

Preface

This text proposes a new paradigm for designing, developing, implementing, and assessing technology-based instruction. It addresses three target populations of today's learner: traditional, adult, and distance education. The text proposes a new model of instructional system design (ISD) for developing effective technology-based education that involves a five-step process focusing on the learner, learning theories, resources, delivery modalities, and outcomes.

The model began as an idea for designing online instruction (Tomei, 2007). In a *Theoretical Model for Designing Online Education in Support of Lifelong Learning*, the author suggested an engine for designing education concentrating on the critical elements of delivering instruction online. As the theoretical underpinnings of the engine came into sharper focus, it was apparent that the author had actually developed a new prototype paradigm for designing instruction using the ISD process.

The concept of a systems approach to instructional design is based on a “30,000-foot” view of the teaching and learning process. It is characterized by an orderly gathering and analysis of collective and individual student outcomes and by the ability to respond to identified revisions to established learning goals. The application of a systems approach to instruction insures that academic programs and required support materials are continually developed in an effective and efficient manner to match the variety of needs in a rapidly changing environment. Surely, nothing is changing faster than the infusion of technology-based resources into the classroom: traditional, adult, or virtual.

INSTRUCTIONAL SYSTEM DESIGN (ISD)

ISD models enable educators to tackle the design of new lessons or curriculum in a systematic, methodical, organized manner. They help visualize the inter-related tasks associated with the sequencing of discrete, manageable instructional units. Most educational psychologists would ascribe behavioral learning styles to the ISD approach; that is, designers who prefer sequential, logical, hierarchical, and chronological instruction tend to steer towards using this paradigm. However, for many other educators who prefer the cognitive or humanistic bent to teaching, ISD still has much to offer. Three ISD models, in particular, form the basis for the new *Engine for Designing Technology-Based Instruction*.

The ADDIE Model (Figure 1) represents five phases found in many, if not all, ISD models although the labels may differ. Most ISD models propose an analysis phase followed by design, development, implementation, and evaluation. They begin with the analysis of tasks to be performed, content area learning objectives, timelines, priorities and constraints. Designing lessons via ISD demands an understanding of the target learner and a hierarchy of instruction from simple to complex, least to most important, or past to present – basically, the behavioral approach to learning. As such, the ADDIE Model is most commonly associated with teaching the traditional learner.

Figure 1. ADDIE instructional systems design model



The Backward Design Model (BDM) begins with desired student learning outcomes in mind (Figure 2). As the authors, Wiggins and McTighe, relate the concept, *“One starts with the end - the desired results (goals or standards) - and then derives the curriculum from the evidence of learning (performances) called for by the standard and the teaching needed to equip students to perform (Wiggins and McTighe, 2000, p8)”*

The BDM design process involves three stages each with a focusing concept, making BDM a perfect vehicle for designing instructional content targeting the adult learner. First, what is worthy and requiring of understanding? In this first stage, instructors focus on the learning goals and “enduring understandings” that adults must develop before completing the lesson. Guiding questions are formulated and universal skills focusing on larger concepts, principles or processes are devised. Stage 2 examines the requisite evidence of understanding, deciding ultimately how learners will demonstrate their understanding. The assessment tasks created in this step ensure that adults develop an understanding of the content presented and demonstrate that understanding throughout the learning process (formative assessment) as well as at its conclusion (summative assessment). The final stage of the BDM develops the learning experiences, sequence of the instruction, and the actual subject area content to be taught.

The final instructional system design model to be considered in this text is the Kemp Model that describes an approach that considers a cycle for designing online instruction. Figure 3 illustrates the iterative process that addresses nine independent elements. Although the creator of the model claims that the elements need not be attacked in any particular order, it seems logical to begin with the definition of the instructional problem and move clockwise around the model, ending with the evaluation of teaching. The model encourages the designer to pay particular attention to content sequencing (Step 5), integrating resources (Step 7), and instructional delivery (Step 8). These critical elements should be of particular concern when designing technology-based lessons.

This introduction to instructional design serves as an underlying foundation for the new *Engine for Designing Technology-Based Instruction* proposed in this text. Each of the five critical focus areas is discussed next.

