ONLINE COURSES AND ICT IN EDUCATION: EMERGING PRACTICES AND APPLICATIONS

Introduction

This newest volume of Advances Series introduces readers to a variety of novel and promising technologies employed in today’s online environment. It covers various social networking tools, learning management platforms, content management tools, online and interactive content delivery methods, virtual assessment methodologies, and emerging applications. The text should be an excellent addition to your personal and professional library of resource materials for online and distance education.

Online Courses and ICT in Education has been organized along an instructional system design model introduced in Designing Instruction for the Traditional, Adult, and Distance Learner: A New Engine for Technology-Based Teaching (Tomei, 2010). In this book, a new paradigm for designing, developing, implementing, and assessing technology-based instruction was proposed and is rapidly gaining acceptance. It addresses three target populations of today’s students: traditional, adult, and distance learners and provides an excellent structure for examining the chapters presented herein.

Introducing the Engine for Technology-Based Teaching

The Engine for Technology-Based Teaching (Figure 1) proposes a new model of instructional system design (ISD) for developing effective technology-based education that involves a five-step process focusing on the learner, learning theories, resources, delivery modalities, and outcomes. A variety of ISD models have been developed since the initial military ISD model came into wide spread acceptance in the 1940’s. The ADDIE Model, perhaps the first and arguably the most popular ISD model, presents the five basic phases of most ISD paradigms although terminologies may differ. Most ISD models propose an analysis phase followed by design, development, implementation, and evaluation. The ASSURE model is another widely accepted prototype for designing lessons. The acronym conveys the importance and inter-relationship of the six major steps in the design of lessons: A Analyze learners, S State objectives, S Select media and materials, U Utilize materials, R Require learner participation, and E Evaluate/review. With the millennium came the recognition of the shortfalls of these past models. For the 21st century educator, evolution was replaced with revolution as technology sought to impact the classroom. And, as in the past, this change, too, was to precipitate yet another new model for instructional design.
In a *Theoretical Model for Designing Online Education in Support of Lifelong Learning*, the author suggested an engine for designing online education concentrating on the critical elements of delivering instruction at a distance (Tomei, 2007). The model began as an idea for designing online instruction. As the theoretical underpinnings of the engine came into sharper focus, it was apparent that a new prototype paradigm was being offered as a methodology for designing instruction using the ISD process. The concept of a systems approach to designing instruction is based on a “30,000-foot” view of the teaching and learning process. It is characterized by an orderly gathering and analysis of collective and individual learning outcomes and the ability to respond to identified revisions to established learning goals. The application of a systems approach to instruction insures that academic programs and the required infrastructure that supports them are developed in an effective and efficient manner and continually revised and updated in a manner to match the variety of needs in an ever rapidly changing environment.

A further explanation of the Engine is provided and the subsequent chapters in this book are organized with respect to their logical connection to the five-step model.

**Focus on the Learner**

Educators who focus on the learner have traditionally advanced three schools of educational psychology subsumed under the general heading of *pedagogy*: behaviorism, cognitivism, and humanism.

The first school spotlights behaviorism and the groundbreaking work of Ivan Pavlov and B.F. Skinner and the natural sciences. Learning, to the behaviorist, results from a series of closely tied events that
links stimuli to its consequences. Reinforcing responses through reward and punishment is the key to changing behavior. By positively rewarding desired behavior and negatively reinforcing (or punishing) inappropriate behavior, learning occurs. Truly, online learning has its roots in behaviourism and the early pioneers of programmed instruction, computer-assisted instruction, and computer-managed instruction.

Cognitivism views the individual as an active agent in their own learning. For learning to occur, thinking (i.e., cognition) must be internalized and is therefore subjective, understood and highly dependent on context. Individuals are born with a penchant to organize their thinking processes into schemes – the basic building blocks of thinking. Through an organized system of actions or thought, learners mentally transpose new objects and events in the world and either add them to their existing knowledge or design a new explanation for the context. Cognitivists would argue that learning management systems – those used in the delivery of online education – manage information rather than knowledge since knowledge is dependent on the individual who assigns meaning to knowledge that they have obtained through their own experience.

