Scheer, S. B., Terry, K. P., Doolittle, P. E., & Hicks, D. (2004). Online pedagogy: Principles for supporting effective distance education. *Journal on Excellence in College Teaching*, 15 (1/2), 7-30.

Online Pedagogy: Principles for Supporting Effective Distance Education

Stephanie B. Scheer
University of Virginia

Krista P. Terry
Troy State University

Peter E. Doolittle & David Hicks
Virginia Polytechnic Institute and State University

Distance education has become a major form of education in the United States. This surge in popularity has launched a plethora of scholarship emphasizing the distillation of those strategies which inform effective, learning experiences in the distance environment. A growing consensus among researchers recognizes the need for a holistic approach to discerning these strategies of effective practice, which can then also be articulated as principles for application. This article presents such a synthesis, detailing the administrative, instructional design and development as well as pedagogical implementation strategies which support effective distance education and summarizes these strategies with a set of guiding principles for practitioners to apply in their individual environments.

Opportunities for enrolling in distance-delivered courses and programs are steadily increasing. With over 70% of colleges and universities now offering some form of distance delivered instruction (Connick, 1999), distance education has become a major form of education in the United States (McIssac, 1998; Molenda & Sullivan, 2000). It is estimated that 350,000 students are currently enrolled in fully online degree programs

(Rudestam & Schoenholtz-Read, 2002). This surge in the popularity of distance learning is the result of a combination of factors. Students are seeking flexible learning opportunities that will allow them to study at their own pace and time, to focus more on their interests, and to pursue avenues for promotion and professional growth. The exponential advances in technology throughout the last half of the 20th century also have helped to increase the quality of electronic instruction. Streaming audio/video, simulation, audiographics/video conferencing, and virtual reality technologies, combined with a greater emphasis on online instructional design, have created environments that can now provide highly interactive instruction in both synchronous and asynchronous contexts.

This improvement in delivery technology and online pedagogy quality has influenced traditional higher education institutions, from Ivy League universities to community colleges, to consider distance-delivered courses and programs legitimate. This perceived legitimacy has, in turn, allayed the fears of many potential students with reservations that online credentials would not receive the same consideration as traditional instruction. The field that was once defined by the postal correspondence course has, within 20 years, undergone a complete metamorphosis into a field of educational practice with the potential to move beyond the constraints of time and space.

This incredible growth in distance learning education has launched a plethora of research and scholarship activity focused on the ever-evolving field. A central emphasis of this research involves the strategies necessary to provide effective, successful learning experiences for individuals engaged in a distance learning course or program. This research and these strategies provide a theoretical and practical base for faculty, administrators, and design personnel involved in the development of online learning. Unfortunately, this research has not yet coalesced into established models and strategies for delivering and implementing online pedagogy (see Reeves and Reeves, 1997; Williams, Paprock, and Covington, 1999; Wang-Chavez, Branon, and Mikolaj, 2001). Current online practices are a fluid mixture of research-based principles and practices, anecdotal-based principles and practices, and folk pedagogy. This lack of an agreed-upon methodology may be seen in the abundance of edited volumes addressing online pedagogy (for instance, Abbey, 2000; Rudestam & Schoenholtz-Read, 2002) and the dearth of well-focused volumes positing an integrated perspective.

While a specific methodology for effective online instruction has yet to emerge, there is a growing consensus that the framework within which this methodology will be employed must be holistic and recognize the need to incorporate principles beyond pedagogy (Bichelmeyer, Misanchuk, & Malopinshy, 2001; Cyrs, 1997). Specifically, effective online instruction is a synthesis of administrative support, instructional design and development, and pedagogical implementation.

To inform the ongoing discussion of distance education and online pedagogy, therefore, we have created a series of empirically supported principles and resources that have proved useful and informative in a variety of online learning contexts (see Table 1). This article represents a synthesis of our ongoing research agendas—self-regulation, online wellness, and the development of metacognitive skills in online environments—and distance education and online pedagogy experiences as institutional technology administrators, instructional designers, and online instructors. These principles do not provide a final and complete list of all that is necessary for effective online pedagogy, however, the principles that are provided are, themselves, necessary for effective online pedagogy.

Institutional Support Principles

The following five principles, which we have generated based on our experience and practice in the field of distance and online education, describe the global institutional considerations that must be in place before offering any type of distance delivered programming. High-level administrative support, faculty incentives, relevant programming, a strong technology infrastructure, and quality student support services are essential components for creating effective and successful distance learning environments. To exemplify how these principles are, in fact, practiced, the authors chose Virginia Tech as a representative university, which has purposefully created an institutional environment holistically engaged in distance education.

Principle 1: Any Organization Planning or Engaging in Web-Based Distance Courses or Program Offerings Must Have Sustained Institutional Commitment.

