Teacher Education and Special Education
2004, Volume 27, No. 3, 000–000

Research-based Online Course Development for Special Education Teacher Preparation

Lewis R. Johnson

Abstract: *Distance education utilizing online courses has emerged as an area of program development for many teacher education programs. Online course learning management systems, such as Blackboard.com, have made putting a course online a relatively simple task; however, in many cases, the online course is little more than a correspondence course with a discussion forum and web resource links. Because individual instructors are developing these courses using the structure of the web-based learning management programs as their pedagogical guidance, instructional design assistance is needed. Online courses must be developed using an analysis of input factors such as learner characteristics, instructional intent, and nature of the content so informed instructional design decisions can be made that result in quality courses.*

Distance education programs have been used to address the critical shortage of special educators, especially in the area of low-incidence disabilities, for the last two decades. (Spooner, Spooner, Algozzine, & Jordan, 1998). The early programs used traditional instructional methods of readings, lectures, and activities delivered through compressed video to remote sites such as the Virginia TELETECHNET system and the Maine Interactive Television Network. With increased access in higher education to web-based learning management programs such as Blackboard (Blackboard.com) and the explosive access of students to the Internet, the landscape of distance education is rapidly changing to mean online learning. These early courses are being developed by migrating courses designed for traditional face-to-face instruction onto the web using the organizational structure provided by the learning management system. If an instructor is not careful, the online course can become little more than a correspondence course with the added features of asynchronous communication using e-mail, discussion forums, and links to other web resources. As a coordinator of an initiative to develop online courses for a graduate program in special education, a developer of seven online courses, and an evaluator of online courses, the author understands the situation of an individual instructor attempting to develop online courses without the assistance of an e-learning design-technology team. Despite the limitations of online courses, they are very much in demand, so much so that universities are racing to create online courses (Newman & Scurry, 2001). Most of the online courses are being developed by individual instructors who are using the structure of the web-based learning management programs as their pedagogical guidance (Firdyiwek, 1999). These courses are online packages consisting of course materials such as syllabus, lecture notes, activities, online quizzes, and links to resources. Unfortunately, according to Leflore (2000), "Often we have let the technol-

TESE, **Volume 27, No. 3**
Summer 2004

ogy drive the way instruction is presented. It is time to consider how we construct on-line learning." (p. 115)

When considering the opportunities presented by online learning there is little dispute that it offers many advantages that are not readily available through traditional face-to-face instruction. Consider this short list of features of web-based learning environments presented by Khan (1997): Interactive, time independent, learner controlled, cost effective, low maintenance, globally accessible, uniform, hypertextual, engaging, environmentally friendly, and collaborative. It is understandable why online learning has caught the attention of students, especially graduate students who must balance work, family responsibilities, and education. Sharing Khan's view are Miller and Miller (2000) who identify three unique features of the web that converge to make it an excellent learning environment. These features include (a) hypermedia structure, with the ability to create nonlinear documents with levels of information and links between documents; (b) media capabilities for presenting audio and video on demand; and (c) communication capabilities for facilitating synchronous (chat) and asynchronous (threaded discussion) communication.

Much of the literature on distance education in special education describes model programs from an organizational or delivery perspective, or compares traditional instruction to distance learning (Schlosser & Anderson, 1994; Spooner, Jordan, Algozzine, & Spooner, 1999). In the literature that focuses on online learning, there are descriptions of the process for developing online courses (Meyen, Lian, & Tangen, 1997) strategies for organizing course information (Richie & Hoffman, 1997), discussion for online learning (Cooper, 1999; Parsons, 2001), and discussions of the technology resources needed to enhance online learning (Ludlow & Spooner, 2001; Schnorr, 1999; Spooner et al., 1998). Additionally, the literature contains descriptions of the development and use of constructivist, theory-based multimedia programs for teacher education in special education (Langone, Malone, & Clinton, 1999; Semrau & Fitzgerald, 1995).

There are a few descriptions of how to use technology to deliver online courses. Meyen et al. (1997) provide a model for developing graduate-level asynchronous online instruction for special education. The courses developed using this model were taught completely online and included streamed audio lectures. Course instructional materials in the form of web pages included text advanced organizers, lecture notes, a glossary, activities for application, and assessments for each lesson. Students engaged in an online collaborative team project as part of the course requirements. E-mail and a list serve were used for communication. The article describes the components of the course but does not describe the instructional design used to create the course.

In the discussions mentioned above concerning online course development, there is an absence of attention to the application of instructional design principles based on learning theory to the creation of online programs and courses for special education teacher preparation. The importance of developing high quality courses becomes a strong area of concern for the instructor when one considers that online courses are permanent products of an instructor's work and may be subject to use in professional evaluation for promotion and tenure. Furthermore, a course developed by one instructor may be assigned to another instructor to teach and this opens the possibility of informal evaluation. Like many innovations in education, online learning presents many opportunities for making instruction interactive and rich in information and experiences that result in enhanced student learning. Therefore, the importance of quality online courses cannot be underestimated.

Different instructional theories are needed to offer guidelines in each of the diverse domains of learning and address different instructional situations (Reigeluth & Squire, 1998). Therefore, attention must be shifted from making technology decisions to instructional decisions. To accomplish the objective of focusing attention on the need for theory-based program and course development, this discussion will list factors to consider when making instructional design decisions, define instructional design theory, present a continuum of relevant instructional

theories, and conclude with a model for the design of online teacher education programs that is relevant to special education courses.