Finally, humanism represents, chronologically at least, the newest of the schools of educational psychology. How a person feels about learning is as important as how the person thinks or even behaves. Advocates describe behavior not from the viewpoint of the teacher as do behaviorists but rather from the vantage point of the student who is performing the activity. Humanists recognize two parts to learning: the acquisition of information and the personalization of information. According to the humanist, teachers often mistakenly assume that students will learn the subject matter if it is properly organized and presented. To them, it is the individual who instills meaning into the lesson. The dilemma in teaching is not how to present subject matter but how to help students derive personal meaning from the information.

Knowles’ (1984) theory of andragogy redefined the previously child-based perception of learning. Unlike children, adults learn experientially using their considerable practice, knowledge base, and problem-solving skills. They must know why they need to learn something and they learn best when that topic is of immediate use. For the most part, adults approach learning as self-directed and expect to take at least some responsibility for their own learning. Adults expect that the learning environments fashioned for them accommodate these fundamental aspects of adult learning. In practical terms, andragogy focuses more on process (how we learn) and less on content (what we learn). Strategies include case studies, role playing, simulations, and self-evaluation – all of which are enhanced using many of the technologies of the 21st century.

Specifically for the online learning environment, the current (i.e., 2000 – present) research base has expanded to identify qualities inherent to successful distance learners. Campbell (1990) examined the success rates of distance students and discovered that certain common characteristics seem to lend themselves to success at a distance. Others, typified by Holmberg (1995) discovered a non-homogeneous population with respect to demographics of distance students. Regardless, research does contribute some broad demographic and situational parallels that help educators profile the ‘typically successful’ distance learner. The term allagegogy has surfaced in the literature to describe the ability of contemporary learners to work independently or in a group, complete assignments and readings with minimal supervision, write in a clear and articulate manner, manage time, learn using different delivery formats, and work with technology tools (Lehigh Carbon Community College, 2006).
Chapters Pertaining to a Focus on the Learner

- Chapter 1, *Factors Influencing Students Intention to Take Web-Based Courses in a College Environment*, by Hamid Nemati and Marcia Thompson, further defines the shift in the long accepted paradigm of understanding how students learn and introduces the question of what influences a student’s decision to learn in an online environment. Their study suggests that individual learning styles, student self-efficacy and self-regulation vis-à-vis learning, and learner expectations regarding online classes are all factors in their decision whether to take online college courses or remain with the traditional, face-to-face modality.

- Chapter 2, *Computer-Mediated Communication that Brings Learning into the Present: Gender Differences in Status Differentials and Self-Disclosure in Online Peer Teaching*, by Seward, Harvey, and Carranza, pair students using e-mail technology in a peer-teaching environment. The authors present the results of their study comparing computer-mediated communication that was not part of a discussion group or chat room to reveal that males and females did not differ in frequency, length or use of social incentives. University affiliation, it was determined, was found to be more significant than gender in the amount of self-disclosure.

- Chapter 3, *Using the Social Web Environment for Software Engineering Education*, by Kamthan, sought to examine software engineering education in light of the technologies used from a human and social perspective. The paper offers its readers a systematic approach towards integrating the Social Web environment (including technologies and applications based on those technologies) in software engineering education, both inside and outside the classroom. Practical examples are offered to examine the potential prospects of such integration and related concerns resulting from their use.

- Chapter 4, *Girls and Computers - Yes We Can! A Case Study on Improving Female Computer Confidence and Decreasing Gender Inequity in Computer Science with an Informal, Female Learning Community*, by Heo and Myrick, looks to suggest ways to increase the awareness of female students with regard to Computer Science (CS) as both a major and a career field. Students from a high school were voluntarily recruited for a computing club curriculum for one academic year and participants were introduced to various technologies in hopes of increasing their computer confidence. Collaboration preferences, perceptions of gender differences, self-reflections, and increased knowledge of the respective field were examined.