A Web-based distance education program cannot succeed without philosophical and financial support from the upper echelons of the university administration (Shoemaker, 1998). In addition, a proposed or existing distance education effort must be viewed as a priority, officially

Table 1
Essential Principles for Supporting Effective Distance Education

	Institutional Support Principles
Principle 1:	Any organization planning or engaging in Web-based, distance courses or program offerings must have sustained institutional commitment.
Principle 2:	To provide Web-based delivered courses or programs successfully, an institution must have engaged, motivated, and supported faculty.
Principle 3:	The Web-based courses or programs that an institution offers must be of interest and value to the determined constituency of learners.
Principle 4:	An appropriate technology infrastructure is crucial to the success of an online course of program offering.
Principle 5:	Access to student support services is an essential component of any online course or program offering.
	Instructional Design Principles
Principle 6:	Each online instructor must thoroughly analyze and assess their learners, their instructional goals, and the instructional context(s).
Principle 7:	Instructional objectives must be developed to address learning outcomes and should be clearly defined and stated on course materials.
Principle 8:	Media should be carefully selected to address learning outcomes appropriately, while recognizing practical constraints.
Principle 9:	Online learning experiences should provide ample opportunities for learners to practice skills, receive feedback, and interact with course content, peers, and instructor.
Principle 10:	Instructional assessment and evaluation should be designed to assess learning outcomes appropriately.

Table 1
Essential Principles for Supporting Effective Distance Education (*continued*)

Online Pedagogical Principles

Principle 11: Teachers and students should be prepared to implement technology as a tool for inquiry.

Principle 12: Teachers should use technology to create authenticity, which facilitates the processes of inquiry and action.

Principle 13: Teachers should use technology to foster local and global social interaction so that students attain multiple perspectives on people, issues, and events.

Principle 14: Teachers should facilitate student knowledge construction by using technology to build on students' prior knowledge and interest.

Principle 15: Teachers should cultivate students' academic independence by using technology to foster autonomous, creative, and intellectual thinking.

recognized, and adopted as part of the organization's strategic plan (Albrecht & Bardsley, 1994). This prioritization must also be reflected in the placement of distance education within the organization's overarching structure. A centralized office to provide leadership, coordination, management and support to all distance learning activities offers the most encompassing approach to facilitating such learning opportunities successfully (Chute, Thompson, & Hancock, 1999).

Example

Understanding that successful distance education offerings must be supported at the highest level, Virginia Tech includes distance education offerings as part of its strategic plan (see http://www.unirel.vt.edu/stratplan/). Most explicit is the following goal: *Strengthen Virginia Tech's role as a recognized leader in distance and distributed teaching and learning, research and scholarship, outreach and public service.* In addition to global administrative support, Virginia Tech has also founded The Institute for Distance and Distributed Learning (IDDL) (see http://www.iddl.vt.edu/), which provides leadership, management, coordination, and support to Virginia Tech's technology-based activities and initiatives. IDDL reports directly to the University's provost and vice provost for academic affairs, thus assuring that a regular, continuous dialogue occurs between top administrators and this centralized office.:

Principle 2:
To Provide Web-Based Delivered Courses or Programs Successfully, an Institution Must Have Engaged, Motivated, and Supported Faculty.

Institutions often fail to reward, support, or encourage faculty members' online teaching efforts. This practice is shortsighted and unlikely to produce quality distance programming. Faculty often require encouragement, recognition, or incentives to begin or maintain their online teaching efforts (Willis, 1994). Specifically, designing and developing any distance learning course requires a significant commitment of time and energy. This commitment should be reflected in a faculty member's assigned workload and/or included in promotion and tenure criteria (Williams & Peters, 1997). Additionally, instructional workshops need to be made available to faculty to provide them with a means for improving their skills in all areas of the instructional process, with a specific emphasis on considerations for Web-based learning environments (Chute et al., 1999; Willis, 1994).

Example

Supporting faculty in their online teaching efforts is organized and administered in a variety of ways at Virginia Tech. Many departments reduce a faculty member's semester teaching load while he or she is developing an online course. Awards also are available: IDDL offers yearly competitive fellowships to faculty engaged in online course development (http://www.iddl.vt.edu/instructors/funds.php). Training workshops are continuously offered to foster faculty members' skills in all areas of online course design and development (http://www.iddl.vt.edu/instructors/workshops.php). Online support resources are available to faculty to utilize at their own convenience (http://www.iddl.vt.edu/instructors/). Finally, faculty are provided with an online database of frequently asked questions (FAQs) to facilitate their ability to access needed information quickly (http://www.iddl.vt.edu/faqs.php).

Principle 3:
The Web-Based Courses or Programs That an Institution Offers Must Be of Interest and Value to the Identified Constituency of Learners.

A mindful approach to determining Web-based content-area offerings is essential to ensuring student success. Traditional distance learners are juggling a variety of roles and have chosen to take an online course or program for a specific purpose. They expect to engage in relevant learning activities with clearly perceived benefits to their personal and professional growth (Scheer, 2001). Therefore, a needs assessment or comparable analysis should be conducted to determine and prioritize the needs and interests of the population of potential distance learners (Chute et al., 1999). Depending on the context, this analysis may be formal or informal; the most important factor is that a clearly perceivable relevancy for learners be determined, because this information will serve as the foundation for all further development and design considerations.

