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Leveraging Affective Learning for Developing Future Airmen

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The mission of Air Education and Training Command (AETC) is to empower our nation's Airmen to fly, fight, and win by "delivering unrivaled air, space, and cyberspace education and training." However, realizing this vision in today's highly interactive, information-saturated, and global environment is tougher than ever. Mission success requires knowledge-enabled Airmen who understand, appreciate, trust, and internalize the tactics, techniques, processes, and procedures necessary to succeed in any number of complex situations.

As leaders at all levels, our Airmen must be able to anticipate and appropriately respond to a complicated and fluid national security environment. Developing such Airmen will require stronger commitments to education and training on the part of the learner to the point where learning never stops. Fostering this highly favorable attitude toward learning is possible only if Air Force education and training programs address learners' goals, motivations, social interactions, and individual learning styles. This means the Air Force needs a stronger focus on affective learning during the instructional design (ID) process for education and training.

The ability to handle complex problems across a wide spectrum of missions is not acquired through traditional rote-learning practices that merely assess an individual's ability to memorize facts in the short term. Air Force learning processes must facilitate intuitive understanding and personal internalization of often conflicting concepts, applications, and decision-making models. Effective education and training methods must recognize the filters and perceptions individuals will employ to frame a solution to any number of problem sets. Relying solely on a cognitive learning approach for leadership development is quickly being eclipsed by a drive to understand and employ affective methods to enhance learning and internalize decision-making skills (Beard & Smith, 2007).

Recognizing the evolutionary changes in the information environment, AETC published a white paper entitled *On Learning: The Future of Air Force Education and Training* (2008), which

stipulates that successful education and training in today's complex environment require a new learning culture. This includes instant and unfettered access to information through knowledge management, nonstop learning opportunities to provide continuous learning, and the right information at the right time that leads into precision learning. However, in addition to flexible and timely access to information, an effective Air Force learning environment must also instill in every Airman a strong desire to learn continuously.

More than just the opportunity and means to learn, effective education and training also require engendering students' desire to improve continuously (Weiner, 1986). This should be directed at improving abilities and knowledge to accomplish the mission more effectively. A large percentage of the academic failure rate in our nation's schools is not because of limited facilities or incompetent teachers. Rather, many students fall behind because they do not feel that learning is important to them (Lemke, 2003). To ensure mission success, the Air Force must have education and training programs that consider not only cognitive goals, but also learners, attitudes, and motivations. This should be carried out through the use of expert ID and innovative technology applications that inspire students to put forth their best effort.

Because of the fast-changing, technology-driven environment in which we operate, a true warrior ethos must be dominated by a desire to learn (AETC, 2008). This paper addresses the importance of instilling that desire through Air Force education and training, and it examines various ways that technology can help. The opening portions of this paper review general learning theory, including the cognitive and affective aspects of learning. The next section considers the impact of ID on cognitive and affective learning. Good ID is the primary means to engage the affective domain. The paper then considers how technology can facilitate cognitive and affective learning processes. Recent advances in technology provide increased social networking and adaptive learning applications that cater to affective needs. The remaining sections discuss how to apply these concepts with regard to advanced technologies, leadership, and future research.

Learning Domains

Learning can be viewed as both a product and a process. Standard definitions of learning from the educational psychology textbooks of 40 years ago generally defined learning as a "change in behavior as a result of experiences" (Twigg, 1994). This behaviorist approach assessed learning as an outcome that resulted in some external behavioral activity; however, not all learning leads to overt behavior. Consequently, many theorists later refined the definition of learning to consider changes in the way people "understand, or experience, or conceptualize the world around them" (Ramsden, 1992). So learning is an increase in information, but it also involves interpreting and comprehending. Different learners filter information in different ways, based on perspective. Individuals then restructure information to create personal knowledge (Ramsden, 1992). In other words, learning is a multidomain process involving intellect, emotion, and physical skills. Further, these domains are connected, and the condition of one influences the others.

Historically, educators have recognized and accepted the notion of separate domains for addressing different types of learning objectives. Bloom and his group's (1956) foundational effort established three categories or domains of educational objectives and identified them as cognitive, psychomotor, and affective. The theory and accompanying research for the cognitive (thinking) and psychomotor (physical) categories are fairly well defined and commonly accepted. The definition and theoretical framework of the affective category has been more problematic and difficult to establish. This lack of clarity exists because the affective domain concerns human cultural beliefs, behaviors, attitudes, motivations, feelings, perceptions, and emotions that are very fuzzy and lead to ill-defined characterizations. Each of the three domains requires specific considerations, based on the intended learning objectives (Main, 1992).

Cognitive Domain

Processes involving the development of intellectual skills characterize the cognitive domain. According to Bloom (1956), the cognitive domain is best described by six categories that typify successive levels of thought complexity. Knowledge, comprehen-

sion, application, analysis, synthesis, and evaluation designate progressive stages ranging from recalling simple information to making judgments about the value of ideas or concepts. Collectively, the theoretical range of the cognitive domain connects the thought processes necessary to acquire, process, and interpret information. This linkage to information processing makes computers and associated information technology applicable, facilitating cognitive objectives (Jonassen & Carr, 2000).

The most effective educational processes in the cognitive domain challenge and support the learner's ability to grasp new information and concepts. They focus on knowledge, reasoning, and performance that underpin the categories in Bloom's taxonomy (Krathwohl, 1964). Assessment processes in the cognitive domain determine the level of understanding achieved and provide feedback on learning outcomes. Educators design lessons intended to maximize the transfer of information and provide valid learning-assessment tools. Most educational programs focus almost exclusively on these processes during ID (Pierre & Oughton, 2007).

Psychomotor Domain

The psychomotor domain involves physical movement, coordination, and the use of motor skills and is generally associated with training. Physical skills, developed through training or practice, are measured in terms of accuracy, speed, precision, distance, or technique. There are several taxonomies describing psychomotor skills, and each includes increasing levels of physical dexterity and ability to adapt new movements when necessary. This domain is considered well defined as the results from empirical research generally agree with theories concerning psychomotor learning (Bloom, 1956). Pilot, vehicle driver, weapons operator, and maintainer training are examples of psychomotor instruction.

