodically



makes key notes. Emily has the full benefit of observing and participating because everything is recorded and preserved.

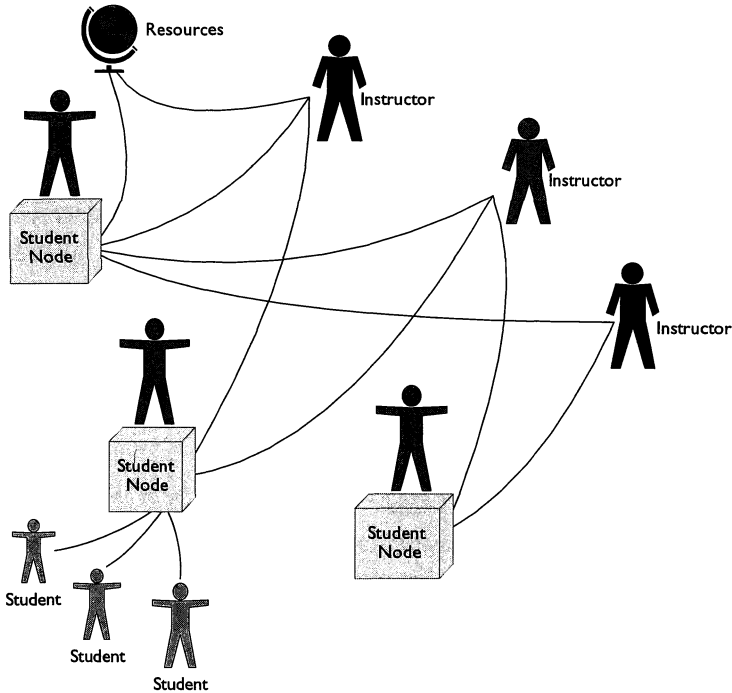
The classroom is anywhere—the manufacturing plant in Manheim, a clinic in China, a workshop in Wellington are all just a click away. Powerful communications technology at work in EmilyU has made it possible to ‘virtualize’ the classroom thus transforming any site into a place and time with tools for learning. Data teleconferencing, with synchronized multi-channel audio, video and visuals has become commonplace with bandwidth abundance. Additionally “Presence” technologies optimize sound and displays to take you there. For Emily the remote class expands her experiences far beyond the campus without leaving town. Recorded course sessions become chapters in Emily’s own learning journal, readily available for replay, review and remarks. Storage is inexpensive—a whole semester on a single optical disc (CD) or memory stick.

### The Personal Learning Experience

Emily returns to her residence to review and reflect. She places her tablet PC in *Review Mode*. A list of all her courses this semester appears on the screen with icons appearing beside each title that indicate if there have been any updates since she last visited them. She sees new material has been added and chooses to review her *Modern Literature* course. There are two video clips for her review. Emily selects and plays them back, annotating one section with one question she sends to the professor and another she will raise in class. Emily then reviews her class recordings from Tuesday; going over points, reading notes and links, book marking sections, watching tutorials and linking key concepts using one of several course map tools. Linked learning is easy this way.

When the hunting, gathering, collaborating and collecting of information stops, Emily wants a place to reflect, to digest and to organize. She works a full-time job. At EmilyU—flexibility is paramount. The learner must be able to shape the learning where and when needed. In the Experience System instructors and students ‘structure’ content and discourse on the fly. Emily is able to chunk a course into her own meaningful parts, parsing, conjoining, and linking the learning in ways only she could find meaningful. She forms the chapters, the sections, and objects of her learning and uses them at will. The instructor is writer, designer, and producer, but Emily directs the play.

Figure 2. The Personal Learning Experience



In the learning experience model each student is a “Personal” Node that connects to and organizes all learning experiences. All of the information and communications from all of the courses arrive and connect in one single place. In EmilyU, the student node is the ‘dynamic’ intersection of all these learning exchanges. The learning system synchronizes every step of every learning interaction across Emily’s learning. Emily can access the system chronologically or categorically or she can scan tags and personal bookmarks. Navigation is quick and simple.

### The Assessment Experience

Emily needs to know what she knows. She places her tablet PC in *Assess Mode*. A list of all her courses this semester appears on the screen with icons appearing beside each title. She chooses the “Take Test” icon for her English class. The tablet asks her to plug in her Webcam and shows a

video screen. She frames herself and the tablet in the picture then presses begin. The camera takes intermittent shots of her as she types out answers. When she is done, she submits the time-stamped test (with time stamped video attachment) to her course instructor. Emily consults her scorecard to see how she's progressing. Real-time results provide the key metrics of her learning. She can even forecast her grades by looking at alternative learning strategies. Complete documentation of her learning and assessment experiences provide a powerful portfolio for advising and career planning.