Example

The past decade has brought an exponential increase in the need for information technologists. Many individuals who wish to pursue this type of graduate degree are limited by career, family, and social commitments that impede their ability to return to school. Having received

frequent and numerous inquiries from individuals working full-time regarding the type of graduate-level information technologist program offerings available at Virginia Tech, the university set out to design a program to fit the niche that was becoming apparent from these requests. The result of this analysis was the Online Master of Information Technology. This program blends coursework in six related IT modules: communications, networking, computer engineering, software development, business information systems, and decision support systems (http://mit.iddl.vt.edu/). The inception and instructional content of this program was, thus, the direct result of a perceived need from Virginia Tech's learning community.

Principle 4:
An Appropriate Technology Infrastructure Is Crucial to the Success of an Online Course or Program Offering.

A key element of a quality online educational offering is clear and consistent information dissemination. Students must interface with Web-based technologies before they interact with their instructional content (Hillman, Willis, & Gunwardena, 1994). The medium is always a factor when considering effective online practice. The technology infrastructure must be systematically organized, adequately funded, and consistently maintained and updated (Twigg, 2000). This infrastructure includes all of the university's networking capabilities: e-mail accessibility and account maintenance, servers to maintain courseware (such as Blackboard or WEBCT), streaming media servers (audio/video), connectivity (T1 cables vs. dial-up modems), virus protection, data file storage space, and trained personnel to keep everything running smoothly. In addition, the technology must be assessed continuously to determine its sufficiency and reliability. If bandwidth, network capacity, and platform compatibility are limited, it will significantly impact the design and delivery of an online course or program (Driscoll, 1998). While this list is not exhaustive, the components described above indicate the complexity of providing such an infrastructure.

Example

In keeping with the centralized approach to supporting all aspects of distance learning course design, development, and delivery, Virginia Tech's IDDL maintains 16 Web, content, and application servers. Specifically, IDDL supports a high reliability server configuration with a

large-capacity file system integrated with Virginia Tech's network and Learning Management Systems and is in contact with database management and administration services (http://www.iddl.vt.edu/services/support.php). In addition, Virginia Tech also houses a centralized computing office that oversees all computer- and network-related activities within the university (http://computing.vt.edu/).

Principle 5:
Access to Student Support Services Is an Essential Component of Any Online Course or Program Offering.

A critical aspect of any distance education project is the availability and access to student support services (Scheer & Lockee, in press). Distance learners have diverse student support needs: administrative, academic, technical, and personal. This diverse combination of needs necessitates providing specifically conceived approaches to student support services (Krauth, 1999). These services must be easily accessible, organized, relevant, and thoroughly developed (Peters, 1998). Any type of support resource must offer learners a variety of strategies to problem solve, such as a database of FAQs, a discussion board, and a specific contact person or office to contact. Special needs may also arise due to learner isolation and heavy dependence on technology for learning and accessing resources (Abate, 1999). Distance learners are physically remote from their fellow learners and instructor. To ensure that this does not evolve into a sense of psychological remoteness, learners need to be included as part of the learning community and given the opportunity to engage in the community in a mediated format.

Example

To ensure that Virginia Tech's distance learners have a complete support network that they can easily access online, IDDL has developed Virginia Tech Online (VTO) (http://www.vto.vt.edu/). VTO is Virginia Tech's virtual center for distance learning students. They may search for courses and degree programs as well as access technical and administrative resources (http://www.vto.vt.edu/resources.php). In addition, VTO has developed the Online Wellness Resource Center (OWRC) (http://www.vto.vt.edu/owrc/) to provide resources for nonacademic distance learners' support needs. The OWRC includes resources pertaining to career planning, physical fitness, healthy eating, stress management, and even medication techniques.

Instructional Design Principles

Within the structure of the institution that provides the technological, philosophical, and financial infrastructure to support distance learning initiatives, faculty and instructional designers are faced with issues concerning how to design and develop courses that utilize existing infrastructure to meet their learners' needs and achieve their instructional goals. The research on instructional design and development provides guidance for the design and development of online courses. Although, as previously stated, this research has not yet coalesced into established models for delivering and implementing online learning, various design principles and the practices of current practitioners can provide support and guidance in this endeavor.

Principle 6:
Each Online Instructor Must Thoroughly Analyze and Assess His or Her Learners, Instructional Goals, and Instructional Context(s).

When designing online learning environments, it is important to assess thoroughly one's learners, instruction, the instructional context, and the prerequisite skills. Many instructional design models (Dick, Carey, & Carey, 2002; Smith & Ragan, 1999) include comprehensive needs analysis components; few, however, specifically address the needs of online learners. Dick, Carey, and Carey (2002) include a *learner and contextual analysis* and an *instructional analysis* as critical components of the initial assessment and analysis process. Smith and Ragan (1999) also cite several components as being critical in the needs analysis process. Both of these predominant models of online design outline several important components that are applicable to the design of online as well as traditional learning environments and that are critical to the development of effective learner-centered instruction.

Example

Florida Gulf Coast University's faculty development and support Web site (http://www.fgcu.edu/onlinedesign/designDev.html) contains specific principles and examples regarding the analysis of the instructional design process. These principles include examples of the types of questions to ask your audience, ranging from conducting an instructional analysis that will help the instructor determine areas of knowledge and skills that should be addressed to determining the learner's technology

skills and previous experiences with online courses. A specific example includes providing potential learners with a technology self-assessment tool (http://www.fgcu.edu/support/techskills.html) and access to tutorials to help support the acquisition of needed technology skills.