Figure 2. Backward design model

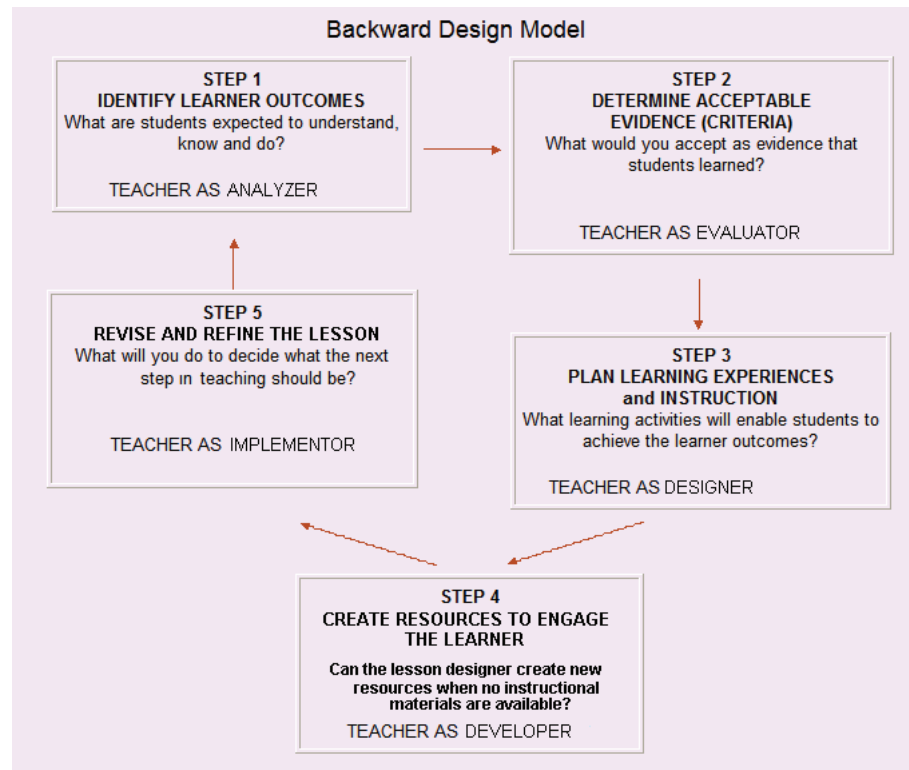
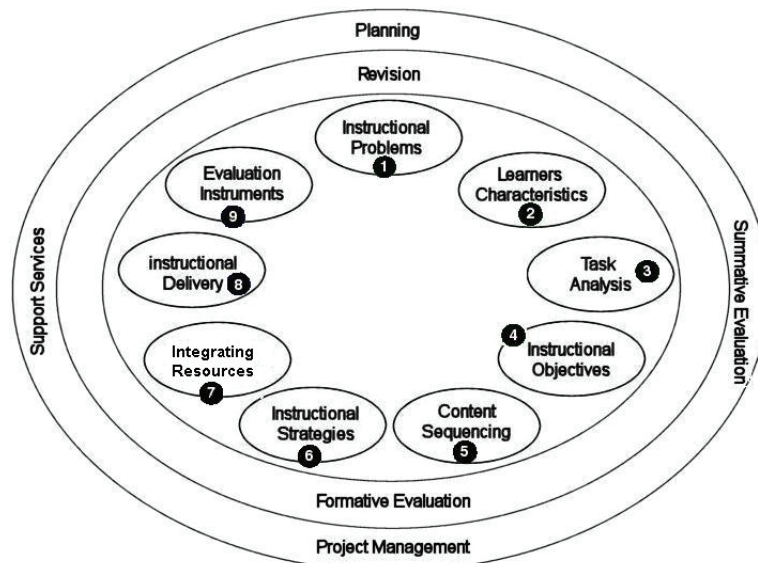


Figure 3. Kemp model of instructional design



FOCUS ON THE LEARNER

Historically, learning theory has advanced through three evolutionary phases. The three schools of educational psychology commonly accepted for teaching are behaviorism, cognitivism, and humanism. Years ago, teachers believed that the best way to learn was through repetition, a principle from behavioral learning theory that dominated educational thinking since the time of Ivan Pavlov and his experiment with animals. Contemporary behaviorists view the environment in terms of stimuli and its resultant behavior or response. Simply put, learning is a response to the environment. Teachers who accept the behavioral perspective assume that the behavior of their students is a response to their past and present experiences and that all behavior is learned.

Cognitive teachers, on the other hand, focus more on the learner as an active participant in the teaching-learning process. Those who adhere to this psychology of learning believe that teachers can be more effective if they know what prior knowledge the student already possesses and how information is processed and structured in an individual's memory. Cognitive-based teachers instruct students by using teaching strategies to help the learner acquire knowledge more effectively.

Humanists believe that how a person feels about learning is as important as how he or she thinks or even behaves. They describe behavior not from the viewpoint of the teacher as do behaviorists but rather from the vantage point of the student who is performing the activity. Teachers create an educational environment that fosters self-development, cooperation, positive communications, and personalization of information.

Each school of educational psychology serves as a primary focus in one of the three target learners explored in this book: the traditional learner, the adult learner, and the distance learner.

Learning Theory for the Traditional Learner. Pedagogy has matured into the time-honored learning theory of the traditional learner.

There is little doubt that the most dominant form of instruction is pedagogy manifested by a didactic, teacher-directed approach to delivering instruction. Pedagogy is derived from the Greek word “paid,” meaning child plus “agogos,” meaning leading. Thus, pedagogy has been defined as the art and science of teaching children. In the pedagogical model, the teacher possesses unequivocal responsibility for deciding what will be learned, how it will be learned, when it will be learned, and whether the content has been mastered. Pedagogy, or teacher-directed instruction as it is commonly known, places the student in a submissive role requiring obedience to the teacher's instructions. It is based on the assumption that the instructor knows best what learners need to know. The result is a teaching and learning situation that actively promotes dependency on the teacher.

More recent thinkers in the field of education have attempted to assuage some of the original shortfalls of pedagogy with a focus on critical thinking; specifically, critical pedagogy. Replacing the authoritarian view of the “sage on the stage,” critical pedagogy seeks to use instructional group activities in which students and teacher work together to create a product or idea; apply strategies and develop interdisciplinary competencies; identify teaching and curriculum within the students' experiences in home, society, and school; establish challenging standards for student performance above and beyond traditional classroom interaction; and, push teachers to expand their lectures with academic, goal-directed, small-group interaction.