Focus on Learning

Traditional learning domains found in the literature include the cognitive, affective, psychomotor, and interpersonal domains. Coupled with highly engineered classification systems called taxonomies, these tools lead to more effective online instruction. Educators employ the taxonomy to classify their learning objectives into increasingly more complex outcomes. Historically, the more popular taxonomies have addressed a broad representation of educational objectives including the cognitive, affective, and psycho-motor domains. Recently, instructional technology has adopted its own taxonomy.

The most famous classification is Bloom’s exposition for the *cognitive* domain (see Figure 2). In his *Taxonomy of Educational Objectives* (Bloom & Krathwohl, 1956), Bloom developed six progressively complex steps of cognitive development (Figure 2) that include: knowledge, comprehension, application,
analysis, synthesis, and evaluation. In 2005, Tomei offered the taxonomy for the adult learner. Dubbed the K-A-RPE model, learning objectives are scaled progressively higher beginning with knowledge and application and extending to research, practice and evaluation (Figure 3). In his final iteration of the taxonomy for the technology domain (see Figure 4) the author encompasses six hierarchal levels of literacy, communication, decision-making, technology for learning, technology for teaching, and technology (Tomei, 2010).

Chapters Pertaining to a Focus on Learning

- Chapter 5, *Reflective On-Line Discourse for Pre-Service Teachers*, by Holdan and Hansen, considers an online venue for providing teachers with increased opportunities to engage in thoughtful discourse. With advances in online education, the authors suggest that teachers who might otherwise not have opportunities to engage in meaningful, reflective discourse consider online synchronous
and asynchronous tools to reflect on teaching and learning. Via such venues it is posited, teachers can get involved in substantive communication about teaching and learning that might otherwise not be available.

- Chapter 6, *The Effects of Web-Enabled Self-Regulated Learning and Problem-Based Learning with Initiation on Students’ Computing Skills*, by Shen, looks at a different category of learner than readers are used to examining: vocational degree earners. A major portion of the work force in Taiwan, the author conducted an experiment to examine the effects of applying web-based self-regulated learning, web-based problem-based learning with initiation, and their combination to enhance students’ computing skills. As a result, readers have an opportunity to witness how combinations of students’ computing skills differ and how online teaching has impacted vocational schools in Taiwan.

- Chapter 7, *Brain Based Learning Environments in an Online Setting*, by Braidic, introduces the reader to successful learning communities and how they meet the diverse needs of university students by creating a brain based online learning environment. The author explores how online instruction creates its own set of challenges in terms of course design and how a brain based online learning environment can benefit the diverse learner.

- Chapter 8, *The Professional Development School: A Building Block for Training Public School Faculty on New Technologies*, by Semich and Gibbons, examine technology training for teachers and their use of technology as an instructional tool in the classroom to improve student learning. The authors report on the results of their grant connecting local public school teachers with university faculty for training opportunities. They discuss how a university provides a high degree of instructional delivery as well as strengthen a collaborative partnership between the University and a K-12 school district in order to improve student achievement.

- Chapter 9, *Virtual Inquiry in the Science Classroom: What is the Role of Technological Pedagogical Content Knowledge?* by Toth, examines prior research on students’ difficulties with inquiry learning and outlines research-based decisions for the consideration of software-based scaffolds for inquiry teaching and learning. The chapter details research findings that assist teachers in their development of pedagogical content knowledge and discusses how to select and use technological tools for classroom inquiry that support such content. Readers will discover a process whereby considering software-design during instructional design has the potential of significantly enhancing students’ learning while also supporting the development of teachers’ technological pedagogical content knowledge.

**Focus on Resources**

Resources for teaching are not terribly different among different categories of learners. For online learners, however, there are a number of resources for technology-based content (Figure 5) from which instructors may choose when designing online instruction. Perhaps the most important is a viable learning management system, for example, should provide centralized and automated administration of the learning tasks, helpful and user-friendly services, rapid content delivery, scalable internet-based elements (e.g., chat rooms, discussion groups, synchronous ‘live’ classrooms, etc.), portability among various hardware suites, and personalized and instructor-controlled release of content.