Assessment at EmilyU is continuous and mostly self-directed. Emily does not need to wait for scheduled tests or exams to measure her progress or comprehension. Several custom banks of tests are readily available to help her monitor her progress. Additional banks are programmed by her instructors for even more specific assessment. EmilyU is secure—the information is private. Students are continuously authenticated—in a variety of methods so resources and information belong to proper owners. Emily's instructors receive periodic notices of Emily's achievement scores. They can monitor the entire body of work—see her connected paths of learning—and make suggestions for adjustment and intervention. Emily's cumulative portfolio is a powerful reflection of her progress.

### *The Course Planning Experience*

Emily reviews her course plan. She sets her tablet into *Course Planning Mode* and sees the full catalog of courses in her degree program. She reviews the three course maps that she created with her advisor and evaluates her strategy and next steps. Her assessment matrices indicate qualifications for advanced courses and the list of electives tells her she still needs thirteen credits. Emily sees the costs of the remaining program and looks at delivery alternatives to see if she can moderate her course expenses.

At EmilyU there is a large catalog of courses, from multiple origins, delivered in a variety of ways. Classroom-based, online-based, and various blended models provide students with the flexibility to choose the best path for their learning. Courses are supplied by a variety of providers. Emily is a “mosaic student”. As Arthur Lendo, President of Pierce College defines it, mosaic students assemble their degree programs from a palette

of course parts from different owner organizations that use various delivery modes. Emily selects the best course; mapping instructional approaches that provide the fastest, most flexible and economical way to achieve her learning goals.

### *The Instructor in the Experience System*

Dr. Simms, Professor of Sociology sees 16 active student nodes in his 240 course. His dashboard for the class indicates that they have all completed the assignments and making B+ progress on their matrices. He prepares for his Thursday session and links three recently released reports with notes to the class. He retrieves his last presentation and proceeds to update the visuals with familiar desktop software and course publishing tools. His classroom(s) are now course creation systems because every presentation—all the interaction, all the visuals, the entire presentation—is captured and made a course resource. He can annotate (with text, audio, or video), index and link these recordings and seek student feedback on any topic.

Dr. Simms teaches more fluidly now. He is more connected and less compartmentalized in his exchanges with his students. The array of tools, places, and channels available to him expands and contracts depending on what he chooses to focus on. Dr. Simms can use a physical classroom or create a virtual one. He can generate new content or re-generate his best ideas. He can access and share information at one moment and collaborate in a physical or virtual space. The tools and practices remain the same.

## **FROM SYSTEMS DESIGN TO EXPERIENCE DESIGN**

The vision and possibility for distributed learning has changed a great deal in the last decade. In 1995, while designing the new “Classroom of the Future” building at the Medical College of Ohio, our project consulting team, consisting of architects, technologists, instructional designers, and facility planners, promoted the concept of the digitally integrated learning environment. The name and the makeup of the team reflected, most directly, the “facilities” bias in our thinking. Through the early nineties, the development of learning spaces was focused entirely on the advancement and optimization of the physical classroom. The project aimed to take the

best practices of facility and technical design and create advanced teaching spaces that enabled instruction with high technology.

In the decade that has followed, the first wave of computing and digital communications technology shifted this design focus, but only slightly. In this second era of design, technologists paid more attention to the data plumbing that goes in and out of learning spaces. Furthermore, applications, such as learning management systems, were introduced to instructors and students to access and use learning content as part of the class. Data communications technology, enhanced by communications on IP (Internet Protocol) networks, changed campus computing and created the opportunity to connect everything into one giant fabric of inputs and outputs. PCs proliferated on faculty desktops and computer labs. All learning spaces were put on the Internet. Classrooms, that had until then been reasonably endowed with video and TV capabilities, could now get access to the rapidly growing wealth of data resources on the LAN and from the increasingly relevant Internet. With a network connection and a PC in place, content and applications resident on the network could be directed for use in the classroom. Everything flowed in.

On the other side of campus, the studio classroom had taken hold. This specialty learning space had a different purpose altogether. It was designed to let the teaching from the classroom flow out beyond the walls. Designers of these particular programs, facilities, and infrastructures catered to the peculiar requirements of an emerging but still novel class of 'remote learner' and created systems and tools to let students participate at a distance. An entirely new design discipline centered on distributed learning came into focus that also created a class of studio instructors willing to work in a technically fortified environment for the benefit of the remote learner. Instruction became more structured to accommodate the technology of television formats.

In both cases, designers were tasked and preoccupied with creating teaching systems to suit an instructional methodology that was shaped by available space and technology. In each of these cases the vision obscured the concept of the learner.

### *The Experience Designer*

Experience shapes learning. The systems designer in education has the unique opportunity to shape learning experiences. Today, the learner is

increasingly and emphatically center stage in design. System designers today have a broader palette of technologies that they can apply and are rethinking the basic constructs of their methods and designs. My outlook, in particular has evolved to place the student's learning experience and the instructor's learning experience at the forefront of our systems thinking. The conduit of experience defines the design. Current frameworks have fused the concepts of in-class and remote learning and created a new distributed learning approach that blends delivery models into one continuum. Classroom delivery and distance delivery, previously in substantially different models, are now underscored by the same digital technologies. The confluence of thinking between practitioners of distance learning, e-learning, and traditional classroom delivery has created a distinctly integrated outlook; many of the principles guiding the design of systems and services for the 'remote learner' have found common ground for the campus learner and vice versa.