Still, behaviorism remains the archetypal manifestation of the historical perspective of pedagogy. From its roots in the late 19th and early 20th centuries, behaviorism has attempted to explain human behavior entirely in terms of reflexes, stimulus-response associations, and the effects of reinforcers. Behaviorism moved quickly through four main theories and three key traditional classroom applications. Classical conditioning was the domain of Ivan Pavlov who viewed all learning as the interaction

of stimuli and responses ($S \rightarrow R$). Thorndike propelled the theory of learning ahead with his premise on connectionism and his laws of exercise and effect. Still further, B.F. Skinner produced the popular theory of operant conditioning, adding reinforcement to the classical equation ($S \rightarrow R \rightarrow R$) and thereby explaining more complex learning patterns.

Traditional learners have benefitted from a host of behavioral applications including programmed instruction, computer-assisted instruction, and mastery learning.

Learning Theory for the Adult Learner. Knowles' (1984) theory of andragogy redefined the previously child-only perception of learning. Adult learning is typically characterized as: experiential, problem-based, immediate, and self-directed.

Unlike children, adults learn experientially using their considerable practice, knowledge base, and problem-solving skills. They must know why they need to learn something and they learn best when that topic is of immediate use. For the most part, adults approach learning as self-directed and expect to take at least some responsibility for their own learning. Adults expect that the learning environments fashioned for them accommodate these fundamental aspects of adult learning.

In practical terms, andragogy focuses more on process (how we learn) and less on content (what we learn). Strategies include case studies, role playing, simulations, and self-evaluation and are often enhanced with the infusion of the right blend of technologies. Instructors adopt the role of facilitator rather than lecturer.

Learning Theory for the Distance Learner. From these early beginnings came a growing research base that continues to identify qualities inherent to successful distance learners. Campbell (1990) examined the success rates of distance students and discovered that certain common characteristics seem to lend themselves to success at a distance. Others, typified by Holmberg (1995) discovered a non-homogeneous population with respect to demographics of distance students. Regardless, research does contribute some broad demographic and situational parallels that help educators profile the 'typically successful' distance learner. Characteristics vary but in general reflect a combination of demographic variables such as age, gender, and ethnic background as well as situational variables including disability, location, and life roles.

In addition, characteristics inherent to allagegogy include the ability to work independently or in a group, complete assignments and readings with minimal supervision, write in a clear and articulate manner, manage time, learn using different delivery formats, and work with technology tools (Lehigh Carbon Community College, 2006).

Summary. As the first component of the *Engine for Designing Technology-Based Instruction*, learning theories encourage designers to develop instruction that combines principles from pedagogical, andragogical, and allagegogical learning theory to produce a lesson that truly targets the traditional, adult, and distance learner, respectively. Lessons designed for a technology-based environment should take into account that some of their target learners anticipate content that must be mastered (behavioral) as well as those who expect exposure to problem-based, real-world experiences. Successful lessons consider these initial traditional competencies while moving towards true online education designed with a set of pre-judged skills; namely, the ability to learn either independently or in a cohort, writing and time management skills, and technology literate. **Learn more in Section 1, Focus on Learners.**

FOCUS ON LEARNING

Learning domains, sometimes referred to as classes of learning, are critical to any model for designing instruction. By considering the various learning domains, the instructor seeks to determine appropriate

activities, assessments, and presentation modalities (traditional, adult, or distance) based on the learning outcomes desired.

With access to learning technologies more available than ever to faculty and with greater numbers of students with technologies available at home and work, it is imperative that educators consider multiple presentation modalities to increase the probability that their instruction will correspond with the multiple learning styles of as many students as possible and, as a result, produce even higher levels of learning outcomes.

Traditional learning found in the literature includes the cognitive, affective, psychomotor, and interpersonal domains. Coupled with highly engineered classification systems called taxonomies, these tools lead to more effective instruction.

A taxonomy is a classification system that establishes and exploits an innate relationship or order among elements. A vocabulary is considered the simplest form of a taxonomy with only one level of terms, common expressions, and established lexis. More complex taxonomies form a hierarchical structure. At the highest level, terms and descriptive phrases are general in nature, followed by an increasingly more refined set of terminology at progressively more specific levels of articulation (Tomei, 2007).

Taxonomies are typically categorized by domain. Historically, the more popular taxonomies have addressed a broad representation of educational objectives (cognitive, affective, and psycho-motor); service-learning outcomes (academic, career, civic, ethical, personal and social); developmental skills (cognitive, social/emotional, language/ linguistic, and fine/ gross motor abilities); lifelong learning skills (knowledge, application, and research/ practice/ and evaluation); or, more recently, instructional technology (literacy, communications, decision-making, learning, teaching, and tech-ology) (Krathwohl, Bloom, and Masia, 1964; National Center For Infants, Toddlers and Families, 2002; Furco & Billig, 2002; and Tomei, 2005). The taxonomies most appropriate for the traditional, adult, and distance learner follow.