Product features, cost and pricing models, and procurement and implementation considerations are involved in the decision to purchase an LMS. The available market frustrates some educators because
of the difficulty in comparing various vendors. For example, high-end options often do not guarantee quality while some low-end solutions might provide quick and easy-to-install resources that handle basic functionality but do not necessarily offer the gamut of features and capabilities required in a totally online environment – especially if that environment is growing as rapidly as online education is at the moment.

Effective online instruction depends on learning experiences appropriately designed and facilitated by knowledgeable educators. Because learners have different learning styles or a combination of styles, online educators should design activities that address their modes of learning in order to provide significant experiences for each class participant. In designing online courses, this can best be accomplished by utilizing multiple instructional strategies. Teaching models exist which apply to traditional higher education learning environments, and when designing courses for the online environment, these strategies should be adapted to the new environment.

Ten instructional resources that have historically been used effectively in a traditional classroom environment have also been found to be effective in an online learning environment. They include: learning contracts, small and large group work, discussion groups, project-based assignments, lectures (often in the form of podcasts for online learners), collaborative learning using chat rooms and asynchronous posts, self-directed learning, case studies, mentoring, and open discussions carried on by one or more learners and/or an entire group with a moderator to ensure the discussion issues are covered, comments are protected and valued, information comes from all participants, and questions are assigned and resolved.

Chapters Pertaining to a Focus on Resources

- Chapter 10, *Benchmarking Online Learning Practices in Higher Education: Software Selection, Teacher Preparation, and Course Evaluation*, by Ray, reviews three major components of online instruction: 1) course management systems, 2) instructor training and support and, 3) evaluation of online courses. The mixed-methods investigation employed both quantitative and qualitative data. The methodology and results examined the process of selecting an institutional course management system, the training practices for online instructors, and the evaluation of online courses from an administrative and student perspective. The manuscript provides an excellent primer into the process of considering the best CMS for a particular institution.
• Chapter 11, *Technology: A Reflective Tool for Professional Development*, by Hyatt, focuses on how technology, specifically, the utilization of an electronic data management system, can be integrated into the college classroom as a lens for reflective practice on teacher preparation. During the study, the instructor documented the impact of instructional resources, collected and analyzed multiple semesters, and considered changes to instructional practices.

• Chapter 12, *Enhancement of TAPS Packages Using Tangible User Interface*, by Sidhu and Maqableh, presents the development of technology-assisted problem solving (TAPS) packages at one university. As a possible technology-based resource, Taps packages have been around for some time. However, this manuscript considers further development of interactive multimedia based packages targeted for students having problems in understanding the subject of Engineering Mechanics Dynamics. If the reader has experience with Taps, or is considering its propensity for better presentation and clarity, step-by-step approach to solve problems, user-friendly environment, unbiased assessment of performance, and flexibility to incorporate 3-D models, this research is highly recommended for your consideration.

• Chapter 13, *ICT Integration Efforts in Higher Education in Developing Economies: The Case of Addis Ababa University*, by Tibebu, Bandyopadhyay, and Negash, studies the integration of ICTs in the educational process; specifically, self efficacy beliefs, institutional support and policy (in the context of developing economies), and the challenges of inadequate resources and insufficient skills. The authors assess the state of affairs and the challenges faced by teachers and management at their University. Their study found that technology resources are generally appreciative by educators as they address the teaching/learning process.

• Chapter 14, *Collaboration between Academia and Industry: A Change in Approach*, by McAvoy, Van Sickle, and Cameron, examines one of the up and coming resources that instructional technologists must consider: storage capacity. As one of the fastest growing segment of technology, academia has been slow to respond to its impact on budgets as well as performance. Few institutions are developing graduates able to respond to this latest trend. Readers of this chapter will be familiarized with the variety of reasons that, so far, storage has not appeared on our radar and recommends that collaboration, while not solution by itself, can be effective in addressing the future impact of this resource on teaching and learning.