Affective Domain

Processes involving our needs and emotions characterize the affective domain. Affective filtering of life's circumstances creates an individual's disposition, enthusiasm, motivation, attitude, attention, value, and emotion regarding another individ-

ual, object, fact, concept, process, and/or belief. Sinclair (1985) refers to *affect* as a term used to describe the feeling or emotional aspect of experience, associated with

- the motivation of behavior,
- the maintenance and enhancement of self-esteem in the educational setting,
- anxiety and achievement motivation,
- development of curiosity and a need to know and understand, and
- social motives, such as a need for praise, recognition, and attention.

Although affective learning is difficult to define, anyone who has taught for very long recognizes its crucial role. In any given lesson, some students seem driven to absorb new concepts and ideas while others seem disinterested. This situation can lead to the often-heard phrase "what is taught is not the same as what students learn" (Atherton, 2005). This highlights the strong influence exerted by affective processes on cognitive learning. Though theoretically incomplete, empirical evidence suggests that the absence of affective internalization of a concept attenuates long-term learning (Rose & Meyer, 2002). Restated more simply, students who have little desire or interest to learn will learn little. Unfortunately, due to the indistinct nature of the affective domain noted above, there is not a good theoretical model for predicting the precise impact of affect on learning. A systematic approach for detecting level of affect is needed to assist teachers as they try to motivate and involve their students.

Several schemas have been proposed to describe the processes of the affective domain. Krathwohl (1964) proposed the most widely cited taxonomy with five major categories describing levels of affect. These categories, listed below in order from lowest to highest affect, provide a rough framework to assess and compare:

1. Receiving—Passive attention to phenomena (e.g., listens attentively, asks, sits erect, and identifies).
2. Responding—Active participation in and reaction to phenomena (e.g., participates, discusses, and helps others).

3. Valuing—Attachment of worth to phenomena (e.g., explains, proposes, shares, and differentiates).
4. Organizing—Construction of value system that compares and relates phenomena (e.g., generalizes, integrates, and synthesizes).
5. Characterizing by value—Application of consistent value system to control characteristic behavior (e.g., works independently).

This taxonomy and its full description provide enough detail to create learning objectives that address the affective domain. The following is an example of an affective learning objective used many years ago by the Air Force Academic Instructor School:

> The objective of this lesson is for each student to respond positively to using reflective teaching techniques to improve teaching ability.

Forty years ago, educators placed nearly as much emphasis on affective objectives as they did on cognitive objectives (Krathwohl, 1964). Since that time, the share of affective objectives in ID has slowly declined to the point that few schools today include affective objectives in their lessons.

A student's affective state influences his or her learning predisposition, and educators should consider this when designing and developing education and training courses. Students use affect as a filter to assist them in developing attitudes about the course, the instructor, their peers, and the topic that in turn contributes to students' overall success in the learning process (Jolivette, 2006). When it comes to mastering skills, it is essential for students to exercise cognitive processes, but effective cognitive retention is marginalized if the affective domain is ignored. If one feels threatened, sad, bored, stressed, or preoccupied, the learning process can break down (Griffith & Nguyen, 2006). Instructional theories and design models focus on the cognitive and psychomotor domains. Research generally makes the obligatory mention of the affective domain, but in practice affect is largely ignored as an area of scientific study in the instructional-technology field.

There are numerous reasons proposed to explain why affective objectives are seldom included in the curriculum of most schools (Krathwohl, 1964; Martin & Briggs, 1986):

1. Affective results are long range and intangible.
2. People fear the perception of brainwashing (blurring of education and indoctrination).
3. Outcomes can be "faked."
4. Assessment is subjective (self-reported observations).
5. Absence of behaviors is as important as presence.
6. Some persuasive communication methods cause uneasiness.
7. Definition and understanding of affect are imprecise.
8. People disagree about affective behavior outcomes.
9. Using computers to teach attitude seems Orwellian.
10. The goal is efficiency, so affect is easily excluded.

Each of these factors has contributed to the limited use of affective learning objectives. However, another factor that may have played a role was the growing influence of technology on education (Achacoso, 2003). During the past half century, technology has grown ever-more present in the educational process. Computers, networks, multimedia, the Internet, online communication, and all forms of digitized information are commonly termed educational technology (Ed Tech) when employed for learning. Ed Tech has revolutionized the educational environment, and few classrooms are without some level of Ed Tech in place.

Impact of Technology

Technology has routinely influenced educational theories, and some models of thinking reference the human mind in terms similar to a computer (Robertson, Elliot, & Robinson, 2007). The senses are seen as input devices, memory as a database, and the brain as some type of microprocessor. This may be a useful construct when considering presentation and recall of information, but one of the drawbacks to this type of model is that it neglects many other human processes such as interest, attention, emotion, beliefs, and motivation. Consequently, the impact of these factors on learning, which are frequently referred to as affective qualities, has often been ignored.

Advances in Ed Tech generally mirror advances in the broader technological realm, which has been dominated by software and hardware focused on efficiently delivering and transferring information. Over the past 40 years, educators have focused on the efficiencies that technological advances afforded educational processes (Lemke, 2003). Computer-based instruction, Internet access, electronic testing, distance-learning applications, television, and content-management systems allow educators to transfer information to students and assess that transfer on a grand scale (Cuban, 1987). The combined effect of these initiatives reduced the influence of human emotions on learning. Predominantly, educators ignored the student's need for connection and personal involvement, both of which are necessary for effective learning. This situation created a bias toward cognitive objectives, which has only lately begun to subside (Griffith & Nguyen, 2006). Recent developments in technology may help restore some balance between information processing and human involvement.

Paradoxically, technology that in the past may have led to a bias in favor of cognitive objectives may now be used to foster and scaffold affective objectives (Jolley, Wolfsberger, Rainer, & Bell, 2004). Improved networking technologies promise new mechanisms for social interaction, and advances in human/computer interaction are on the threshold of allowing computers to recognize user affect and respond accordingly. The latest social and communication technologies have led to applications that promote collaboration and student interaction. Educators now recognize that social learning (collaboration) tools have the potential to create opportunities to meet both cognitive and affective learning objectives. These tools include discussion forums, blogs, wikis, virtual worlds, and personal Web pages. However, the key to employing technology to support affective objectives is proper ID, which blends Ed Tech into the learning process.