Taxonomy for the Traditional Learner. The most famous classification is Bloom's exposition for the cognitive domain. In his *Taxonomy of Educational Objectives* (Bloom & Krathwohl, 1956), Bloom developed six progressively complex steps of cognitive development (Figure 4) that include: knowledge, comprehension, application, analysis, synthesis, and evaluation. Further investigation and exploration of his premise over the past 50 years has produced a plethora of rubrics for designing and implementing instructional objectives at increasingly advanced levels of higher order thinking. Krathwohl and Kibler

Figure 4. Taxonomy for the cognitive domain



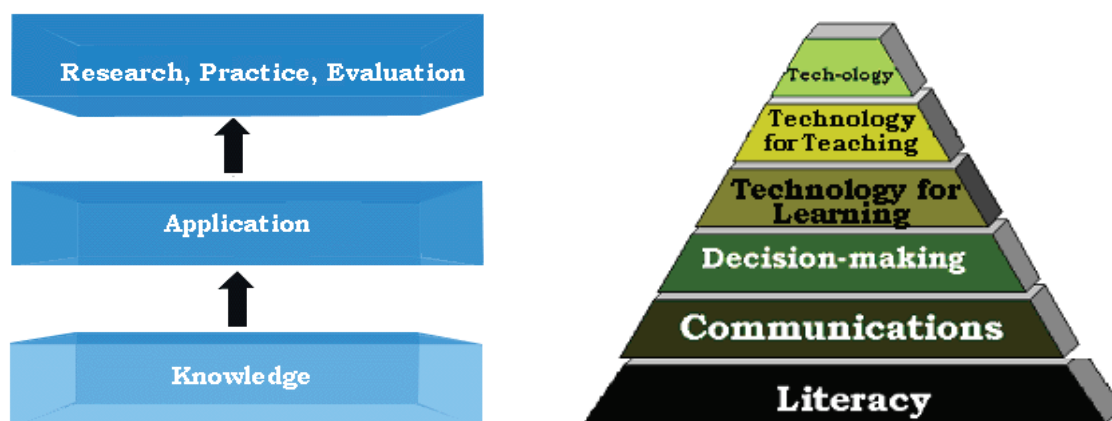
would complete the trilogy of domains with similar classifications for the affective and psychomotor learner, respectively (Krathwohl et al., 1964). Howard Garner, Jean Piaget, and Jerome Bruner would further expand on Bloom's effort with their own contributions in the areas of multiple intelligences, the age-stage theories of cognitive development, and a major new theme in theoretical framework called constructivism. With all these simultaneous efforts in the cognitive domain, the traditional learner would continue to benefit from learning objectives created to advance higher order cognitive thinking skills.

Taxonomy for the Adult Learner. The higher order learning (HOL) domain offers a schema for adult education, corporate training, and professional development. Designing instructional learning objectives at the knowledge, application, and research, practice and evaluation HOL levels applies to all learners in all disciplines but most specifically adult learners; develops the adult learner in progressive, sequential steps beginning with the basics; and, assumes mastery and competency at previous levels before advancing up the hierarchy as do most classification systems (Tomei, 2005). Using the KAR-P-E taxonomy (Figure 5) answers the perennial question from adult learners who seek a distinction among undergraduate, graduate and post graduate courses. Many of these courses use the same course titles; some use many of the same learning objectives. The KAR-P-E taxonomy (and the research that supports it) addresses the demands of teaching adults by proposing undergraduate courses constructed with a focus on knowledge. Graduate courses present learning on an application level. Advanced programs (e.g., doctoral studies) should concentrate on research, practice, and evaluation.

Taxonomy for the Distance Learner. The final classification system for educational learning objectives is the Taxonomy for the Technology Domain (Figure 6). A 21st century classification system, the technology domain includes a similarly progressive level of higher order thinking skills complete with action verbs and intellectual activities on each of its six hierarchical levels of literacy, communication, decision-making, technology for learning, technology for teaching, and technology. Distance learners begin with the pursuit of primary technologies (literacy) and move upward on the taxonomy to communications (email, word processing) and decision-making skills (spreadsheets, decision-making software, etc.).

True distance learning design begins with the infusion of existing and available technology-based resources (e.g., files, audio and video, web-based learning environments, etc.) for learning (usually self-learning) and advances to the integration of new technologies and new technology-based learning

Figure 5. K-A-RPE Taxonomy for the higher order learning domain Figure 6. Taxonomy for the technology domain



materials created by a highly motivated and technologically-prepared instructor who tops the lesson by placing technology in its rightful place and priority in the learning equation (tech-ology).

Summary. As the second component of the *Engine for Designing Technology-Based Instruction*, learning domains and taxonomies offer the designer a focus on learning and classification schemata that aids in the development of student learning objectives. Use of an appropriate educational taxonomy for the traditional, adult, and the distance learner establishes a consistent set of terms defined by a common rubric that accepts a common body of knowledge. Especially useful for conceiving the new model offered in this text is the adherence of a classification system to the rigors of the instructional system design process (and discussed later). Using the correct taxonomy, a lesson designer can develop exceedingly successful learning objectives at increasingly higher stages of abstraction by following the levels of the cognitive, HOL, or technology taxonomy. **Learn more in Section 2, Focus on Learning.**

FOCUS ON RESOURCES

Resources for teaching the traditional, adult, and distance learner are not terribly different among the three categories of learners. Text, visual, and web-materials have come to form the triad of technology-based content materials that most instructors master when designing new instruction. For example, the basic features of word processing are sufficient to develop text-based handouts and study guides for students. A few simple techniques result in professional classroom products. Graphics packages such as Power Point have become essential tools for designing student-centered, content-specific visual-based resources. Using the capabilities of full-featured presentation software, educators tailor course content, classroom delivery, and learning applications to meet the needs of even their most challenged student. The World Wide Web, and its power to teach at a distance, has literally revolutionized learning. Volumes of the Library of Congress are now literally at the fingertips of the student, conversations with the most important people of the twentieth century are as close as a desktop camera, and the instructional materials of the world's most prominent educators are no further than the memory of a personal computer.