• Chapter 15, *Availability and Utilization of Classroom Computers across Urban and Rural Schools in Southwestern of Nigeria*, by Aduwa-Ogiegbaen and Iyamu, explores the availability and use of classroom computers in urban and rural schools in Southwestern Nigeria. While such a targeted population may seem to be too restrictive in its scope, readers will find a nearly application of the authors’ findings. When properly utilized, computers hold a great deal of promise to improve teaching and learning, it reports. As a result, the findings of this research are pertinent to ascertain the availability of computer facilities and their use by teachers in secondary school in urban and rural schools wherever they may apply. Recommendations are made as to how this particular situation can help improve other schools who find themselves in similar situations where computers are a limited resource.

**Focus on Delivery**

Learning systems are used to manage online courses, deliver content to learners, conduct learning activities, and evaluate learning outcomes. The learning systems software used to deliver online, hybrid,
and Internet-supported courses are known by many different names. They have been called courseware, course management systems, learning management systems, learning content management systems, and virtual learning environments.

Learning technology alone does not necessarily advance learning. But, when combined with best practices, chances of successful learning outcomes are significantly increased. With both learning principles and best practices in mind, technology is finally providing the level of service to learning that was promised several decades ago with the introduction of computer-aided instruction. New technologies may advance learning even in a traditional learning environment when implemented with pedagogically sound practices.

Numerous professional associations are examining the delivery modalities supporting online education. The EDUCAUSE Learning Initiative (ELI), for example, has scrutinized such critical issues such as: what are the emerging learning technologies and practices, and how can we use them? How do we accommodate emerging practices associated with new learning technologies within our institutions? How do we evaluate the potential impact new technologies and practices may have on advancing learning? What do our students think about these technologies and higher education’s perspective on them? How can we understand what is happening on our campuses? And, can surveys help us develop strategies that align student and faculty expectations for the use of learning technologies? (Oblinger, 2005).

The National Center for Education Statistics (2008) estimated that the number of K-12 public school students enrolling in a technology-based distance education course grew by 65 percent in the two years from 2002-03 to 2004-05. Nearly 12 million post-secondary students in the United States take some or all of their classes online right now. Nagel (2009) estimates that this number will nearly double to more than 22 million by 2014.

Chapters Pertaining to a Focus on Delivery

- Chapter 16, *Generating Motivation to Learn via Tailored Lesson Introductions*, by Banas, examines the delivery of instructional content from the perspective of behavioral construct tailoring as a message design technique to generate motivation and improve cognitive performance. This research on an uncommon delivery modality attributed performance to affect or competence-related factors and employed a risk assessment methodology to strategically assign experimental learners to one of three tailored lesson introductions. Results indicated that experimental group learners were more motivated and positive trends were found for some affective and competence-related performance attributions.

- Chapter 17, *An Investigation on Course Characteristics that Fit Well with Online Offering*, by Klaus and Changchit, investigate a premise that in higher education institutions all classes are not as adaptive to an online format as others. While this probably comes as no great surprise to readers of this text, the authors offer us a deeper understanding of course characteristics that affect student preferences for either traditional classroom environments or online environments. Their initial paper from the IJICTE is expanded to offer additional guidelines to institutions considering which courses to offer in their online curriculum.

- Chapter 18, *Computer-Based Simulation in Blended Learning Curriculum for Hazardous Waste Site Worker Health and Safety Training*, by West, Slatin, Sanborn, and Volicer, pay particular attention to interests of those individuals and institutions that provide adult/worker training and education. The chapter discusses computer-based simulation training tools as part of a hazardous waste site
worker health and safety training curriculum. It presents the development, implementation, and assessment of the simulation tool for learning from several perspectives including small group learning, end-of-course trainee assessment, and trainer focus groups. Other delivery modalities discussed include participatory instruction, blended learning, and simulation advanced training impact.