Principle 7:
Instructional Objectives Must Be Developed to Address Learning Outcomes and Should Be Clearly Defined and Stated on Course Materials.

Clearly defined learning objectives for online courses assist instructors in developing appropriate learning activities, convey to students the learning expectations, and signify the type of learning that will occur. Learning objectives should identify the types of skills to be learned, the conditions under which the skills are to be learned, and the criteria for assessment. The objectives should be precise, challenging, and complete (Laurillard, 2002). Furthermore, instructional objectives are essential for creating valid instructional strategies and assessment. Ultimately, instructional objectives are "the means by which the skills in the instructional analysis are translated into complete descriptions of what students will be able to do after completing instruction" (Dick et al., 2002).

Example

Georgia State University's middle-secondary education and instructional technology department provides guidance for creating instructional objectives that guide and facilitate the learning process (http://www.gsu.edu/~mstmbs/CrsTools/Magerobj.html). In addition to providing a rationale for the development of objectives, the Web site provides the Audience, Behavior, Condition, and Degree (ABCD) model of development and provides many examples of behaviors within the cognitive and affective domain that can be included in well-written instructional objectives. GSU's Web site provides examples of developing measurable, concrete instructional objectives that can assist online instructors with creating the framework for instruction that will scaffold the learning processes of online learners. The model of development and the concrete examples provided are articulated within the framework of Mager's (1984) research.

Principle 8:
Media Should Be Carefully Selected to Address Learning Outcomes Appropriately, While Recognizing Practical Constraints.

There is an extensive history addressing the need to select and utilize specific media for specific learning outcomes (see Gagne, 1985; Reiser and Gagne, 1983). More recently, research on the development of multimedia has provided those who teach online with guidelines for creating online media to address specific learning outcomes (see Mayer, 2001). Mayer (2001) suggests that multimedia, or online media, are most effective when audio (for instance, narration) and video (for instance, text and pictures) are used simultaneously, when the audio and video convey the same message, and when the audio and video are void of extraneous sounds and images. Ultimately, Mayer concludes, "the most effective computer-based multimedia presentation is a *concise narrated animation* (CNA)" (p. 191).

Example

An example of an online learning module in which design and development considerations were informed by (a) selecting media to address appropriate learning outcomes, (b) integrating media elements to maximize learning, (c) utilizing the technology support and infrastructure options available and (d) providing alternatives for learners with bandwidth and/or access concerns is Peter Doolittle's modules for his Advanced Educational Psychology course site (http://edpsychserver.ed.vt.edu/5114web/modules/). The modules that were developed for Doolittle's site utilized streamed QuickTime movies, Flash animations, and SQL database applications to provide learners with presentations that addressed specific learning outcomes, accommodated specific learner needs, and accepted multimedia principles.

Principle 9:
Online Learning Experiences Should Provide Ample Opportunities for Learners to Practice Skills, Receive Feedback, and Interact With Course Content, Peers, and Instructor.

Online instruction should provide many opportunities for interaction and communication with instructors, peers, and content matter. Distance learners should not feel "distanced" due to a lack of interaction. Wol-

cott's (1996) discussion of psychological distance, or how the separation of learner and instructor functions psychologically, includes discussions on adopting learner-centered instructional practices when teaching online in order to minimize potential psychological distractions and maximize learning. Wolcott (1996) proposes utilizing strategies that engage students actively with course content and each other while providing opportunities for feedback in order to create a learner-centered classroom environment.

Example

The companion Web site to Lohr's (2003) *Creating Graphics for Learning and Performance* (http://www.coe.unco.edu/LindaLohr/index.htm) provides learners with many opportunities to practice relevant skills and interact with content by viewing examples of student work and visiting related Web sites. This site can be used in conjunction with other tools, such as the Blackboard course management systems' discussion board or chat features, or with tools such as multi-user domain object-oriented (MOOs) or multi-user domain (MUDs). It can, therefore, provide learners with opportunities to practice skills, interact with content, and communicate with and receive feedback from peers and instructor. The combination of this rich online resource and interactive tools such as chats and discussion boards engages students in levels of dialogue and interaction that reduces the psychological effects of distance and facilitates a community of learners.

Principle 10:
Instructional Assessment and Evaluation Should Be Designed to Assess Learning Outcomes Appropriately.

Dick et al.'s (2002) model of instructional design articulates a component in which assessment instruments are developed with the goal of engaging learners in an event that encourages "self-assessment on their path to assuming responsibility for the quality of their own work" (p. 145). Jonassen, Howland, Morre, and Marra (2003) also advocate the development of meaningful and authentic assessment measures and states that learners should be assessed on the product or performance that results from the learning task in which they are engaged. Teaching in an online environment, however, presents additional challenges for developing learner-centered assessments. Without the face-to-face interactions of traditional classrooms, in which instructors can garner

information regarding comprehension and understanding, learner progress, and the effectiveness of instruction, the burden falls on the online instructor to develop assessments and evaluations that will most effectively leverage the attributes of different media types in order to gather this information.