Selecting Learning Materials for the Traditional Learner. Teachers of traditional learners (and sometimes adults and online learners as well) still find that concrete, hard copy resources make very effective learning tools for learning. Student handouts serve as assessment instruments, remedial content material, and enrichment activities. Study guides offer target instruction in the form of guiding questions for discovery learning and additional reading material for test preparation. No matter how much technology becomes available to the classroom instructor, sometimes text-based material is still the best way to teach a lesson objective.

Prototypically, traditional learners are provided with textual materials that offer significant learning opportunities coupled with the advantages of portability and low-price cost. The ability to use these materials in any instructional environment, plus the inherent utility that these materials already have with a majority of students, ensures that most learners are comfortable using these materials. Add to these advantages the cost-effectiveness and availability of these low-tech resources and it becomes immediately evident why text-based textbooks, handouts, worksheets and workbooks, manipulatives, encyclopedias, and lesson kits remain the instructional materials of choice for the traditional learner. Other learning materials, technology-rich but traditionally delivered, include CD-ROMs, videotapes, and 35 mm slides.

The hyper book offers learners the opportunity to work individually or together in groups and encourages teachers to create their own materials targeting specific peculiarities of their own traditional class. Text-based materials are very effective in helping students, using technology to open the door for

individualized discovery and inquiry learning opportunities and encouraging students to make intuitive guesses using guided questions to keep them on task.

Selecting Learning Materials for the Adult Learner. Adult learners demand a broader range of learning materials. Visual-based materials are especially important, including classroom presentations, video and audio reproductions, and interactive lessons.

Self-directed materials encourage the adult learner to take responsibility for growth by diagnosing their own learning needs, setting individual goals, identifying appropriate resources, implementing successful strategies and assessing the personal worth of learning outcomes. Typical resources brought to bear to promote self-directed adult learning include audiovisual materials; first- or second-hand experts; education-focused institutions such as museums; and involvement with professional associations.

The interactive lesson is a particularly valuable resource for teaching adults since it integrates self-paced content with specific, logical, systematic instruction that places a good deal of the responsibility for mastering the material directly in the hands of the learner. It embraces mastery learning techniques and suggests alternatives for presenting learning objectives, corrective instruction, and enrichment activities.

Selecting Learning Materials for the Distance Learner. Distance learners command the widest assortment of learning materials in terms of quantity, format, and form. Web-based materials are the particular forte of the distance learner, roughly divided across print, audio (voice) and video, and computer (data) objects. Several subdivisions and widely diverse applications of the same many of the technologies extend this grouping into multiple categories. Particular attention will be paid in this text to the advantages of web-based lessons to especially focus on the distance learner.

Web technologies comprise the broadest and fastest growing dimension of distance learning materials. The primary web technologies used for distance education include both asynchronous and synchronous environments that host a wealth of materials for the distance learner. Most state-of-the-art online courses host digital content, audiovisual presentations, and links to related web content. They offer chat rooms with online logs, threaded discussion groups with multiple levels, online quiz editing and grading, whiteboards, grade books, calendars, drop boxes, and webliographies. Instructors of distance learners have come to rely heavily on popular learning management systems such as Blackboard, WebCT, e-College, Moodle, Angel, and others.

In addition, the virtual tour is a web-based teaching strategy that presents multi-sensory, multimedia instruction appropriate for individual student exploration and group learning experiences. The virtual tour is appropriate for students who learn best when instruction is offered in a student-controlled learning environment embracing discovery and cooperative learning techniques. It represents a natural extension of sequential learning with content presented from first to last, simple to complex, general to specific. The distance teacher offers content in progressive steps until a schema, or pattern, emerges to aid the learner in the construction of new knowledge. The virtual tour supports each of these major psychologies perhaps better than any previous teaching strategy ever devised. With the advent of the World Wide Web, responsibility for creating student-centered, age-appropriate material rests in the hands of the distance teacher. The design of the virtual tour is the newest strategy for linking literally millions of content specific sites that add images, sounds, and video media to an instructional lesson.

Summary. The focus on resources accounts for the third rung on the *Engine for Designing Technology-Based Instruction*. With this step comes a shift from the predominantly theoretical considerations of the previous two stages of instructional design to the more practical focus on the methodologies of teaching the traditional, adult, and distance learner. **Learn more in Section 3, Focus on Resources.**

FOCUS ON DELIVERY

The research and literature was examined to generate a list of the most well-known teaching and learning strategies for the traditional, adult, and distance learner. The fourth stage of the *Engine for Designing Technology-Based Instruction* identifies which strategies are best for which learner and describes how some of the strategies work, how they can apply to the delivery of instruction, and what results can be expected from their application.