Measuring Affect

Assessing progress in meeting affective learning goals requires more effort than evaluation for cognitive objectives. "Difficulty with measuring affective goals is cited in the literature

as one of the major reasons for neglecting the affective domain in instructional design models" (Main, 1992). Perhaps the most important factor in this regard is the protracted period required to cultivate complex affective behaviors. Most instructional periods are relatively short. Influencing a learner's value system generally requires instruction over a prolonged period. In addition, some affective objectives such as attention usually require periodic reinforcement. Main (1992) points to advertising or public relations campaigns as examples that address lower-level affective objectives over an extended period.

There are several basic methods for assessing affect. Direct behavioral observation is considered the most reliable but may not be possible for a large number of students or for dispersed learning activity. The ability to discern the affective state of students is a vital skill for effective teaching. One-on-one conversations or an interview is another method available to query a learner's affective state. However, workload and personnel constraints frequently impede such time-intensive assessment methodologies.

Self-reporting is another means to determine a learner's affective state. Surveys or questionnaires are generally used to query attitude or other affective characteristics, but there can be problems with reliability. Some students may give the answers they believe more suitable rather than express their true emotional state or attitude. Another means to measure overall affective state is an implicit questionnaire designed to reveal affect without bias from the student (Anderson, 2000). These instruments probe affective characteristics through a series of highly formatted, previously validated questions to register affect reliably. Writing assignments are commonly used as a valid assessment of affect. Essays can provide evidence of a learner's attitude toward a particular subject. However, analyses of essays can be somewhat subjective and may require a rubric and trained evaluators (Anderson, 2000).

Instructional Design Process

So how do we bridge the gap and develop linkage between cognitive and affective instruction as we develop lifelong learners? The key is to use an integrated ID process that targets both the

affective and cognitive domains. According to Smith and Ragan (1999), ID refers to the "systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation." Good ID produces effective lessons based on sound educational principles. To be effective, lessons must both engage the learner and provide instruction in a clear and an efficient manner.

Engaging learners requires instructional designers to focus on incorporating the affective domain along with the cognitive domain during the ID process. The problem resides with the prevalent tendency to use ID models centered on instruction for cognitive objectives (Main, 1992). However, the more instructional designers know about both the cognitive and affective processes involved in learning, the more competent and confident they are with regard to designing effective learning (Sugrue, 2004). Expert ID of affective objectives can lead to greater motivation on a particular lesson and to successful cognitive and affective outcomes.

According to Pierre and Oughton (2007), instructional designers should not limit efforts in the affective domain to just motivating students to learn. Rather, they should consider how to engage students in deeper learning through the use of affective learning with appropriate pedagogy and evaluation methods. ID needs to become more effects based by creating instruction that addresses teaching strategies and learning outcomes that span the various levels of Bloom's taxonomy. In effects-based design, the designer considers holistic effects and the interrelated and interdependent nature of the learning domains. Main (1992) stated that integrating the affective instructional component into, or alongside, the ID model or process ensures that domain objectives are covered in every lesson.

The ID process ensures that learning does not occur in a haphazard manner but is guided using a process with specific, measurable outcomes. The responsibility of the instructional designer is to create an instructional experience which ensures that learners will achieve the desired learning outcomes. ID has the appearance of a linear system; however, it is best viewed as an interactive process in which sequencing and fine-tuning of objectives are possible. There are no prohibitions against

incorporating affective events or making changes to instruction. Teachers can adapt instruction based on evaluations and flow changes back through the process. Using ID as a working template can create the right learning program or process and justify necessary resources (Piskurich, Beckschi, & Hall, 2000).

The ID process considered for the purpose of this study is the Military Instructional System Development (ISD) Model (Branson et al., 1975). Analysis, Design, Development, Implementation, and Evaluation—generically known as ADDIE—is widely accepted as an industry standard for ID of educational media (Liu, 2008). The ADDIE model brings a generic, systematic approach based on foundations-of-learning principles and standard system theory to the ID process (Tennyson, 1989). The ADDIE process provides a framework that instructional designers can use to optimize the effectiveness of instructional products and the efficiencies of creative processes (Hall, 1997).

Each phase of the ADDIE model is a decision-making process that needs to ensure the effectiveness of the instructional experience (Smith & Ragan, 1999):

- **Analysis**: The instructional problem is clarified, the goals and objectives are established, and the learning environment and learner characteristics are identified.
- **Design**: The instructional strategies are designed, the media choices are made, and the objectives and tasks that will show student mastery are created.
- **Development**: Materials are produced according to the instructional process.
- **Implementation**: Instruction is tested using prototypes (with the targeted audience). Flaws are corrected or revised before the product goes into production, and learners and instructors are trained on product use. Flexibility is the key element during the implementation phase.
- **Evaluation**: Feedback is gathered to help determine instructional effectiveness. Many consider this the most important stage, and it should be an ongoing process.

Affective or Motivational Design

Motivational design is a systematic process that results in the preparation of learning programs that predictably influence the learner's behavior. Consequently, motivational design is concerned with connecting instruction to learner goals, providing stimulation and appropriate levels of challenge, and influencing how learners will feel following success or failure of goal accomplishment. Every educator understands the challenge of stimulating and sustaining learner motivation and the difficulty of finding reliable and valid methods for motivating learners.

One approach to motivational design is provided by Keller's Attention, Relevance, Confidence, and Satisfaction (ARCS) model of motivation (Keller 1983, 1999a, 1999b, 2000). The ARCS model is based on a synthesis of motivational concepts and characteristics that provide guidance for analyzing the motivational characteristics of a group of learners and then designing motivational strategies to fit the learners (Keller, 2000). The four conditions that comprise ARCS must be met to motivate learners.

There are two major parts to the model. The first is a set of foundational factors representing the components of motivation, based on research into human motivation. The instructional designer should use them as guidelines during lesson-development activities:

- **Attention** strategy relates to stimulating and maintaining the learner's attention by initiating an instructional event with some sort of sensory stimuli and/or varying the kinds of activities or media.
- **Relevance** strategy communicates to the learner how the activity or event relates to personal needs, interests, or motives.
- **Confidence** strategy relates to the learner's expectancy to feel it is worth the effort to participate in the activity.
- **Satisfaction** strategy provides extrinsic and intrinsic reinforcement from the learning experience.