- Chapter 19, *The Dragon in the School’s Backyard: A Review of Literature on the Uses of Technology in Urban Schools*, by Kidd, provides our readers an examination of the literature pertaining to technology as a tool for delivering instruction in the classroom from the 1980s. Proponents arguments, the dream and promises (and ultimate reality) of technology is presented. Issues of chronic underachievement of urban learners and how they were enticed to hold up technology as a tool for reversing the historical influences of poverty, discrimination, inequity, underachievement, and lack of opportunity are discussed. This chapter concludes with renewed hopes and aspirations, issues and trends, associated with technology and perhaps a more realistic appreciation for the benefits of technology as a tool for teaching and learning.

- Chapter 20, *Examining Technological Disparities and Instructional Practices in English Language Arts Classroom: Implications for School Leadership and Teacher Training*, by Song, Owens, and Kidd, continues the exploration of urban students and the quest of schools to provide a quality education with the integration of technology. Research is considered, socio-cultural aspects are probed, and educational practices are inspected as the authors present their finding of the factors that affect the integration and use of technology in the instructional practices. Their premise that a call for curricular and instructional reform is imminent (if not already underway) encourages educational institutions to embark on a process to reform their educational practices in light of new technologies available. The English classroom is the focus of their research to implement technology interventions in support of quality teaching and active student learning; however, their findings are applicable across academic disciplines. The results of this study showed an overall positive relationship regarding the use of technology interventions within the English classroom with levels of student achievement.

- Chapter 21, *Teaching Advanced Computer Networking: A Miniproject-Based Learning Approach*, by Sarkar and Petrova, reports on the experience of using miniproject-based learning (MPBL) as a key pedagogical method for teaching advanced computer networks at the graduate level. Readers are shown how MPBL increases a student’s practical experience, gives them a deeper understanding of the key concepts of network protocols and technologies, and uses face-to-face teaching, group discussion and class presentations to allow students to develop better communication and presentation skills. This chapter does an excellent job of exemplifying the Engine for Technology-Based Teaching’s fourth level, *Focus on Delivery*.

- Chapter 22, *Business Report Writing Students’ Perceptions of Their Ability to Succeed in an Online Environment vs. Students’ Performance in an Online Course*, by Wilkinson and Crews, views the trend for online courses and programs in pursuit of an anytime, anywhere learning environment. This chapter describes an experimental research study in which the experimental group was taught in a blended learning environment. Readers can scrutinize the significant differences in performance between the two groups on assignment and post-test scores.
Focus on Outcomes

Do students taking online courses and programs learn as much as their counterparts in traditional classrooms? Is the quality of their educational experience equivalent to face-to-face learning? Recent research is replete with evidence that seems to point to “no significant difference” in learning outcomes. Studies regarding the effectiveness of online learning and distance education have been conducted since its introduction (before personal computers) as programmed instruction in post-War 1950’s. Many of these studies compare student outcomes in online courses to those in traditional courses. Statistically, the majority indicate that student success rates are comparable. Yet, many faculty (and students) are hesitant to accept these findings as valid and reliable because of the novelty of the delivery modes, the scope of comparative criteria employed, and the consistency of methods used to compare student outcomes. For example, studies have incorporated modes such as evaluating grade distributions, examinations, course completion and retention rates, learning styles, critical thinking skills, and others to arrive at their conclusions.

What measures of comparability are used to compare distance to traditional learner outcomes?

Assessing learning outcomes takes many forms, extends over a semesters or entire programs of study, and often serves more than one purpose. For the traditional learner, assessment is often objective in its measurement, summative in its scope, and limited to the lower levels of Bloom’s taxonomy (i.e., knowledge and comprehension). For those wishing to promote higher order thinking skills, authentic assessment requires learners to build responses rather than choose from pre-selected options, thereby eliciting analysis, synthesis, and evaluation.

Online educators, as compared, are forced by time and geography, to employ virtual assessment to provide necessary feedback, track learner progress toward complete assignments, verify attainment of learning objectives, and provide a final grade for administrative purposes. Many online learning management systems provide instructors with standardized analytical data including rate of student progress, completion rates, access to course materials, quantity of instructor/student interaction, assignment completion tracking, examination item analysis, and more.