Selecting Appropriate Delivery Strategies for the Traditional Learner. Historically, instructors of traditional learners have opted for classroom-centered presentations. In many respects, classroom lectures represent the “but we’ve always done it this way” approach to teaching. Such emphasis on the lecture-rich “sage on the stage” has rapidly diminished as research and technology combined to offer new and exciting venues for delivering instruction to contemporary students. Direct instruction, often in the form of lectures, seminars, and demonstrations are arguably the easiest mode for both the sender (teacher) and receiver (learner) requiring less student preparation and groundwork than more complicated modes of presentations. As educational psychology matured over the years since the 1940’s emphasis on behavior, research and the literature have combined to uncover many of the major shortcomings of the direct instruction-based lesson. Equally important, the growing sophistication of learners (even at the K-12 level) has moved many traditional educators towards thinking skills strategies that are discernible in such instructional styles as differentiated instruction, graphic organizers, and manipulatives.

Selecting Appropriate Delivery Strategies for the Adult Learner. Teaching adults demands the incorporation of a different suite of instructional strategies, expanding an already complex inventory of diverse teaching tools. Andragogy places instructional emphasis on activities as well as individual and group work, suggesting several new modes of participative, self-directed instruction, the most widely known being cooperative and discovery learning. The use of independent learning strategies as an adult mode of presentation encourages a manner of interaction similar to how successful adults master many real-world experiences. A solid learning experience using this tactic incorporates realistic tasks, shared leadership, predefined responsibilities, and often ill-defined outcomes to trigger the desired learning outcomes. Presentation modes for the adult learner are characterized by collaborative projects and shared endeavors and other self-governing efforts such as problem-based learning, reflection, and service learning.

Selecting Appropriate Delivery Strategies for the Distance Learner. Distance learning adds still other strategies while expanding on previous approaches to provide a wealth of communications-intensive presentation modes including: asynchronous and synchronous communication, immersion/hybrid/ repository online courses, and online learning management systems.

Independent learning strategies provide the majority of delivery strategies to the distance learner followed closely by a host of thinking skills and cooperative strategies.

Summary. This focus on delivery comprises a review of appropriate instructional categories for the traditional, adult, and distance learner and covers a classification of teaching tools from the more straightforward direct instruction to the more virtual independent strategies. **Learn more in Section 4, Focus on Delivery.** Next, a discussion of assessment methodologies and their importance in measuring learning outcomes completes the introduction of a new model for designing technology-based education.

FOCUS ON OUTCOMES

Assessment takes many forms and typically extends over a protracted period of time (class periods, semesters, entire programs of study) to serve multiple purposes. Principally, assessment measures the

quality of a student's work and attainment of mastery. In its more robust roles, it is the stimulus for continuous course improvements, faculty development, and lifelong learning.

Rubrics and checklists are suitable for evaluating traditional learning. Portfolios and rating scales are proper instruments for measuring adult learning outcomes. Virtual assessment tools are necessary for examining such distance-based assessment as online examinations, electronic portfolios, online surveys, conferencing, and games and simulations.

Selecting Assessment Methodology for the Traditional Learner. For the traditional learner, conventional assessment often takes the form of a single dimension, timed exercise characteristically objective in its measurement, summative in its scope, and often limited to rote memorization, a rehash of definitions, or a reiteration of terms. Traditional assessments are commonly multiple-choice, true-false, or short-answer instruments and have garnered considerable criticism over the years from teachers, students, and administrators.

Even its staunchest critics will concede that conventional assessments do have their advantages. They are less time consuming to construct, easier to grade, and much more straightforward to administer. They are also less problematic to validate for internal consistency and reliability. Past studies by Gaynor and Millham (1976) found that students who were given weekly quizzes earned higher scores on final examinations when instruction was modified based on class results; a powerful testimony to more frequent student-centered feedback. The use of rubrics and checklists can add a new dimension of measurement to the assessment of the traditional learner.

Selecting Assessment Methodology for the Adult Learner. Adult learners expect real-world challenges that oblige them to apply their personal skills and experiences to the knowledge base under consideration. Proponents of andragogy have come to find that experience, communications, and interpersonal skills define the unique characteristics that form the successful adult learner. For the adult learner, such expectations have come to mean authentic assessment.

Authentic assessment requires learners to build responses rather than choose from pre-selected options, thereby eliciting higher order thinking and a return to the educational learning objectives of Bloom. Authentic assessment focuses on students' analytical skills; abilities to integrate what they learn; creativity; capacities to work collaboratively; and written and oral expression skills. Portfolios and rating scales are manifestations of viable assessment instruments for measuring authentic learning outcomes.

Assessing authentically values the learning process as well as the finished product and includes an inventory of tools such as portfolios, performance tasks, demonstration presentations, observations (formal and informal), discussions, and learner self-reflection and self-assessment.

Selecting Assessment Methodology for the Distance Learner. As a group, distance learners are probably more anxious about how they are performing. As with the delivery modalities discussed earlier, the use of online examinations, electronic portfolios, online surveys, conferencing, and games and simulations results in a more complex use of virtual assessment tools to provide the frequent feedback needed to track their learners' individual and collective efforts to complete assignments, master objectives, and gauge progress. Because distance learners are forced to read directions online, detailed information on how assessment will be conducted is highly recommended. Basic information such as the specific form(s) that assessment will take is paramount. For example, synchronous participation using chat rooms, videoconferencing, and web conferencing is an excellent option when teaching at a distance. Distance learners should be pre-warned that, even though a course may be labeled as online, participation during scheduled synchronous discussions may comprise a significant percentage of the final course grade. Likewise, timely submission of asynchronous contributions is important to keep most online courses within semester timelines. Strict adherence to issues of APA style, copyright infringements, and academic integrity often contribute to final grades while email, bulletin board posts, discussion forums, and listservs are integrated into formative and summative course assessment. Finally, the

online versions of the more traditional evaluator instruments remain viable assessment tools and include digital documents (e.g., essays), other electronic files (e.g., spreadsheets), as well as online exams in the form of multiple choice, true/ false, or short answer completion graded electronically online as soon as responses are submitted.