## **SUMMARY**

Scenarios, like the day in the life of a student with the Experience System (ES), provide educators, instructional planners, and designers with a broader vision of how instructional programs can be structured and digital technology can be applied. Consumers of education services require more flexibility and greater performance at lower cost. Instructors want a teaching and learning environment where tools and resources are integrated and aligned with their instructional practices and skill sets. Institutions need solutions that can respond to the full breadth of affordable and practical course offerings. A new delivery methodology that blends physical and digital systems design with a creative consideration of instructional programming is in order. To get there, program leaders first must create the opportunity to reflect on the legacy assumptions that underscore much of today's program development. Market expectations and realities are in a state of flux. The digital era creates more opportunity and broader participation but requires more innovation. A new vision for expanding distance and distributed learning environments through digitally integrated learning systems is in order.

## DISCUSSION QUESTIONS

1. The design and development of learning systems requires an interdisciplinary approach centered on learning behavior. What are the focal points and outcomes that systems designers and program creators must consider?
2. The blended learning model is becoming increasingly popular as digital technology becomes more pervasive and instructional models evolve to integrate “continuous interaction”. Discuss the teaching and administrative challenges associated with this model.
3. In EmilyU, the student moves much more fluidly through the learning programs. What are the advantages of this approach and how does it impact the current “compartmentalization” structure of university curricula?
4. What are the practical realities associated with providing a ‘learner-directed’ student model of distributed learning?





# Perspectives on the Future of Distributed Learning in Technology Education

## Chapter 13

Chris Merrill  
Illinois State University

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### INTRODUCTION

While distributed learning has been utilized in various forms for many years, recent technological and programmatic developments have enabled education to be delivered to virtually any place on land, air, and even space. With new technology, i.e., knowledge, process, and artifacts, institutions, educators, and students alike will be faced with many new challenges. The purposes of this chapter are not based on the latest and greatest hardware and software configurations, but rather the trends, conceptual framework, and issues surrounding distributed learning in technology education. This chapter is designed to provide assistance to the technology education field as they plan, use, and assess distributed learning for technology education purposes.

In the early 1980's how many of us fathomed the full extent or use of emerging instructional or educational technology as a means of teaching for the future? Certainly the use of the personal computer was on the rise, but how many of us thought about the future of learning as being distributed via the World Wide Web, satellites, etc.? In 1983, Sam Gibbon was forecasting the future of electronic learning, more specifically the future of distributed learning. Gibbon was correct, or maybe idealistic, when he wrote:

ultimately, and ideally, the user will be able to create the electronic learning environment by selecting from among the available components, that combination which is the most appropriate to the learning task and most congenial to the learning style of the user (Gibbon, 1983, pp. 3-4).

Gibbon based his distributed learning forecast on the following characteristics: (a) distributed learning environments will be responsive and flexible to the learner's actions; (b) a distributed learning environment will possess text, images, sound, and be visually pleasing; and (c) a distributed

learning environment will be dynamic, an environment able to communicate with varying environments simultaneously.

During a more recent series of studies and research projects on distance/ distributed learning, the American Council on Education described distributed learning as one of the most complex issues facing higher education institutions today and for the future. Distributed learning environments will raise financial challenges, change traditional teaching and learning roles, and possibly change the current mission of learning as we currently know it (American Council on Education, 2001). The future of distributed learning does not rest in the traditional mission and operation of today's educational institutions. The future of distributed learning is not a "size ten shoe" that most people fit into, but rather an exciting opportunity for more effective learning, initiated partially by new technology and the prospect of reaching more learners. One thing that is certain about the future of distributed learning is that it will be in a constant state of fluctuation.

## **DISTRIBUTED LEARNING: CURRENT AND FUTURE TRENDS**

### *The Private Sector and Educational Institutions*

Educational institutions are usually on the tail-end of new technologies, updating infrastructures, etc., all of which are beyond the scope of this chapter. However, an examination of literature revealed that for once, education is not running a distant second to the private sector, i.e., business and industry when it comes to e-learning/distributed learning. In a recent research study, Hequet (2003) discovered that business and industry are faced with some of the same difficulties as educational institutions. Hequet noted that only 20% of businesses in the United States used e-learning/distributed learning even four years ago, and the number one reason was initial cost. The private sector, similar to the multitude of educational institutions offering partial or complete degrees through a distributed environment, see the future of distributed learning being influenced by technological change, increased global competition, the

need to increase learning efficiency and effectiveness, and overall productivity (Guglielmino & Guglielmino, 2001). There are similarities associated with current and future trends between and among technology education institutions and the private sector in regard to distributed learning:

1. Learning is [and will be] self-managed;
2. Content is [and will be] individualized instead of predetermined;
3. Application of learning is [and will be] primarily immediate, rather than delayed;
4. Learning is [and will be] primarily independent or interdependent rather than dependent; and
5. The cost to the organization is [and will be] reduced (Guglielmino & Guglielmino, 2001, p. 3).