Example

An ERIC document (http://ericacve.org/docs/pfile03.htm) outlines the many issues surrounding the principles and practices of assessing learners in an online environment, including security, computer programming, and the development of assessment tools. It also provides practitioners with principles and solutions, among them: providing continuous and interactive formative and summative assessments in order to ensure appropriate levels of interaction and communication between instructor and students.

Online Pedagogical Principles

Principle 11:
Teachers and Students Should Be Prepared to Implement Technology as a Tool for Inquiry.

The use of Web-based instructional technologies requires a new set of tools for both teachers and students. Indeed, while the skills necessary to succeed in face-to-face versus online instructional environments are similar, they are not the same (Palloff & Pratt, 2002). For online pedagogy to succeed for both teachers and students requires significant levels of self-regulation (Terry, 2002), problem solving (Jonassen et al., 2003), interaction (Scheer, 2001), introspection (Vye et al., 1998), and Web-specific conceptual and procedural knowledge (Abbey, 2000). Therefore, teachers and students need to be taught how to construct and interact, respectively, with Web-based pedagogy.

Example

Preparation for online instruction may take several forms, including guides-to-inquiry and online course orientations. Guides-to-inquiry focus on facilitating teachers and students in the processes of using online materials, such as those available through the Library of Congress' American Memory (http://memory.loc.gov/ammem/amhome.html), and engaging in online inquiry, such as using WebQuests (http://

webquest.sdsu.edu/webquest.html). Online course orientations may range from self-paced, comprehensive introductions (http://www.venturacollege.edu/distancelearning/onlinecourses/orientation.htm) to a step-by-step walk-through of course management software (http://jaguar.sjcc.cc.ca.us/orientation/) to short introductory activities (http://ollie.dcccd.edu/Faculty/InfoForFaculty/DistrictResources/secure/olorient.htm).

Principle 12:
Teachers Should Use Technology to Create Authenticity, Which Facilitates the Processes of Inquiry and Action.

Authenticity provides context and comprises three equally important components: authentic materials, authentic experiences, and authentic inquiry. Fortunately, technology is tailor made for delivering primary source materials—for example, pictures, diaries, maps, newspapers, audio/video recordings, and manuscripts. Creating the conditions necessary for authentic experiences is a bit more tenuous, however, for while constructing and engaging in conversations with forestry experts or Egyptologists can be facilitated by Web-based pedagogy, an actual walk in the woods or an excavation of antiquities is not possible online. In addition, mere access to materials and experiences is not sufficient; indeed, these materials and experiences must be used in the process of engaging in authentic inquiry (see Rouet, Levonen, and Biardeau, 2001). This combination of authentic materials, experiences, and inquiry moves instruction away from "teacher-talk" and student memorization to "teacher-facilitation" and student inquiry.

Example

Creating authenticity requires knowledge and perspective, and in a world that is made smaller by the rapid exchange of information, yet larger through fear of subjugation, political knowledge, and perspective is essential. *International Constitutional Law* (ICL) (http://www.oefre.unibe.ch/law/icl/info.html) provides constitutions and other textual material from over 150 nations, including a primer for comparing constitutions and international constitutional law. The ICL site also links users to the CIA World Fact book (http://www.odci.gov/cia/publications/factbook/) and Elections Around the World (http://www.electionworld.org). The material, resource guides, and instructional guides available on these three sites provides teachers with the opportunity to develop instruction that allows for comparative political studies using authentic materials, experiences, and inquiry.

Principle 13:
Teachers Should Use Technology to Foster Local and Global Social Interaction So That Students Attain Multiple Perspectives on People, Issues, and Events.

Interaction and computer-mediated communication (CMC) are fast becoming the *sine qua non* of Web-based pedagogy. Indeed, the Web provides an unprecedented avenue for local and global interaction with others, exposing students to multiple perspectives and contexts beyond the textbook (see Palloff and Pratt, 1999). Through the use of chat rooms, MOOs/MUDs, audiographics, e-mail, and listservs, it is possible to employ effective instructional strategies such as cooperative learning groups, group discussions, and debates in which students may interact with individuals and domain experts in other states or countries (Barab, MaKinster, Moore, Cunningham, & the ILF Design Team, 2001). This access to multiple perspectives provides the broad range of experiences necessary for students to challenge their currently held beliefs and to value the established beliefs of others. However, Berson, Lee, and Stuckhart (2001) stress the importance of critically evaluating these online exchanges. While they may, on the surface, appear to offer the potential for exploring multiple perspectives, they may easily "perpetuate biased views of the world that are informed by interactions with predominantly elite segments of society . . . and [be] devoid of perspectives which promote pluralism through critical self-reflection as well as historical and cultural contexts of power and intolerance" (p. 223).

Example

Bringing the world into the classroom through online newspapers is a powerful example of how the Internet can support teaching about current events, peoples and cultures of the world, and the international position of one's homeland (http://www.majbill.vt.edu/history/ewing/Global_newspapers.htm). In addition, the building of virtual communities, while challenging, can quickly and efficiently forge relationships across towns, states, and nations (http://www.isoc.org/isoc/conferences/inet/00/cdproceedings/8j/8j_2.htm). Virtual communities of practice are available in a multitude of domains, including conservation science

(http://www.virtualscience.org/conbio/), physics (http://about.iop.org/IOP/Groups/), and education (http://www.iearn.org/).