The second part of the ARCS model is a systematic design process that assists in creating motivational strategies appropriate for a given set of learners. The synthesis allows educa-

tors to identify the various elements of student motivation; the design process helps profile students' motivational characteristics in a given learning environment and then design appropriate motivational tactics (Keller, 1999b). Keller further breaks down each ARCS strategy into three psychological concepts that assist designers by providing a theoretical foundation for each component:

- **Attention**—perceptual arousal, inquiry arousal, and variability
- **Relevance**—goal orientation, motive matching, and familiarity
- **Confidence**—learning requirements, success opportunities, and personal control
- **Satisfaction**—intrinsic reinforcement, extrinsic rewards, and equity

Combined Instructional and Motivation Design

Keller never intended that the ARCS model stand apart as a separate system for ID; rather, it should be incorporated with instructional models (Keller & Song, 2001). Additionally, history and research have revealed that no one theoretical foundation for ID practices is suitable for all applications (Willis & Wright, 2000). Both affective and cognitive ID approaches account for meaningful learning and realistic contexts for application knowledge and skills (Atkins, 1993). Both recognize the importance of learner motivation and prior experience (Dick, 1996).

Keller's ARCS model attempted to correct discrepancies that marginalized the efficacy of most educational theories (Main, 1992). That is to say, while a learner may be motivated toward learning, there is no assurance that a person is motivated to learn what the instructional event delivers. Additionally, instructional designers cannot assume they understand student motivation. During analysis, designers must attempt to understand how best to encourage students to reach the same conclusions regarding the values, interests, motivation, and content intended by the lesson's learning objectives (Gunter, Kenny, & Vick, 2006). The goal should be a combined ID model

that includes a structured process incorporating both cognitive and affective concerns. Main (1992) suggested integrating the ADDIE and ARCS models using a matrix to address the two domains in a systematic manner. Integrated ID (Figure 1) is an essential component for building an effective learning program.

Figure 1. Combining ISD and affective-design models

The design process has become more complex as advanced communication technologies have made social networking, information retrieval, and knowledge management available 24/7 worldwide. To bridge the gap and engage students in deeper, meaningful learning, instructional designers need to incorporate the affective domain during the design process. They must also follow the fundamental principles that apply to all pedagogy, including the external conditions that support learning and performance (Sugrue, 2004).

A large number of instructional strategies and models are available for designers to help facilitate learner engagement and the learning process. It is important for instructional designers to have a solid understanding of the theory and the design process though they need not be subject-matter experts in a particular discipline. This paradox makes it important for instructional designers to keep sight of what Sugrue (2004) calls the five fundamental learning and performance principles:

1. Learning is not performance: Align learning objectives with required performance objectives entwined with adequate incentives for applying the new skill and knowledge.

2. Medium is not the method: Design to maximize strengths of the medium, but don't expect the medium itself to influence content effectiveness.
3. External and internal conditions should match: Ensure that flexible instructional methods are compatible with the cognitive processes of acquisition, knowledge storage, and retrieval while motivating learners to engage in their own learning.
4. Authentic practice makes perfect: Design as contextually realistic as possible, matching goals of instruction for deepening knowledge.
5. One size does not fit all: Accommodate individual differences by monitoring performance; diagnosing weaknesses; and adjusting feedback, information, and practice activities to meet group and/or individual goals.

Instructional designers well grounded in affective and cognitive learning and motivation processes are better equipped to design effective learning products.

Learning with Technology

Ed Techs are evolving daily, and the use of advanced Ed Techs in the classroom is now the rule rather than the exception. Higher education in the United States has given priority to integrating technology into the curriculum. The primary benefits of technology integration include efficiency in accessing information, distribution and presentation of course materials, applications to calculate and record, flexibility to adapt to individual learning differences, and meeting real-world technological skill requirements. Even the simplest use of technology (e.g., spreadsheets, presentations, word processing, downloading information) appeals to faculty and learners.

Today, advanced communication technologies have enabled instant delivery of massive amounts of information in a variety of formats and user-defined levels. Some posit that the instantaneous availability of massive amounts of unstructured data leads to problem-solving errors (Sweller, 1988). Others take the opposing view, suggesting that "digital natives" have adapted

their learning skills to accommodate the technology (Prensky, 2001) and have acquired a self-regulating ability to organize the data necessary to resolve decision-making conflicts (Bandura 1971, 1986). Further research is required on the subject, but advanced communication technologies are alluring to the educator because they provide the power to reach more students at a variety of learning levels (Jolley et al., 2004). Additionally, such technologies afford a multisensory approach to gaining and maintaining student cognitive and affective interest as long as such approaches are based on sound pedagogical principles (Achacoso, 2003). The quandary facing researchers and faculty members alike is the question of whether or not advanced communication technologies actually improve learning.

The literature on the subject is varied, but a majority of people writing on Ed Tech have found that technology alone does not necessarily enhance the learning process over traditional methods (Ehrmann, 1995; Sugrue, 2004). Rather, research has shown that technology can aid the learning process but only if applied correctly. Therefore, we can assert that although learning is not technology dependent, technology as an enabling tool has potential to improve the level of learning when properly applied.

One advantage of integrating technology into ID is its ability to present or provide access efficiently and effectively to a variety of information. However, it is imperative that educators shift the paradigm from where students learn from technology to where students use technology as a cognitive tool or learning enabler. The real power of Ed Tech comes not from automating information transmission but from enabling student education while engaging their desires to continue lifelong learning.

Cognitive tools allow students to interact with information to acquire, synthesize, create, and share new knowledge. Technology allows students to use cognitive tools to seek and present information while organizing and integrating knowledge (Robertson et al., 2007). Technology facilitates this process by enabling the learner to access and retrieve information beyond the limits of memory, which enables the student to return to previous information, engaging it throughout the learning process (Robertson et al., 2007).

Cognitive tools are distinct in their implications of technology. Jonassen and Carr (2000) distinguish the impact of learning

from technology and that of learning with technology. Simply stated, when students work with technology, instead of being controlled by it, they enhance the technology's capabilities, and the technology enhances their thinking and learning. This interaction empowers learners to become active and responsible filters of information who engage in directing their mental processes. Cognitive tools should allow students to "activate metacognitive learning strategies" (Jonassen & Carr, 2000). Metacognitive learning strategies are used when students encounter new information, connect it to their prior knowledge, and then construct and revise their schemata (Flavell, 1979). The effective use of cognitive tools should enable learners to undertake this process and assist them in experiencing cognitive processes that would be impossible without such tools (Mayes, 1992).