## **EDUCATIONAL TRENDS**

Current trends and delivery platforms in distributed learning were made possible by the advancement of technology (e.g., network capabilities and connection speed, personal digital assistants (PDA), access to the World Wide Web, cellular telephones, satellite technology, Internet Protocol (IP) conferencing, etc.). Today it is not uncommon for technology educators and students to be interacting with Web cameras, Web casting, videoconferencing, and “beaming” information in a distributed learning environment. These technological processes and artifacts have advanced in ease of speed, use, durability, cost, size, and options. Eastmond (2001) stated that “wireless technology has the potential of breaking through economic, cultural, and political barriers worldwide to bring knowledge opportunities to the most isolated and economically disadvantaged communities” (p. 117).

On the cutting-edge of distributed learning in educational paradigms is the use of virtual environments. The virtual environment allows the user(s) to interact with a plethora of mediums in real time, regardless of geographical location. Virtual environments, according to Bouras, Philopoulos, and Tsiatso (2001) “combine the best features of real-world information navigation—memory of places and visual cues—with the best features of online navigation—fast searches, sorting, and quick cross-referencing” (p. 175). Several approaches to using virtual environments for

distributed learning include: (a) multi-user, (b) collaborative, (c) learning virtual environments, and (d) immersive virtual environments, all of which have a more realistic experience than virtual reality (Bouras, et al., 2001).

A multi-user environment is based on a connected network of multi-users independent of location. The multi-user environment is solely aimed toward communication, similar to chat rooms, instant messenger, and e-mail communications. The aim of a collaborative environment is to provide an environment where information is shared collaboratively with other users. An application to this approach would be training. The learning virtual environment is similar to the multi-user and collaborative environments, but its focus is mainly synchronous and asynchronous learning. In the learning virtual environment, users can graphically show gestures, movements, and sound on the desktop of a computer screen. The immersed virtual environment utilizes technological artifacts like data gloves and head mounted displays to communicate and interact with other users beyond the interaction on the desktop of a computer screen (Bouras, et al., 2001).

Virtual environments may not be fully comprehended in text form, nor explained in terms of all the requirements needed, but imagine sitting at a computer, using your handheld device, or cell phone and virtually walking through the school doors and into the classroom. On the left is a room for asynchronous or synchronous communication with other classmates or the instructor, to the right is a room that contains library resources packed with text, audio, and video-based information. Another room contains artifacts and yet another contains machines and tools to use. Students enter the room that they select for their learning. Inside the room are activities and lessons that help the student gain knowledge and skills. The student stays in the room for a period of time and begins to start interacting with various other rooms in the environment. This may seem farfetched, but this type of environment currently exists in a learning center among Austria, Greece, Italy, and the United Kingdom. The aim of the center is to enable international social contact between students and teachers (Bouras, et al., 2001). This type of environment is central to the theme of distributed learning, which Kochtanek and Hein (2000) described as focusing on learning experiences and resources in support of student interactions. In a similar learning environment, a Web-based pro-

fessional development tool was developed for in-service and pre-service mathematics and science teachers called the Inquiry Learning Forum which is housed at Indiana University's Center for Research on Learning and Technology (Barab, MaKinster, Moore, & Cunningham, 2001).

## DESIGN

Designing distributed learning environments involves many different dimensions. One of these dimensions is design. The type of design being referred to is not which type of software or technological artifacts that are being used, but rather the design of an interactive, learner-centered environment. Distributed learning environments are a shift from the didactic approach of teaching and learning to one that is learner-centered, interactive, and multi-faceted. Distributed learning environments should provide the learner with the options to learn and explore the content or skills that are needed to fulfill course goals and objectives. Before designing a distributed learning environment or instructional course, several questions need to be asked and answered by all parties involved and invested in distributed learning environments. These parties include the teacher and other faculty members, administrators, and support staff, all of which guide the design of the environment:

- Who wants or needs to take this course;
- Where else can they take this course;
- How does this course meet a currently unmet need for this type of instruction;
- How can the targeted audience be made aware that this course is being offered; and
- How is this course equal or superior to any other similar course offering? (Porter, 1997, p. 86).

Using an analogy of the 1989 film *Field of Dreams*, Nelson, Bueno, and Huffstutler (1999) identified four phases that a multimedia/distributed learning environment should encompass before designers “build it and believe students will come”:

1. Usability—learnability, efficiency, memorability, and user satisfaction;
2. Input from users;
3. Field testing; and

4. Revising (pp. 270–282).

These four phases of design criteria are not earth shattering, but need to be at the forefront of designing a distributed environment. One of the biggest pitfalls for teachers and all other parties involved in designing and implementing distributed learning environments is that they do not field test and obtain input from their constituents.