Principle 14:
Teachers Should Facilitate Student Knowledge Construction by Using Technology to Build on Students' Prior Knowledge and Interests.

A student's prior knowledge must always serve as the point of origin in the pursuit of new and meaningful knowledge. According to Ausubel (1968), "The most important single factor influencing learning is what the learner already knows. Ascertain this, and teach . . . accordingly" (p. 1). While in an online environment it may not always be feasible to assess students' prior knowledge and change the nature of instruction "on the fly," it is always possible to provide students with opportunities to self-assess their own knowledge and then to provide them with choices from which they may select based on their self-assessment and interests (Mantyla, 1999). This continued, or formative, assessment provides positive or negative feedback relative to the viability of the knowledge that is constructed.

Example

Graphic organizers (http://www.writedesignonline.com/organizers/) may be used as advance organizers (http://www.ilr.cornell.edu/tac/toolbox/tips/adv_organ.html) to provide a link between students' prior knowledge and an upcoming lesson. In addition, formative assessments allow students to assess their prior knowledge and to make changes in task engagement, as needed (http://edpsychserver.ed.vt.edu/5114web/assessment/formative.cfm?FA=Principles). Finally, students may engage in large-scale projects that integrate their own prior knowledge with the prior knowledge of the surrounding local community, as in the case of the Christiansburg Institute (http://www.christiansburginstitute.org/).

Principle 15:
Teachers Should Cultivate Students' Academic Independence by Using Technology to Foster Autonomous, Creative, and Intellectual Thinking.

Online academic independence, or self-regulated learning, necessitates students developing the knowledge and skills required to engage

in personally meaningful inquiry: the ability to think and act. That is, before online students can engage in self-motivated, meaningful courses of action, they must be taught to engage in the online strategies and cycles of learning that promote appropriate strategy use and lead to gains in efficacy beliefs (Terry, 2002). Technology, therefore, becomes a tool in the pursuit of large, meaningful questions, providing resources, stimulating thought, challenging ideas, and fostering personal understanding (Cho & Jonassen, 2002). The challenge that lies before students is not to memorize a seemingly well-defined corpus of knowledge, but rather to engage that knowledge intellectually and with discipline.

Example

Ruth Sandwell of McGill University provides a powerful example (http://web.uvic.ca/history-robinson/) of online pedagogy that supports and encourages students to be autonomous, creative, and intellectual thinkers. This site allows students to investigate the 1868 murder on Salt Spring Island, British Columbia, of the black American William Robinson. While Sandwell provides an example of an online, domain-specific site that fosters autonomous thinking, the Whole Student site (http://www.ento.vt.edu/ihs/distance/lectures/whole_student/) operated by the entomology department at Virginia Tech provides an online domain-general site emphasizing autonomous thinking.

Conclusions

Educators striving to create effective online pedagogy must not become myopic or reductionistic. Admittedly, one can easily become overwhelmed by the maze of knowledge management systems, interactive design, and computer-mediated communications, which can result in a narrowed pedagogical focus on Web-page design itself. Creating effective online instructional environments, pedagogy, and learning, however, requires a broader vision of the online educational system (see Figure 1). This vision must include gaining institutional support prior to initiating online educational programs, designing and developing instructionally sound online media and methods, and engaging students in meaningful inquiry as a prerequisite to the construction of knowledge and meaning.

Fisher (2000) notes, "as Web-based instruction is rapidly increasing in our educational system . . . there is the need for designing some guide-

lines for [its] structure. . ." (Vafa, 1999). Fisher's call must be met cautiously, however, so that the resulting guidelines are holistic and flexible in nature. In the current zeitgeist of "best practices," there is the tendency to attempt to create strategies or guidelines that will be universally effective, or *teacher proof*. Doolittle and Hicks (2003) caution against this approach:

> It is imperative to note that this framework [of online pedagogy] is not a prescriptive set of pedagogical strategies for the integration of technology . . . that if employed will yield maximal student learning. To be blunt, the framework provided is not "teacher proof," but, rather, requires the presence and involvement of a professional teacher—"an intermediary inventive mind must make the application."

The online pedagogical principles we have elucidated here are proffered on the grounds of theoretical support and practical implementation. That is, the principles are well grounded in the distance education and educational psychology literature, and we have employed them successfully on numerous occasions and in varied contexts. Ultimately, effective online pedagogy is predicated on a holistic approach to online teaching and learning, careful design and development of online instructional environments, and mindful implementation of sound pedagogical principles.

References

Abbey, B. (2000). *Instructional and cognitive impacts of web-based education*. Hershey, PA: Idea group.

Abate, K. (1999). Support services for distance education. *eduport.Kiosk, 1*, 1-4. Retrieved January 29, 2003, from http://eduport.com/community/kiosk/19991/serve.htm

Albrecht, R., & Bardsly, G. (1994). Strategic planning and academic planning for distance Education. In B. Willis (Ed.), *Distance education strategies and tools* (pp. 67-86). Englewood Cliffs, NJ: Educational Technology.