Technology to Promote Affective Learning

Research has proven that learners who are not engaged and motivated are not learning as effectively as their peers who are engaged and motivated. According to Rose and Meyer (2002), educators engage and motivate by providing a choice of content (print, audio, information, video, simulation, and instruction), adjustable levels of challenge, and choice of learning context since learners are unique, like fingerprints. Technology enables designers to embed video, pictures, sounds, and story lines while providing links to additional information and social networks that learners can access. In multimedia learning, the student engages in three cognitive processes: selecting, organizing, and integrating based on dual coding theory (Mayer, 1996). Additionally, the affective domain is engaged through an emotional story, an evocative image, a video, or mood-provoking music.

By properly designing and integrating with correct technology, the educator can emphasize the desired effect to engage the learner to promote knowledge construction and problem solving (Um, Song, & Plass, 2007). For example, consider an online instruction consisting of text explaining that one should avoid filling a gas can in the bed of a truck. Now consider the same learning goal using video showing an individual at the gas station as gas fumes—ignited by static electricity—explode, and flames engulf the truck. Such poignant examples, delivered by

means of technology, are designed to engage emotions while making people think about potential consequences.

Another proven influence on affect is socialization and personal interaction with others, including students and faculty. Social interaction can lead learners to make strong internalizations and can affect their reasoning and beliefs. Learners' comprehension or retention of knowledge (cognitive learning) as well as their feelings about, attitudes toward, behavior during, and satisfaction with the course (affective learning) may also be influenced. Social presence has emerged as an important social factor in the field of education. To understand the concept of social presence, one must understand what socialization and presence entail (Guanwardena & Zittle, 1997). According to Kandwar and Swenson (2000), socialization refers to the "process by which people learn the characteristics of their group and the attitudes, values, and actions thought appropriate for them." Presence—important in social learning to reach learning goals—is reported to have positive effects on student perceptions of the course's communications and relevance (Jacobson, 2001).

The recent advance of several new Ed Techs such as online learning environments, social networking, mobile devices, and intelligent agents is reshaping the nature of Ed Tech. These technologies allow asynchronous and synchronous communication that facilitates socialization and social presence. Technology can facilitate communication across barriers of time and distance while enabling virtual communities with affective and social support that fosters deeper shifts in education practices (Dede, 1999). Educators are using these advances to meet affective learning objectives. The following Ed Techs focus on current and ongoing capabilities, thus facilitating the affective educational processes.

Online Learning Environments

Online learning environments encompass a variety of types and styles, providing different capabilities such as content management, discussion, assessments, and messaging. If properly designed and employed, these environments can facilitate affective and social interactions. The key is providing social, learning, and technology support in the learning environment (Chen, 2007). All three areas impact affective learner characteristics.

Successful learning environments must facilitate a variety of learners and educators across the spectrum of affective and cognitive knowledge levels. Successfully providing such support requires instructional designers to consider the ID process for the learner and to plan for costs, logistics, and faculty support in all three areas.

Social Networks

Social networks and social learning are coming of age as technology grows and the Internet expands across the world. Social learning can take place in discussion forums, chats, blogs, wikis, and virtual worlds. Social theory provides insight into why social networks need to be part of the learning process. According to social-learning theory, human behavior is based on continuous reciprocal interaction among individuals in terms of cognitive, behavioral, and environmental influences (Bandura, 1971; Jones & Issroff, 2005). Preece (2000) emphasizes that, if online communities wish to be successful, developers and designers need to pay attention to social as well as technical issues while infusing sociability in communities that depend on trust, collaboration, and appropriate styles of communication.

Online-learning communities normally congregate around formally organized learning activities. Wenger's concept of communities of practice (CoP) (1998) has gained acceptance across the education domain, enabled by new technologies that permit the development of virtual CoPs. Air University's Commander's Connection is one of those communities that has proven successful in allowing new and current squadron commanders to get together virtually and educate, assist, and update each other. CoPs have provided motivation and emotional support while allowing peers to operate in real-world contexts (Jones & Issroff, 2005).

Technology not only has the capability to engage students by enriching the learning environment, but also can assist the faculty. Professional networking can link educators as a community of peers to help establish best practices and pedagogical strategies. Such online communities also assist faculty engaging in research and provide a means for them to compare cognitive and affective strategies. Distance-learning technology also enables teachers to reach more students than face-to-face

meetings would allow. An experienced teacher in the role of subject-matter expert may participate in the design, development, and implementation of both an online class and pedagogical techniques focused on cognitive or affective strategies that can aid novice educators; such a teacher could also act as a mentor (Wepner & Tao, 2002).

The most common method for social interaction in CoPs and other online venues is the discussion forum. The creation of a discussion forum to encourage social interaction among individuals while they undertake online studies has become a common practice as increasingly sophisticated learning-management systems pervade education. Pilkington and Walker (2003) assert that effective teaching and learning is predicated on the forum's capacity to facilitate collaborative and critical discussion to "develop student ability to reason" for both cognitive and affective learning. As Roberts (2007) suggested, it is not just about participating but about how this participation can enrich student-learning experiences.

CoPs, discussion forums, or online chats are all ways to integrate social learning and networking with the educational process. Learners are able to extend their range of learning opportunities by collaborating with others to achieve goals and complete assignments not otherwise possible. According to Woods and Ebersole (2003), a properly designed social-learning network facilitates interconnectedness and shared responsibility for learning outcomes, allowing cognitive and affective aspects of online learning to produce optimal results. Technology has facilitated social learning and brought it to a higher level of educational awareness. Further research is necessary to determine the best means to exploit it for optimized learning.

Virtual Worlds

Perhaps we are reaching the next stage of social presence through the use of virtual worlds, which are gaining acceptance as a viable teaching and learning tool. Virtual worlds can provide an immersive environment that facilitates a strong social presence. They allow simulated experiences not possible in school settings, increase learner engagement

by visually immersing students, support new forms of interaction and collaboration with the potential to increase students' knowledge and skills, and build self-efficacy (Metcalf, Clarke, & Dede, 2009).