Chapters Pertaining to a Focus on Outcomes

• Chapter 23, Influences on Student Performance in a University Networks and Telecommunications Course, by Brookshire, Crews, and Brown, examined probed the factors that contribute to the success of undergraduate technology support and training management students. Using multiple regression, the study found that only performance in prerequisite course significantly predicted success implicating future efforts with regard to faculty course design and curriculum organization. Readers who wish to improve the success students in technology-rich courses should read this chapter.

• Chapter 24, Information and Communication Technology in China: Connecting One Billion People for Education, by Li, Huang, and Tang, describes the positive impacts and shortcomings that information technology has had on Chinese basic education in early grades. The chapter provides an overview of the current development of information technology and presents applications and issues in higher education. The potential for further developing distance education is also considered. The target audience of this chapter, per the authors, is policy makers, educators, ICT professionals and researchers.
• Chapter 25, *Evolution by Evaluation*, by Mahlow, Hess, and Grund, describes the process of formally evaluating an e-learning system and makes for an excellent primer for readers responsible for assessing online instruction. The authors employed a professional usability expert for their study to find the right questions to determine how students really feel about the infused technology and how further improvements could be incorporated. Developers of learning systems (both of software and of content) are highly encouraged to consider usability experts when evaluating the use of technology for instruction.

• Chapter 26, *Why Choose an Online Course?* by Tomei et al wanted to understand why students choose online learning instead of traditional face to face instruction. The researchers reviewed the available body of literature and surveyed dozens of students in three consecutive semesters at participating universities. They found several factors of online learning that affect why schools recommend an online course to their students and why these students succeed or fail in an online environment.

• Chapter 27, *Do Orientation Materials Help Students Successfully Complete Online Courses?* by Tomei et al sought the importance of orientation materials to successfully completing an online course taken from another institution. The review of the literature supported the position that proactive development of orientation materials is essential to the growth and development of online learning and results in additional revenue to participating institutions.

• Chapter 28, *Information and Communication Technology in Chinese Elementary and Secondary Education: Connecting Every Child for Better Learning* by Li examines the recent development of information and communication technology in Chinese elementary and secondary education. Student learning outcomes have been positively impacted by technology and bode well for the potential for further developing education in their school.

**Summary.** A new model, the *Engine for Designing Technology-based Instruction*, provides the ideal structure for this newest text on online instruction and distance education. As readers progress through this text, they should seek to build an appreciation for the many facets of online education represented in the manuscripts as subsumed under each of the five steps of the Engine.

This book provides key manuscripts published in each of the five steps of the Engine. From a general discussion of factors that influence whether students take online courses to consideration of gender differences with respect to technology, Chapters 1-4 provide the reader with excellent reflections pertaining to the learner in an online education environment.

Chapters 5-9 focus on the cognitive, K-A-RPE, and technology domains of the learning process. The practical, real-world foundations of instruction in these three domains are characterized by such theoretical online learning applications as reflective thinking, problem-based learning, brain based online learning environments, and virtual inquiry.

If this text could be any more comprehensive, it would necessarily be in the area: Focus on Resources. Chapters 10-15 attempt to highlight a number of the most popular contemporary technologies including course management systems, technology-assisted problem solving packages, and storage technology. The editor would highly recommend a number of Selected Texts that Explore Other Technologies directly applicable to online teaching (Appendix A).

Chapters 16-23 focus on some of the more popular delivery modalities for online education. Online learning as a modality for delivering instruction as well as from the perspective of both students and teachers is one of the fastest growing trends in educational uses of technology.
The final series of chapters expands on assessment, perhaps the newest of the focus areas for online education development – and, arguably, the most important.

It is recommended that the reader use these contributions to the literature to gather a working knowledge of how each element of the model interacts with the technologies presented. Apply the results; consider the recommendations when designing your own online lessons. Use the research base contained in these pages to evaluate and revise your efforts. In the end, Online Courses and ICT in Education can help any educator design a lesson that is sure to improve teaching and learning.

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