Ausube D. P. (1968). *Educational psychology: A cognitive view*. New York: Holt, Rinehart, & Winston.

Barab, S. A., MaKinster, J. G., Moore, J. A., Cunningham, D. J., & the ILF Design Team. (2001). Designing and building an on-line community: The struggle to support sociability in the Inquiry Learning Forum. *Educational Technology Research and Development, 49* (4), 71-96.

Berson, M. J., Lee, J. K., & Stuckart, D. W. (2001). Promise and practice of computer technologies in the social studies: A critical analysis. In W. B. Stanely (Ed.), *Critical issues in social studies research for the 21st century* (pp. 209-229). Greenwich, CT: Information Age.

Bichelmeyer, B. A., Misanchuk, M., & Malopinsky, L. (2001). Adapting a master's degree course to the web: A case analysis. *Quarterly Review of Distance Education, 2* (1), 49-58.

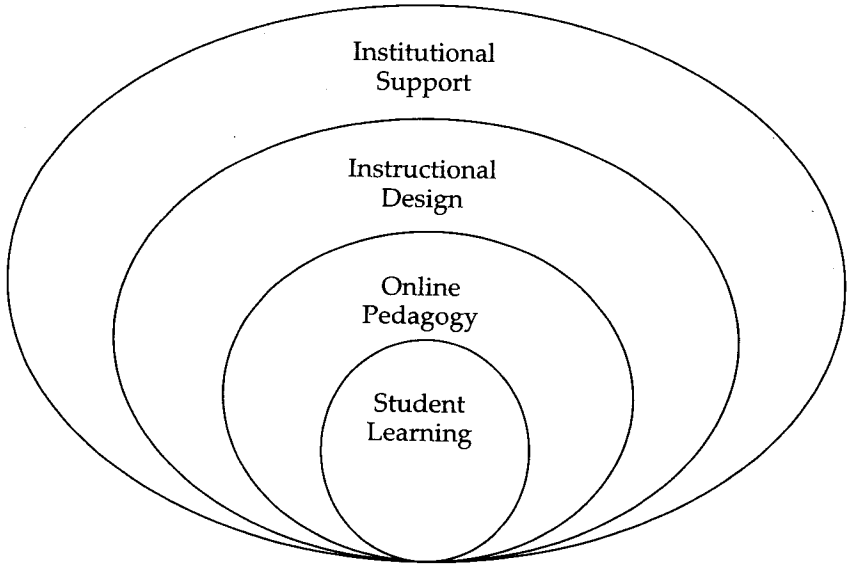
Cho, K., & Jonassen, D. H. (2002). The effects of argumentation scaffolds on argumentation and problem solving. *Educational Technology Research and Development, 50* (3), 5-22.

Chute, A. G., Thompson, M. M., & Hancock, B. W. (1999). *The McGraw-Hill handbook of distance learning*. New York: McGraw-Hill.

Connick, G. P. (Ed.). (1999). *The distance learner's guide*. Upper Saddle River, NJ: Prentice Hall.

Cyrs, T. E. (Ed.). (1997). *Teaching and learning at a distance: What it takes to effectively design, deliver, and evaluate programs* [Special Issue]. New Directions for Teaching and Learning, No. 71. San Francisco: Jossey-Bass.

Figure 1
Effective Online Pedagogy and Student Learning Requires a Holistic View of the Online Instructional Experience.



Dick, W., Carey, L., & Carey J. (2002). *The systematic design of instruction.* New York: Addision Wesley Longman.

Doolittle, P. E., & Hicks, D. (2003). Constructivism as a theoretical foundation for the use of technology in social studies. *Theory and Research in Social Education, 31* (1), 72-104.

Driscoll, M. (1998). *Web-based training: Using technology to design adult learning experiences.* San Francisco: Jossey-Bass.

Fisher, M. M. (2000). Implementing considerations for instructional design of web-based learning environments. In B. Abbey (Ed.), *Instructional and cognitive impacts of web-based education* (pp. 78-101). Hershey, PA: Idea Group.

Gagne, R. M. (1985). *The conditions of learning.* Forth Worth, TX: Holt, Rinehart, and Winston.

Hillman, D. C., Willis D. J., & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *The American Journal of Distance Education, 8* (2), 30-42.

Jonassen, D., Howland, J., Moore, J., & Marra, M. (2003). *Learning to solve problems with technology: A constructivist perspective.* Upper Saddle River, NJ: Merrill.

Krauth, B. (1999). Trends in support services for distance learners. In M. Beede & D. Burnette, (Eds.), *Planning for student services: Best practices for the 21st century* (pp. 13-17). Ann Arbor, MI: Society for College and University Planning.

Laurillard, D. (2002). *Rethinking university teaching: A conversational framework for the effective use of learning technologies.* London: Routledge-Falmer.

Lohr, L. (2003). *Creating graphics for learning and performance: Lessons in visual literacy.* Upper Saddle River, NJ: Merrill Prentice Hall.

Mager, R. F. (1984). *Preparing instructional objectives.* Belmont, CA: David S. Lake.

Mantyla, K. (1999). *Interactive distance learning exercises that really work!* Alexandria, VA: American Society for Training and Development.