Summary. Any focus on outcomes is fraught with challenges as well as opportunities. For many learners, technology already places them in isolation from both their instructor and their peers. Even though technology has invaded every aspect of twenty-first century living, there remains uneven access to some resources necessary to learn at a distance. Finally, technical problems are common, variations in learner (and instructor) skills are endemic, and learner anxiety must all be factored into every consideration when selecting appropriate assessment methods for distance learning. **Learn more in Section 5, Focus on Outcomes.**

USING THE ENGINE FOR DESIGNING TECHNOLOGY-BASED INSTRUCTION

Each of the previous elements of lesson design offers a unique perspective for developing successful lessons. Each of the notable models presented also focuses on many of the same key elements: the different types of learners (traditional, adult, and distance), the learning domains (cognitive, higher order learning, and technology), instructional resources (text, visual, and multimedia), possible delivery methods (direct instruction, thinking skills, cooperative learning and group projects, or independent activities), and assessment of learning outcomes. In graphical depiction, Figure 7 illustrates the new model for designing technology-based instruction.

The remainder of this text considers each component independently and presents a schemata for moving from the perspective of the traditional learner to one that considers the peculiarities of the adult, and finally, to a unique perspective of the demands of distance education. The new *Engine for Designing Technology-Based Instruction* examines the various “gears” that must be turned by the instructor to design, develop, implement, and assess technology-based lessons in the emerging virtual world of learning.

Using the new engine, designing technology-based education embraces the structured approach of a sequential, step-by-step process that begins by identifying the learner, flows through a considered examination of learning domains, resources, presentation modes, and ends with appropriate assessment. Let’s turn the gears and follow the development of a typical lesson before pursuing the specifics of each component.

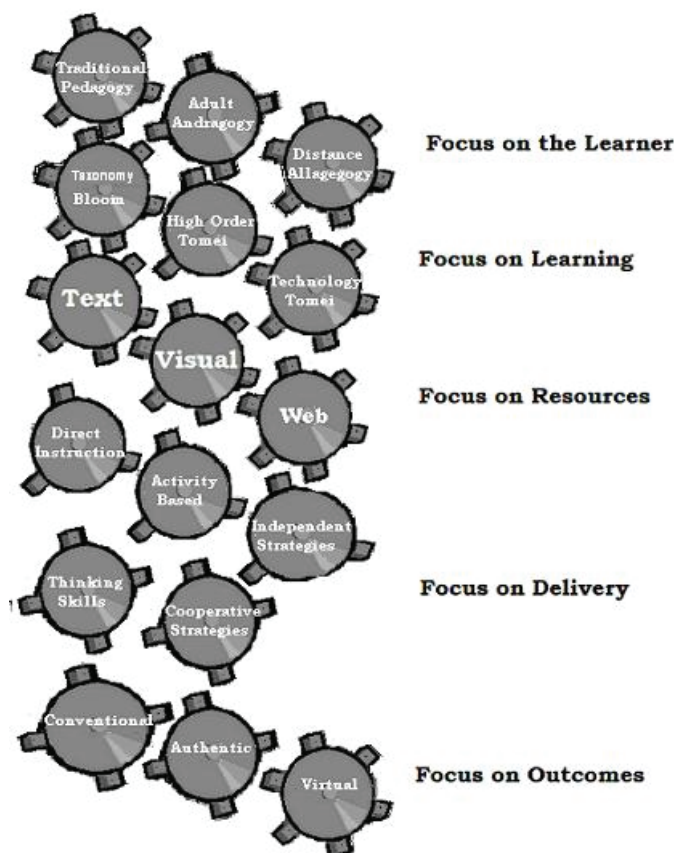
Using the Engine for Designing Instruction – A Practical Example for the Traditional Learner. For purposes of example, assume a teacher has been asked to design a lesson for a traditional classroom lesson on the generals of the Civil War.

First, identify the target learner: traditional, adult, or distance learner, by opting to design a lesson using pedagogical, andragogical, or allagegogical principles of teaching. The target audience in this example will be traditional learners, so the lesson will be designed using principles of pedagogy (**Section 1 – Chapter One**).

Second, focus on learning. Select from among the taxonomies for the cognitive, high order learning, or technology domains to prepare lesson objectives. Since a lesson for traditional learners is under design in this example, the taxonomy for the cognitive domain is the logical candidate. Use Bloom’s Taxonomy and the cognitive domain (**Section 2 – Chapter Four**) to design successful learning objectives for Civil War education.