Virtual experiences can have a more profound influence on affective outcomes than other pedagogy because multiple senses (visual, auditory, and tactile) are involved. Additionally, learning in virtual environments can be tailored to individual needs. Rather than learning by listening to lectures or reading, students will be able to access information, work collaboratively, and evaluate knowledge using virtual simulations. Although virtual worlds in education and training are still in their infancy, they show potential.

Massachusetts Institute of Technology Affective Computing: Human/Computer Interface

As discussed earlier, it is problematic to assess short-term affective status, and it is even more difficult to measure long-term affective learning outcomes. However, advanced technology is promising new means to provide affective feedback. The Massachusetts Institute of Technology (MIT) is actively researching ways to measure the affective state of learners via technology. One aspect of MIT's research is the affect-sensitive AutoTutor, which aspires to keep students engaged, boost self-confidence, and maximize learning by narrowing the communicative gap between the highly emotional human and the emotionally challenged computer (D'Mello et al., 2008). AutoTutor is intended to be responsive to learners' affective and cognitive states. Whether or not the affect-sensitive AutoTutor positively influences learning and engagement awaits further development and empirical testing (D'Mello et al., 2008). AutoTutor represents just one of a handful of related efforts currently being researched. Technology that senses or measures human affect will need to be considered as we design our future educational and training courses.

Affective-Reasoning Agents

Affective-reasoning agents are similar to an expert tutor who uses artificial intelligence to respond to a learner's cognitive

needs. These agents parse learner responses for affective content and respond realistically with correct emotional expressions to the human user. Similar to affective computing, they have the potential not only to provide social-learning contexts intertwined with affective reasoning, but also to provide a way to reach learners with inspiring, affective presentations and realistic experiences. If properly designed and executed, affective-reasoning agents can also offer powerful affective feedback, which can take the form of natural conversation, gestures, or verbal clues, allowing the learner better insight into and connectivity to the educational outcome the designer intended (McQuiggan & Lester, 2007). Like the work at MIT, affective reasoning is in its infancy, and more research is needed to find the proper mix of technology and design.

Mobile Learning

Technology also enriches learning by extending education and training away from normal education sites. Learners can take learning on the road, using laptops, mobile-learning devices (m-learning), and wireless or wired networks. Learners can then tie into Web sites, social networks, or e-learning sites (e.g., Blackboard), where they can engage in research, communicate with students or faculty, write papers, do homework, take tests, read required articles, or even catch the lecture they might have missed. Mobility allows formal and lifelong learners to control the learning experience in a number of dimensions (Paulsen, 1993).

Mobile technology allows learners to tailor education to their lifestyles. Learners can stay connected with other students, faculty, and instructional resources. The result is that learners feel more comfortable with the educational process and are more likely to internalize what they are studying and sharing (Prensky, 2001). Further, some learners are tied to their friends and business activities through their mobile devices, and the trend of using the devices may be culturally ingrained. The combination of convenience and connectivity can increase the level of social presence, which can improve the level of affect toward learning. The use of mobile devices requires active interest and precludes the passive process found in some traditional learning

environments (Shen, Wang, & Shen, 2009). Businesses are starting to look at ways to take advantage of mobile and m-learning capability, including learning-content systems, assignment reminders, and learning aids. According to the eLearning Guild, over 30 percent of organizations surveyed currently deliver some amount of learning content through mobile platforms (e.g., iPod, Blackberry, or other smartphones).

Leadership

The affective domain is vital to overall learning, but it holds special interest to leaders and those individuals who develop tomorrow's leaders. Leadership requires influencing people's attitudes, motivations, and goals, which correlates directly with the factors comprising the affective domain. All leaders must be able to address problems and make decisions, but truly effective leaders must be able to create positive affect in themselves and their followers to motivate everyone toward a common goal. This synergy between leadership and affect makes affective learning a vital concern to the Air Force. The most likely means to develop motivated leaders who can motivate others is to cultivate them through substantive affective learning in Air Force education and training programs.

One approach to acquiring leadership skills involves studying the philosophy, habits, and methods of one or more highly successful leaders and then trying to develop a personal leadership style based on a single leader or a composite of several (Lorenz, 2005). This method relies on inspiration to create affect in the learners toward leadership. A well-designed leadership course should provide a wide variety of leadership examples and highlight key achievements and methodologies that reinforce desired philosophy and traits. Ed Tech's integration of video, audio, or other multimedia to grab learners' attention by introducing relevant, informative, and inspirational leader aspects provides essential learner ownership (Keller, 1999a). Additionally, designers need to provide learners with opportunities to conduct discussions, engage in authentic practice, and build confidence as they apply and synthesize the desired philosophy and traits.

Recently, practitioners of leadership and business development have become increasingly interested in the formation of

leadership networks as a way to strengthen relationships among leaders. Within groups, peer members build relationships with each other, based on cooperation rather than a chain of command (Wenger, 1998). Group members converse about their experiences as part of a shared social/cultural community, or perhaps just as people who share similar values (Preece, 2000). Learners participate in exercises virtually, online in games, or through authentic role-playing opportunities to build the confidence vital to leaders. Designers can use the advantage of technology to allow the learner to replay scenarios, discuss issues with peers, or try out a different leadership philosophy. These activities can occur whether learners are collocated or geographically separated. A related process entails developing future leaders through mentoring, which also relies on social relationships but involves interactions not only among peers, but also among senior leaders and younger protégés. The desired end state still requires the creation of positive affect in future leaders and their followers to motivate everyone toward a common goal.

Recommendations

The results of this study give rise to several recommendations that could help Air Force education and training develop knowledge-enabled Airmen and foster leadership. The first suggestion is to institutionalize affective learning throughout all aspects of Air Force education and training:

- Integrate affective objectives into the ID process.
- Develop and adopt a combined ID methodology that merges cognitive and affective concerns.
- Develop Air Force faculty who are sensitive to the student's affective states, and devise empirically validated methods to positively impact affect.
- Promote policies that encourage affective-learning tactics, techniques, and procedures throughout Air Force education and training programs.

- Implement experienced Ed Tech manning positions at higher headquarters along with a similar institution at Air University.

Significant integration of affective learning will be possible only with the buy-in of Air Force leadership. Senior leaders must recognize the importance of affective learning and work to institute policies that promote its use in all Air Force education and training programs.