Mayer, R. (2001). *Multimedia learning.* Cambridge, UK: Cambridge University Press.

McIssac, M. S. (1998). Distance learning: The U.S. version. *Performance Improvement Quarterly, 12* (2), 21-35.

Molenda, M., & Sullivan, M. (2000). Issues and trends in instructional technology. In R. Branch & M. Fitzgerald (Eds.), *Educational media and technology yearbook 2000: Vol. 25* (pp. 3-13). Westport, CT: Libraries Unlimited.

Palloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom.* San Francisco: Jossey-Bass.

Palloff, R. M., & Pratt, K. (2002). Beyond the looking glass: What faculty and students need to be successful online. In K. E. Rudestam & J. Schoenholtz-Read (Eds.), *Handbook of online learning* (pp. 171-184). Thousand Oaks, CA: SAGE.

Peters, O. (1998). *Learning and teaching in distance education: Analyses and interpretations from an international perspective.* London: Kogan Page.

Reeves, T. C., & Reeves, P. M. (1997). Effective dimensions of interactive learning on the World Wide Web. In B. H. Kahn (Ed.), *Web-based instruction* (pp. 59-67). Englewood Cliffs, NJ: Educational Technology Publications.

Reiser, R. A., & Gagne, R. M. (1983). *Selecting media for instruction.* Englewood Cliffs, NJ: Educational Technology Publications.

Rouet, J., Levonen, J., & Biardeau, A. (Eds.). (2001). *Multimedia learning: Cognitive and instructional issues.* Oxford, UK: Pergamon.

Rudestam, K. E., & Schoenholtz-Read, J. (2002). *Handbook of online learning.* Thousand Oaks, CA: SAGE.

Scheer, S. B. (2001). *The inclusion of an online wellness resource center within an instructional design model for distance education.* Unpublished doctoral dissertation, Virginia Polytechnic Institute and State University.

Scheer, S. B., & Lockee, B. B. (2003). Addressing the wellness needs of online distance learners. *Open Learning: The Journal of Open and Distance Learning, 18* (2), 178-196.

Shoemaker, C. C. J. (1998). *Leadership in continuing and distance education in higher education.* Needham Heights, MA: Allyn and Bacon.

Smith, P. L., & Ragan, T. J. (1999). *Instructional design* (2nd ed.). New York: John Wiley & Sons.

Terry, K. S. (2002). *The effects of online time management practices on self-regulated learning and academic self-efficacy.* Unpublished doctoral dissertation, Virginia Polytechnic Institute and State University.

Twigg, C. A. (2000). Institutional readiness criteria. *Educause, 35* (2), 42-51.

Vafa, S. (1999). Web-based instruction and motivation: Some useful guidelines for educators. *Technology and Teacher Education Annual, 1999.* Charlottesville, VA: Association for the Advancement of Computers in Education.

Vye, N. J., Schwartz, D. L., Bransford, J. D., Barron, B. J., Zech, L., & Cognition and Technology Group at Vanderbilt. (1998). SMART environments that support monitoring, reflection, and revision. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Metacognition in educa-*

tional theory and practice (pp. 305-346). Mahwah, NJ: Erlbaum.

Wang-Chavez, J., Branon, R., & Mikolaj, P. (2001). Facilitating web-based instruction: Formative research on improving an online undergraduate business course. *Quarterly Review of Distance Education, 2* (3), 209-220.

Williams, M. L., Paprock, K., & Covington, R. (1999). *Distance learning: The essential guide.* Thousand Oaks, CA: SAGE.

Williams, V., & Peters, K. (1997). Faculty incentives for preparation of web-based instruction. In B. H. Kahn (Ed.), *Web-based instruction* (pp. 107-110). Englewood Cliffs, NJ: Educational Technology.

Willis, B. (1994). Engaging faculty effectiveness in distance education. In B. Willis (Ed.), *Distance education strategies and tools* (pp. 277-290). Englewood Cliffs, NJ: Educational Technology.

Wolcott, L. (1996, October). Distant, but not distanced. *TechTrends, 41* (7), 23-27.

Stephanie Scheer *is an assistant professor and instructional designer within the division of educational technologies in the School of Continuing and Professional Studies at the University of Virginia. Her chief duties include university faculty instructional development, specifically for distance and distributed learning modalities. Her research interests include determining viable approaches to developing student support services for distance learners.* **Krista P. Terry** *is the director of instructional design and technology and assistant professor in the College of Education at Troy State University. In addition to providing instructional design and development support to the College of Education faculty, she teaches graduate-level instructional technology courses both on campus and through Troy State University's online degree program.* **Peter E. Doolittle** *is an assistant professor and current head of the Educational Psychology Program in the School of Education at Virginia Tech. He is also the co-director of the Metacognition and Multimedia Project (MMP) at Virginia Tech. His research focus includes the investigation of the development of cognitive and metacognitive strategies within multimedia environments.* **David Hicks** *is an associate professor of social studies education in the School of Education at Virginia Tech. He serves as co-editor of the social studies current issues section of* Contemporary Issues in Technology and Teacher Education. *Currently he is investigating how concepts of citizenship and the integration of technology can influence how teachers approach the teaching and learning of history and social science.*