Third, a focus on resources flows from the learning objectives developed in the previous step. Text, visual, and web-based materials are equally acceptable for a distance lesson. Considering the learner

Figure 7. The engine for designing technology-based instruction



and the domain, chances are just as good that any modality would be effective. For illustrative purposes here, assume that the traditional learner has access to a computer lab and prefers web-based materials. A solidly built home page highlighted the most important leaders and battles of the Civil War would be an ideal use of technology resources. (**Section 3 – Chapter Nine**)

The fourth set of gears considers a focus on delivery from among five instructional strategies: direct instruction, thinking skills, activity-based, independent, and cooperative strategies. The merits and shortcomings of each strategy are discussed later in **Section 4 – Chapter 10**. Direct instruction and a focus on thinking skills are logical teaching strategies for the traditional learner. These delivery modalities should be considered by the designer of a traditional lesson such as the Civil War.

Finally, with the increased emphasis on learning outcomes from among various concerned entities, the final gears of the *Engine for Designing Technology-Based Instruction* suggest to the designer that conventional, authentic, or virtual assessment tools are available for the choosing. For traditional learners, conventional instruments are the tools of choice. Since this example is considering traditional learners, the designer should concentrate on one of many conventional assessment tools to be discussed in **Section 5 – Chapter 13**.

Using the Engine for Designing Instruction – A Practical Example for the Adult Learner. For purposes of this next example, assume that a teacher was requested to design a lesson for an adult lesson addressing the Israeli-Palestinian Conflict.

First, for the adult learner, the lesson will be designed using principles of andragogy. (**Section 1 – Chapter Two**).

Second, with a focus on adult learning, a lesson on a geo-political topic such as the Israeli-Palestinian conflict would move quickly from the knowledge level to the research and evaluation level. Using the higher order learning domain to develop learning objectives makes perfect sense for this lesson. (**Section 2 – Chapter Five**)

Third, adult learners, especially those who work for a living, prefer accessibility to text-based materials over Power Point presentations or even the Internet. The text-based hyper book is a logical choice for infusing technology resources into this illustrative geo-political lesson. (**Section 3 - Chapter Seven**)

The fourth step of the *Engine for Designing Technology-based Instruction* suggests that designers consider activity-based and independent learning opportunities to deliver a lesson to adults. The use of such activities to support adult learning as well as their ability to pursue independent learning is discussed further in **Section 4 – Chapter 11**.

The final step for designing instruction for the adult learner recommends using authentic assessment tools to ensure that student learning outcomes have been met. An example of a sensible authentic assessment for a topic such as the Israeli-Palestinian conflict might be to have students create a portfolio of newspaper articles, video clips from the web, or digital images of reports of the conflict in the news, television, or the Internet. Specific tools for assessing adult learning are discussed in more detail in **Section 5 – Chapter 14**.

Using the Engine for Designing Instruction – A Practical Example for the Distance Learner. For a final example, assume the instructor is designing a lesson for a distance learning course in educational psychology and learning theories.

First, for the distance learners, the lesson will be designed using principles of allagegogy. (**Section 1 – Chapter Three**).

Second, preparing lesson objectives for the distance learner assumed a technology-based lesson. The technology taxonomy is the logical focus for learning in this domain. In general, it is wise to use the Taxonomy for the Technology domain to formulate successful learning objectives for online education. (**Section 2 – Chapter Six**)

A focus on resources flows from the learning objectives developed in the previous step. Text, visual, and web-based materials are equally acceptable for distance lessons. Considering the learner and the domain, chances are just as good that either modality would be effective. For illustrative purposes here, assume that the distance learners in this course prefer visual materials: classroom presentations and interactive lessons. (**Section 3 – Chapter Eight**)

For the distance learner, independent activities such as online research, web-based virtual tours, and inquiry learning as well as cooperative strategies such as collaborative teaching and online mentoring would be at the top of a short list of prospective teaching strategies for distance learners. It might be wise to consider each of these practices. (**Section 4 – Chapter 12**)

For distance learners, this final step in the *Engine for Designing Technology-based Instruction* embraces the many virtual assessment tools to be discussed in **Section 5 – Chapter 15**.

CONCLUSION

The search for an ISD-based methodology for designing effective technology-based instruction boils down to a simple, five-step process. Whether the target student is a traditional, adult or distance learner, a successful lesson is constructed by following an orderly, sequential process that considers the learner, the learning process, technology-based resources, delivery methodologies, and outcomes.

A new model, the ***Engine for Designing Technology-based Instruction***, is offered to assist the educator in developing traditional, adult, and distance instruction. As readers continue through this text, they should gather a working knowledge of how each element of the model interacts with all other elements. Apply the constructs discussed in each part and each chapter of the book to determine how best to design a successful lesson. Use the research base contained in this book to evaluate and revise individualized lesson development efforts. In the end, the ***Engine for Designing Technology-based Instruction*** can help any educator design a lesson that is sure to improve teaching and learning.

An anonymous educator expressed it best, “Learning is difficult. To better learn a subject, try teaching it. To truly master content, try teaching it using different technologies.” The application of technology has moved learning past the conventional models of instructional design to a new paradigm for lesson development. The consequences of teaching with technology force educators (classroom teachers, cyber instructors, corporate trainers, etc.) to simultaneously consider multiple instructional foci. At the same time, they must recognize their own style and how technologies help or hinder their ambitions to learn.

Turn all the gears. Follow the concepts and tools presented in the following chapters. Infuse the wealth of information provided elsewhere in this text. And, develop successful instructional lessons in support of learners – whoever they might be.

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