Porter (1997) developed a list of criteria for teachers to consider when designing a distributed learning environment. The distributed learning environment:

- Provides the tools that learners need when they need them;
- Is conducive to learning;
- Is built upon sharing and exchanging information;
- Is designed in such a way to allow students to experiment, practice, and apply what they have learned;
- Facilities evaluation of performance is readily understood and accessible; and
- Provides a safe haven for learning (p. 24).

One could also look at this list as the criteria for a face-to-face class, and would not be wrong. The underlying criteria, or bottom line, is that the design of a distributed learning environment must be built on sound pedagogical skills—today and for the future.

In an attempt to discover what and how students experience in a distributed learning environment, Petrides (2002) conducted a research study that focused on designing learner-centered experiences in a Web-based distributed course. Petrides concluded that students felt the distributed learning environment provided them with more access to the instructor and fellow classmates than the traditional face-to-face class, additional benefits of a virtual environment when interacting with mediums, and an option to build upon class experiences. There are several other research studies that also offer similar student conclusions or were aimed at discovering student interactions in a distributed learning environment (Bonham, Beichner, Titus, & Martin, 2000; Hargis, 2001; Jones & Paolucci, 1999; King, 2002; Leonard & Guha, 2001; Whitis, 2001, etc.).

Kahn (1998) summarized Web-based instruction learning environments to include the following features of design, which, again are trans-

ferable skills and knowledge to distributed learning environments: multi-media elements; device, distance, and time independence; global accessibility; worldwide uniformity; online resources; cross-cultural interaction; multiple expertise; learner control; convenience; authenticity; a non-discriminatory environment; cost effectiveness; collaborative learning; formal and informal environments; and virtual cultures. Multiplicity may be a good construct to describe Kahn's list.

Multiplicity in a distributed learning environment, however, goes beyond a list of design features. Multiplicity is a key feature of distributed learning environments. Levin, Levin, and Waddoups (1999) described multiplicity as having four distinct categories or stages:

1. Learning in an online class;
2. Learning by implementing work in the classroom;
3. Learning through simulations; and
4. Learning with informal groups (p. 259).

Thus, true distributed learning environments include interactions between and among various design elements.

Designing distributed learning environments is not an easy task. Technology educators will have to rely on a myriad of constituents to help make decisions regarding the efficacy of teaching in this type of environment. Designing a rich, interactive, distributed learning environment involves not only a shift in pedagogical skills, but skills beyond the "norm" of teaching and learning. To help understand the skills needed for the future, we need to investigate the learning approaches and learning theories associated with technology education and distributed learning.

## **DISTRIBUTED LEARNING APPROACHES AND THEORIES**

"The goal we want to achieve for our learners is to continuously improve the quality of the learning process" (Mantyla, 1999, p. 14). How do technology educators reach this goal? Through a review of related literature, three approaches or theories associated with distributed learning environments became evident: interactive model, constructivism/cognition, and problem-based/resource-based learning. Below is a synthesis of

each approach and/or theory. There is no “best” approach or theory for every technology education institute to infuse and/or implement when designing distributed learning environments, but you may discover an approach that may fit your mission more than another. It is strongly advised when reading these approaches that technology educators try to construct a “best of” model that would most properly be used at their educational institution, taking into account the user (student) and the goals of the technology education program.

## **INTERACTIVE MODEL**

Vygotsky (1935, 1962, 1978, 1981) emphasized that the learner’s framework is developed through interactive activities. The five basic principles of this theory are: (a) the hierarchical structure of the activity; (b) object-orientedness; (c) internalization/ externalization; (d) mediation; and (e) development. Hassan (as cited in Crawford, 2001) described that each of Vygotsky’s interactive principles folds directly and neatly into distributed learning.

Without carefully designed interactive activities to offer meditative opportunities for the learner to develop an understanding, a hierarchical structure of activity, internalization/externalization, and an understanding of a forming conceptual object the learner cannot fully comprehend the knowledge imported and cannot further develop the higher order thinking skills associated with the conceptual nature of information. Therefore, interactive activities must be carefully designed and integrated into the distributed learning environment (p. 2).

To enable or bring Vygotsky’s interactivity model to life, Crawford (2001) listed ten interactive activities students and teachers encompass that not only satisfy Vygotsky’s activity model, but the scope of distributed learning environments:

- learner and content—integration of content into a conceptual framework;
- learner and interface—a clear learning environment that helps learners acquire information;



- learner and instructor—facilitation of communication and information;
- learner and learner—collaboration between and among a community of learners;
- learner and self—metacognition;
- learner and community—learners interact on a professional manner with members of the learning community in formal and non-formal settings;
- instructor and community—similar activities as the learner and community activity;
- instructor and content—ability to change, update, alter, etc. distributed learning environment content and activities;
- instructor and interface—skills and knowledge needed at the beginning of the design process of a distributed learning environment; and
- instructor and self—similar activities as the instructor and interface activity (pp. 2–6).

Each of the ten interactive activities mentioned above are critical to the success of a distributed learning environment. The ability of the learner and instructor to integrate knowledge and skills is an imperative aspect of the activity model. Regardless of the approach that technology educators initiate, facilitate, and implement when designing a distributed learning environment, a successful “plan of attack” requires a great deal of thought to ensure appropriate learning and opportunities for learners.