A second suggestion is that the Air Force actively develop and apply social networking and other technologies described in this study to achieve affective-learning goals. This may be problematic due to current limitations imposed by network security. Discussion boards, CoPs, streaming videos, chats, blogs, and other applications enabling social interactions are encumbered with security policies on military networks. Consequently, educational networks may be necessary before social-networking technologies can be employed throughout the Air Force. However, it is important for the Air Force to cultivate lifelong learners by encouraging engagement and social interchange during the learning process. Social networking is being exploited in civilian education and promises to change the face of learning from directed information exchange to a more learner-centered approach.

A third recommendation is to conduct further studies on affective learning to address questions regarding its use in and impact on Air Force education and training:

- How can cognitive and affective-design methods be combined to create a more effective overall curriculum-development process?
- What assessment or survey methods provide the best measurement of a learner's affective state and success in meeting learning objectives?
- How does the learner's affect influence cognitive learning?
- Which methods and technologies are most effective in building positive attitudes, motivation, leadership, and confidence?

Conclusion

This study is intended to help Air Force leadership and educators better understand the importance of affective learning in the development of Airmen as lifelong learners. Affective learning concerns learners' attitudes, motivations, beliefs, and emotions. Unfortunately, the affective domain has been a neglected area because its characteristics are neither directly observable nor easily measured. Consequently, most educational systems evaluate student performance against cognitive proficiency rather than against affective measures. However, it is important to realize that affect is critical to the overall learning process since cognitive learning depends on attitude, motivation, and other affective factors.

It is necessary to include a learner's emotional/cognitive state in the ID process to assist the learner in understanding the efficiency and satisfaction of the learning process. ID that merges affective and cognitive objectives is even more critical as more instruction is conducted through distance learning without a facilitator present. An important Air Force goal should be to partner technology with the affective and cognitive domains to provide distance students with an experience similar to that of in-residence students.

Technology offers the opportunity to promote affective learning through multimedia, social networking, mobile learning, and more. Additional study is needed to assist short- and long-term affective gains using technology. Social networks and learning are having successes and failures; further research is needed to gain more understanding of affective and cognitive linkages in social-learning environments. It is imperative that technology support education and not the other way around.

There is a great deal of overlap and synergy between the concepts of affect and leadership. Successful leaders must be able to motivate themselves and those they lead toward a common goal. How we encourage today's learners impacts how they develop into tomorrow's leaders. To be successful, affective learning must be institutionalized into Air Force culture, including strong support from senior leaders.

References

Achacoso, M. (2003). *Evaluating technology and instruction: Literature review and recommendations*. Austin, TX: University of Texas.

Air Education and Training Command. (2008). *On learning: The future of Air Force education and training*. San Antonio, TX: Randolph AFB.

Anderson, L. (2000). *Assessing affective characteristics in the schools* (2d ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Atherton, J. S. (2005). So what is learning? Retrieved from http://www.learningandteaching.info/learning/whatlearn.htm

Atkins, M. J. (1993). Theories of learning multimedia applications: An overview. *Research Papers in Education, 8*(2), 251–271.

Bandura, A. (1971). *Social learning theory*. New York, NY: General Learning Press.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall.

Beard, C., Clegg, S., & Smith, K. (2007). Acknowledging the affective in higher education. *British Educational Research Journal, 33*(2), 235–252.

Bloom, B. S. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain*. New York, NY: McKay.

Branson, R. K., Rayner, G. T., Cox, J. L., Furman, J. P., King, F. J., & Hannum, W. H. (1975). *Interservice procedures for instructional system development*. Fort Monroe, VA: Army Training and Doctrine Command.

Chen, S. (2007). Instructional design strategies for intensive online courses: An objectivist-constructivist blended approach. *Journal of Interactive Online Learning, 6*(1), 72–86.

Cuban, L. (1987). Teachers and machines: Classroom use of technology since 1920. *Teacher's College Record, 88*(3), 457–460.

Dede, C. (1999). *The role of emerging technologies for knowledge mobilization, dissemination and use in education.* Retrieved from http://www.virtual.gmu.edu/EDIT895/knowlmob.html

Dick, W. (1996). The Dick and Carey model: Will it survive the decade? *Educational Technology Research and Development, 33*(3), 52–70.

D'Mello, S., Jackson, T., Craig, S., Morgan, B., Chipman, P., White, H., . . . Graesser, A. (2008). *Auto tutor detects and responds to learners affective and cognitive states*. Retrieved from http://affect.media.mit.edu/pdfs/08.dmello-etal-autotutor.pdf

Ehrmann, S. C. (1995). Asking the right question: What does research tell us about technology and higher learning? *Change, 27*(2), 20–27.

Flavell, J. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist, 34*(10), 906–911.

Griffith, K. A., & Nguyen, A. (2006). Are educators prepared to affect the affective domain? *National Forum of Teacher Education Journal* [Electronic version], *16*(3E), 2005–2006.

Guanwardena, C., & Zittle, F. (1997). Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *The American Journal of Distance Education, 11*(3), 8–26.

Gunter, G. A., Kenny, R. F., & Vick, E. H. (2006). A case for a formal design paradigm for serious games. *The Journal of the International Digital Media and Arts Association*, *3*, 93–105.

Hall, B. (1997). *Web-based training cookbook*. New York, NY: John Wiley & Sons.

Jacobson, D. (2001). Presence revisited: Imagination, competence, and activity in text-based virtual worlds. *CyberPsychology & Behavior, 4*(6), 653–673.

Jolivette, B. J. (2006). Social presence and its relevancy to cognitive and affective learning in an asynchronous distance-learning environment: A preliminary literature review. In *Academy of Human Resource Development International Conference (AHRD)* (pp. 533–539). Columbus, OH: Academy of Human Resource Development.

Jolley, A., Wolfsberger, A., Rainer, L., & Bell, C. (2004). *Using Technology to Support and Facilitate Student Learning*. Retrieved from http://webpages.uah.edu/~bellcl/bellcl%20wp%20project.doc

Jonassen, D., & Carr, C. (2000). Mind tools affording multiple knowledge representations in learning. In S. Lajoie (Ed.), *Computers as cognitive tools: Volume II. No more walls* (pp. 165–196). Mahwah, NJ: Lawrence Erlbaum Associates.

Jones, A., & Issroff, K. (2005). Learning technologies: Affective and social issues in computer-supported collaborative learning. *Computers & Education, 44*, 395–408.