## **CONSTRUCTIVISM AND COGNITION**

Constructivism has been defined by many educators and educational theorists, (Biehler & Snowman, 1997; Von Glaserfeld, 1989; Wiggins & McTighe, 1998; etc.) but stems from the work of Piaget. Piaget viewed learning as the accommodation and assimilation of new information based upon previous experiences of the learner. A distributed learning environment may be best categorized by constructivism where a learner moves through various material and constructs knowledge about what they encounter or learn to meet course goals and objectives. As the learner encounters new experiences, a mental framework of knowledge and skills begins to assimilate (Smith-Gratto, 2000).

A distributed learning environment that is based on problem solving and active learning is central to the constructivist view of learning. Problem solving and active learning in a constructivist approach involves the learner in a process of informed decision making by reading, doing, listening, and watching. Crampton (1998) stated “couched within a constructivist pedagogical perspective [distributed learning] offers a highly interactive, inquiry-based educational experience” (p. 4).

Similarly, DeMiranda and Folkestad (2000) in their studies of cognitive science and technology education discussed that when instructional materials are designed with cognition or active learning in mind, students integrate knowledge using various schema to acquire and learn knowledge. DeMiranda and Folkestad discussed that cognitively-based models possess three elements: (a) active engagement and processing; (b) reflection on learning; and (c) provide for communities of sharing. In distributed learning environments, distributed cognition implies an iterative interaction and connection between and among knowledge, skills, and artifacts; a feeling that the whole is greater than the sum of the parts (Dillenbourg, 1996; Pillay & Elliott, 2002).

## **PROBLEM-BASED AND RESOURCE-BASED LEARNING**

Problem-based learning may be categorized by four elements: activation of prior learning; authentic learning; discussion and reflection; and no top down structure from the teacher to the student (Friedman & Deek, 2002). Similar to constructivism, problem-based learning is student-centered, interdisciplinary, authentic, and reflective in nature. Typically in this approach, students are presented a problem in the early stages of a course or unit of study or a series of problems throughout the course structure. These problems are not solved on the first day of study, but rather require the uncoverage of material. Problem-based instruction relies on the student to analyze and frame the problem in a self-contextual and/or motivating setting. Based upon the knowledge and skills of the student, the problem or problems are attempted to be solved. The distributed learning environment in the problem-based approach is established to provide the student with opportunities to solve problems through various forms of media and interaction between their peers and instructor.

In a distributed learning environment, resource-based learning encompasses static (print-based), dynamic (Web-based), contexts (real and virtual), external contexts (teacher and peers), tools (to enable and organize), and scaffolding (learner decided importance) resources. These resources attempt to enable or provide the student potential in learning and understanding course material, providing cultural perspectives and interpretation (Hill & Hannafin, 2001).

A resource does not simply “tell” in a singular or specific sense but provides information to be engaged and interpreted by the student. Meaning is influenced more by the diversity than the singularity of the perspectives taken. Multiple resources are accessed and interpreted for meaning, evaluated for veracity and utility, compared with competing perspectives, and acted upon (Hill & Hannafin, 2001, p. 40).

The resources available for learners and instructors in this model or approach offer potential to support and augment the learning process in a distributed learning environment, both in static and digital formats. Technology educators will have to critically examine the resources that they provide learners within this environment to ensure the course goals and objectives will be met and to provide the learners with opportunities to expand upon their current knowledge base. In order to place teaching and learning models at the forefront of distributed learning environments, we will turn our attention to teaching and assessment strategies and/or tips that can be used today and for the future.

## **DISTRIBUTED LEARNING ENVIRONMENTS**

### Strategies

While distributed learning is the focus of this yearbook, a plethora of related literature exists on specific constructs, i.e., online teaching and learning, Web-based teaching, communities in cyberspace, etc., (Collison, Elbaum, Haavind, & Tinker, 2000; Ko, & Rossen, 2001; Palloff, & Pratt, 1999; Sanders, 2001). All of these specific approaches are interrelated in the distributed learning environment and need to be explored and understood by the technology educator. For example, Hanna, Glowacki-Dudka, and Conceicao-Runlee (2000) developed a list of 147 practical tips for teaching online groups. Most, if not all, of the tips that these authors

offered can be comprehended easily by sound pedagogy. However, after an examination of these tips, five came to the forefront for technology educators to consider for the future:

- Recognize the absence of physical presence—in a face-to-face class, the instructor can easily present information or make a comment about content or an assignment and will usually receive instant feedback from the learners. In a pure online or distributed learning environment where the instructor might post or send a message without the learners being online at the same time, a misinterpretation of information may occur. Technology educators have to be careful to clearly communicate and anticipate what the learner needs to know.
- Establish the preferred class size—an online or distributed learning environment is not the same as a pure face-to-face environment. Smaller class sizes are needed to ensure all learners receive the attention they deserve. It is often misunderstood by some educators and administrators that because there may not be a physical location for the class, an unlimited amount of students can be added to the course. Technology educators have to evaluate and assess their personal strengths and weaknesses when determining how many students they can “handle” when implementing a distributed learning environment.
- Define your role—In an online or distributed learning environment, the technology educator will need to decide how and to what extent they will play. Your role will be determined by your teaching philosophy and pedagogical skills.
- Design strategies to introduce learners to each other—It is possible in a distributed learning environment for the learners to be self-sufficient and not interact with students; this approach is not advocated and does not relate to sound pedagogical skills, but nonetheless is possible. Technology educators have to develop tools and or strategies for involving students with one another. One example of making sure students introduce one another to the rest of the class and interact on a regular basis is to create periodic lessons or team-building activities that enable communication between learners.
- Understand that you are not the only one who feels a little overwhelmed once in a while—as technology educators readily know and understand, technology, especially communication technologies involve change. Learners and instructors can become overwhelmed

with the distributed learning environment; this phenomenon will always continue. Technology educators have to develop strategies to minimize becoming overwhelmed in a learning environment that is constantly changing. There is no “best way” to accomplish this task, but a situation that needs to be solved on a practical, self-rewarding basis.

For some technology educators creating distributed learning environments, these five tips may seem obvious, but for others, especially those creating their first distributed learning environments, these may be overlooked.

Technology educators have to determine how to create effective distributed learning environments that offer students an enriching, intellectually developing experience. Moore, Kim, and Esser (2002) developed a list of questions that they asked and answered when developing their Web-based classes, which can also be asked and answered in a distributed learning environment:

1. Why do students take Web-based courses?
2. What are the characteristics of students enrolled in these courses?
3. What do they expect from Web-based courses?
4. How do they perceive and experience the course? and
5. How satisfied are they with Web-based courses? (p. 204).

These questions and answers are critical for technology educators because they need to be addressed to successfully implement sound pedagogical strategies. One thing that is certain about Web-based or distributed learning environments that has a clear answer is pedagogy.

Electronic pedagogy is not about fancy software packages or simple course conversion. It is about developing the skills involved with community building among a group of learners so as to maximize the benefits and potential that this medium holds in the educational arena (Palloff & Pratt, 1999, p. 159).

### Assessment

Technology educators are used to assessing students in the classroom and laboratory utilizing both formative and summative approaches. How is assessment accomplished in a distributed learning environment? What characteristics of assessment do learners expect and need? One assessment

approach in a distributed learning environment is to utilize competence-based assessments. In this approach, the technology educator would rely on formative assessment strategies to provide the learner with feedback in order to master or have competence in a skill or attainment of knowledge before moving onto another skill set or knowledge acquisition adventure.

Another approach to assessment may be one of a contract between the technology educator and the learner. In a contract-type of distributed learning environment, the learner controls the pace of their own learning needs. The technology educator would have to provide formative assessment strategies to facilitate and guide the learner throughout the contract, which would help steer the learner in the right direction of meeting course goals and objectives.

A third assessment approach that technology educators may utilize is to rely on self or peer assessment. In this approach, learners are assessed by not only their peers, but also the work that peers submit and share in the distributed learning environment. For example, the technology educator may assign a timeline of technological inventions and inventors to be completed. Once completed, the projects are shared and reviewed by the learner's peers. The learner could certainly assess him/herself based upon other student work.

A fourth approach that may work in the distributed learning environment for technology educators is the holistic approach. This assessment strategy utilizes case studies, scenarios, projects, etc., that can be based on formative and summative assessments.

A fifth, and possibly the most useful, assessment strategy in distributed learning environments is authentic assessment. Authentic strategies rely on the engagement of real life experiences and problems. Utilizing authentic assessments permits the technology educator to determine higher-level thinking in applied settings.

Distance or [distributed learning environment] learners are more dependent upon effective, early communication of assessment requirements, together with well-designed and cohesive assessment tasks, useful and timely support, and a transparent marking scheme that explains how judgments are to be made. They are also more dependent on rapid turnaround of assignments, so that the feedback can contribute to subsequent efforts and help maximize the valuable formative function of assignments (Morgan & O'Reilly, 1999, p. 22).

In addition to assessments during the class, an assessment tool must be used at the end of the class to provide the technology educator with the perceptions that students hold about their experience. Sound pedagogical skills would inform a technology educator that feedback from students is needed throughout the course by the learner, so that the technology educator could adjust the distributed learning environment. In the end, however, an assessment must be made about the course. Below is a list of “satisfaction” types of statements Mantyla and Gividen (1997) developed that technology educators could utilize to determine the effectiveness of their distributed course. How was the learner satisfied with:

- Achieving learning objectives;
- Enjoying the learning experience;
- Knowing how to apply the subject content to work and personal applications;
- Feeling comfortable asking questions;
- Getting answers to those questions;
- Being comfortable in the learning environment;
- Understanding how to use the technology;
- Participating in an active learning experience;
- Being able to use supporting materials in an easy-to-use, self-directed format; and
- Getting support from the site facilitator [instructor] (p. 134)?

Assessment in a distributed learning environment is multi-faceted. Technology educators teaching in distributed learning environments will most likely utilize all of the assessment strategies discussed here in part or in whole. Most importantly, however, is for the technology educator to design their assessment protocols with all users in mind, be clear in their expectations of the students, and provide a mechanism for feedback.

## **THE FUTURE OF DISTRIBUTED LEARNING**

Throughout this yearbook you have discovered that distributed learning is multi-dimensional, made up of educational institutions, the private sector, design, theories and approaches to structuring environments, strategies for implementing a distributed learning environment, and

assessment strategies that can be utilized for not only students, but for the technology education teacher. There are, however, several issues that exist or questions that still need to be answered for the future of technology education in a distributed learning environment: (a) What does the future hold for distributed learning environments and technology education?; (b) What are some of the emerging technologies that students and educators will use and interact with in a distributed environment?; (c) How will the hands-on approach of technology education work or survive in a distributed environment?; and (d) With the depleting amount of technology teacher education institutions in the United States, will colleges and universities collaborate and offer distributed content between campuses?

One current and future trend that will need to be addressed in technology education institutions is whether they are committed to a competitively strong market; to position themselves to capture the cost and demand of distributed learning, utilizing a myriad of delivery systems. If so, institutions will have to address the following questions outlined by the American Council on Education (2001):

1. Speed—how quick is the response of change?;
2. Money—how much is available and who controls it?;
3. Talent—does our institution have it?; and
4. Alignment—how does distributed learning fit within the mission, scope, and sequence of our institution (p. 13)?

Examining the future technological artifacts or emerging technologies that educators and students will utilize in a distributed learning environment is not as difficult as once imagined. In addition to traditional technological artifacts used today in a distributed learning environment, students and teachers will use cellular telephones, personal digital assistants, and tablet-style personal computers to connect to networks, receive and send e-mail, browse and download information from the World Wide Web, and edit documents and projects on the fly. The physical size of these artifacts has become and will continue to become smaller and more portable, connection speeds will be faster, pen and paper features will be better integrated, and the synergy between technologies will become virtually seamless. With the addition of wireless networks and wireless access



points, learning atmospheres are not, and will not, be bound by the classroom, but accessed by walking down the road, sitting in a coffee shop, or visiting a friend's home.

Designing and building hands-on projects is one of the cornerstones of technology education. One of the biggest challenges in a distributed learning environment for technology education will be the assigning, supervision, and collection of hands-on artifacts. Hands-on projects have been easily accommodated in today's labs, but imagine assigning a project to a group of students across the country. How will you know if students actually designed and built their project? Who will supervise student work? How will the artifact be delivered to you? These issues are very real in the technology education field. However, rather than look at these issues as problems, technology educators will need to look at these issues as opportunities.

With the growing use of digital cameras and digital video cameras, students will be able to upload their work (designs and artifacts) to a network and share it with their peers via the World Wide Web. Supervision will take place between technology education partners. School districts, colleges, and universities will establish "open-lab" formats for students to design, build, and test hands-on projects. Finally, technological artifacts that have to be delivered to a particular site will be shipped. These steps are not too futuristic, in fact they are already being implemented in places like Illinois State University, Ball State University, and Valley City State University. The assigning, completion, and distribution of hands-on projects does not have to be dismissed in a distributed learning environment, but the partnering and collegial cooperation between partners must be established.

Collaboration between and among colleges and universities should be established in technology education for a distributed learning environment. Imagine being able to take a class or have a guest speaker from a university or college that focuses on appropriate technology, another campus that has expertise in integrated studies, and yet another that emphasizes teaching methodology or is known for their pedagogical skills. Moreover, it would be more beneficial for the student to have multiple areas or contacts of expertise from around the country or globe. The future of distrib-

uted learning is predicated on the fact that students will need to participate in a knowledge-based economy for social and economic development. Students will need new avenues or learning opportunities to acquire the skill sets, roles, and relationships of the future.

The traditional educational model, based primarily on the concept of the school and the teacher in a classroom as islands, standing alone and not interconnected with society or other educational institutions, will not generate competence in a knowledge society (as cited in Palloff & Pratt, 1999, p. 166).

## **DISCUSSION QUESTIONS**

1. What are the relationships between and among the private sector and technology education institutions regarding the development and assessment of a distributed learning environment?
2. How will trends in education affect distributed learning?
3. What would the design of a distributed learning environment entail? What would this environment look and act like? Would this environment be different than a face-to-face learning environment?
4. What approaches and theories are utilized in a distributed learning environment? What are the pros and cons of each?
5. What kind of instructional strategies are needed in a distributed learning environment? How would these strategies be assessed?
6. How are learners assessed in a distributed learning environment? Would these assessment practices be the same in a face-to-face class?
7. What does the future hold for distributed learning? How will the impact of technological artifacts change learning?

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