Kandwar, M., & Swenson, D. (2000). *Canadian sociology.* Dubuque, IA: Kendall/Hunt Publishing Co.

Keller, J. M. (1983). Motivational design of instruction. In C. M. Reigeluth (Ed.), *Instructional-design theories and models.* Hillsdale, NJ: Lawrence Erlbaun Associates.

Keller, J. M. (1999a). Motivational systems. In H. D. Stolovitch & E. J. Keeps (Eds.), *Handbook of human performance technology* (2d ed.). San Francisco, CA: Jossey-Bass.

Keller, J. M. (1999b). Using the ARCS motivational process in computer-based instruction and distance education. In M. Theall (Ed.), *New directions of teaching and learning: Motivation from within: Approaches for encouraging faculty and students to excel* (p. 78). San Francisco, CA: Jossey-Bass.

Keller, J. M. (2000). *How to integrate learner motivation planning into lesson planning: The ARCS model approach.* Florida State University. Santiago: VII Semanario.

Keller, J. M., & Song, S. H. (2001). Effectiveness of motivationally adaptive computer-assisted instruction on the dynamic aspects of motivation. *Educational Technology Research and Development, 49*(2), 5–22.

Krathwohl, D. R. (1964). *Taxonomy of educational objectives: The classification of educational goals. Handbook II: Affective domain.* New York, NY: McKay.

Lemke, C. (2003). Standards for a modern world: Preparing students for their future. *Learning & Leading with Technology, 31*(1).

Liu, G. Z. (2008). Innovating research topics in learning technology: Where are the new blue oceans? *British Journal of Educational Technology, 39*(4), 738–747.

Lorenz, S. (2005). Lorenz on leadership. *Air & Space Power Journal, 19*(2), 5–9.

Main, R. (1992). *Integrating the affective domain into the instructional design process.* California State University,

College of Communications. Brooks AFB, TX: Air Force Systems Command.
Martin, B. L., & Briggs, L. J. (1986). *The cognitive and affective domains: Integration for instruction and research*. Englewood Cliffs, NJ: Educational Technology Publications.
Mayer, R. E. (1996). Learning strategies for making sense of expository text: The Structure-of-Intellect (SOI) model for guiding three cognitive processes in knowledge construction. *Educational Psychology Review, 8*, 357–371.
Mayes, J. T. (1992). Cognitive tools: a suitable case for learning. In P. Kommer, D. Jonassen, & J. Mayes (Eds.), *Cognitive tools for learning*. Berlin, Germany: Springer-Verlag.
McQuiggan, S. W., & Lester, J. C. (2007). Modeling and evaluating empathy in embodied companion agents. *International Journal of Human Computer Studies, 65*(4), 348–360.
Metcalf, S., Clarke, J., & Dede, C. (2009). Virtual worlds for education: River City and EcoMUVE. In *MiT6 International Conference* (pp. 1–6). Cambridge, MA: Media in Transition.
Paulsen, M. (1993). *The hexagon of cooperative freedom: A distance education theory attuned to computer conferencing*. Retrieved from http://www.nettskolen.com/forskning/21/hexagon.html
Pierre, E., & Oughton, J. (2007). The affective domain: Undiscovered country. *College Quarterly, 10*(4), 21–28.
Pilkington, R., & Walker, S. (2003). Facilitating debate in networked learning: Reflecting on online synchronous discussion in higher education. *Instructional Science, 31*(1 & 2), 41–63.
Piskurich, G. M., Beckschi, P., & Hall, B. (2000). *The ASTD handbook of training design and delivery: A comprehensive guide to creating and delivering training programs, instructor-led, computer-based, or self-directed* (2d ed.). New York, NY: McGraw-Hill Professional.
Preece, J. (2000). *Online communities: Designing usability, supporting sociability*. New York, NY: Wiley.
Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5).
Ramsden, P. (1992). *Learning to teach in higher education*. London: Routledge.
Roberts, A. G. (2007). Beyond a participation focus. In *Information and Communications Technologies (ICT): Providing*

choices for learners and learning: *Proceedings Ascilite Singapore 2007* (pp. 898–903). Singapore: Ascilite.

Robertson, B., Elliot, L., & Robinson, D. (2007). Cognitive tools. In M. Orey (Ed.), *Emerging perspectives on learning, teaching and technology*. Retrieved from http://projects.coe.uga.edu/epltt/

Rose, D., & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning*. Alexandria, VA: Association for Supervision and Curriculum Development.

Shen, L., Wang, M., & Shen, R. (2009). Affective e-learning: Using "emotional" data to improve learning in pervasive learning environment. *Education Technology & Society, 12*(2), 176–189.

Sinclair, K. E. (1985). Student's affective characteristics and classroom behavior. In T. Husen & T. Postlethwaite (Eds.), *Neville international encyclopedia of education* (pp. 4881–4886). Oxford: Pergamon Press.

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

Sugrue, B. (2004). Five instructional design principles worth revisiting. *The Criterion* (Spring), 10.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257–285.

Tennyson, R. D. (1989). *Cognitive science update of instructions systems design models*. Lexington, KY: Mei Associates.

Twigg, C. (1994). The changing definition of learning. *Educom Review*, 23–25.

Um, E., Song, H., & Plass, J. (2007). The effect of positive emotions on multimedia learning. In C. Montgomerie & J. Seale (Eds.), *Proceedings of world conference on educational multimedia, hypermedia and telecommunications 2007* (pp. 4176–4185). Chesapeake, VA: Association for the Advancement of Computing in Education.

Weiner, B. (1986). *An attributional theory of motivation and emotion*. New York: Springer-Verlag.

Wenger, E. (1998). *Communities of practice.* Cambridge, UK: Cambridge University Press.

Wepner, S., & Tao, L. (2002). From master teacher to master novice: Shifting responsibilities in technology-infested classrooms. *Reading Teacher, 55*(7), 642–651.

Willis, J., & Wright, K. E. (2000). A general set of procedures for constructivist instructional design: The new R2D2 model. *Educational Technology, 40*(2), 5–20.

Woods, R., & Ebersole, S. (2003). Becoming a "communal architect" in the online classroom: Integrating cognitive and affective learning for maximum effect in Web-based learning. *Online Journal of Distance Learning Administration, 6*(1).