Factors to Consider in Selecting an Instructional Design

As course instructors and designers begin the process of developing quality online courses it is imperative that the same factors that influence the design of traditional face-to-face instruction be considered rather than starting with decisions regarding technology resources for instructional delivery. For online course development, technology and media decisions should follow instructional design, and instructional design should be based on consideration of input factors such as nature of the content to be learned, learner characteristics and needs, and the goals of instruction.

Miller and Miller (2000) identified five factors that influence the design of web-based instruction. Their discussion provides a sound basis for the instructor beginning the course development process. The factors they discuss are (a) the goals of instruction, (b) the nature of the content, (c) learner characteristics, (d) technology capabilities, and (e) theoretical orientation of the course developer.

Goals of Instruction

The course developer must address the question, "What is the instructional intention of the course?" Is it an introductory course with emphasis on building an overview understanding of topics? Or is the course intended to develop advanced skill performance and the ability to apply the skills in a variety of novel settings? While a course may not be easily categorized as introductory or advanced in nature, the stage of learning (i.e., acquisition, proficiency, or generalization) addressed by the sections of the course are a consideration in course development.

Different learning goals require different learning approaches. Courses may have the overall goal of providing content information to build a substantial knowledge base. In developing a course, the developer will examine the knowledge, skill, and disposition standards to be addressed in the course. For example, in reviewing the International Standards for Entry into Professional Practice (Council for Exceptional Children, 2002) for assessment there are knowledge performance items related to knowing basic terminology used in assessment and legal provisions regarding assessment. The instructional intent is to convey an understanding of this objective information in an efficient manner. However, within this same set of standards there are skill performance items, like administering nonbiased formal and informal assessments. Clearly, the instructional intent is different, and this must be a consideration in designing course instruction. Consequently, an examination of learning goals from a "level of knowing" perspective range from low-level knowledge acquisition to higher-order thinking skills, such as problem solving and evaluation, will result in the selection of different instructional designs (Miller & Miller, 2000).

Nature of the Content

In the consideration of content as it relates to instructional design three characteristics will be explored: (a) forms of knowledge, (b) structure of the content, and (c) the sequential nature of the content. Examples drawn from special education course content are included to assist the reader.

Gagne, Briggs, and Wager (1992) describe various forms of knowledge and instructional activities to assist the learner in acquiring the various forms. The lowest form of content knowledge in Gagne's hierarchy is verbal associations, which are discrete pieces of information such as definitions, and progresses to discriminations, concepts, rule relationships and finally strategies for problem solving. Instruction varies for each of these forms of knowledge with concepts being taught using multiple examples and non-examples to strategies, which are best, taught by modeling and guided practice (Gagne, 1985). Gagne's contribution of matching knowledge forms to instructional activities is significant and worth in-depth study by course developers. Reigeluth's (1999a) work on the analysis of content for instructional design identified three types of content: con-

TESE, **Volume 27, No. 3**
Summer 2004

cepts, theories, and procedures. He outlines instructional procedures or "elaborations" to address each form, which will be presented later in this article.

Content can be objective in nature and consequently well structured, or it can be quite subjective and perhaps ill structured. In content that is well structured, such as statistical and measurement principles related to test technical adequacy and score interpretation, the sequence of terms and concepts to be learned is rather consistent between texts and instructors. On the other end of the continuum is information that is quite subjective in nature and is much less structured. In assessment, the process of selecting, administering, and interpreting instruments that are nonbiased is an example of an ill-structured knowledge domain. There are so many variables, possible combinations of conditions, and perspectives that need to be considered in nonbiased assessment that a single chapter in a text would not adequately prepare a person to perform nonbiased assessment. Therefore, perhaps an effective instructional module on this topic would include content related to nonbiased assessment, several case examples, a database of assessment instrument technical adequacy information, or case-based tasks. In summary, the nature of the content has a significant influence on instructional design decisions.

Finally, the last characteristic of the content to be used as a basis for course design is the sequential nature of the information. Some information such as history has a built in sequential nature that is difficult to ignore in designing a course. However, in a course that presents multiple assessment procedures no sequential organization of information exists. Another view of the sequencing of the content may be reflected in a top-down approach that starts with central or general core information or concepts, then through successive lessons expands the learner's knowledge and understanding by adding details of greater complexity (Reigeluth, 1999a) to form something that resembles a grouping of concentric circles with links between the circles. In some situations the use of hypertext course materials that permit the linking of course materials to reflect the interconnectedness of the content has been recommended (Jonassen, 1986).

The question to consider next in accommodating content structure is, "Should content structure be taught explicitly through the use of advanced organizers and concept maps to allow the learner to construct a schema of the content?" Knowledge of the learner and an understanding of the instructional intent of the course are needed to answer this question.

Learner Characteristics

Miller and Miller (2000) devote significant attention to the description of learner characteristics that affect instructional design decisions, especially when the developer considers the use of hypertext learning environments. In this section learning styles, prior content knowledge of the learner, and technology competence are discussed.

The document *Quality online: Benchmarks for success in Internet based distance education* produced by the Institute for Higher Education Policy (2001) generated a list of quality indicators for courses intended for distance education. Indicator #9 addresses the course development process by stating, "During course development the various learning styles are considered." Factors include the learner's cognitive style as in (a) field dependence/ independence, (b) epistemic beliefs about one's own learning, (c) the level of motivation or self-directedness, and (d) the degree to which an individual prefers a social context for learning.

Field dependence/independence is defined as a tendency to approach a learning situation in either a global fashion or in an analytic fashion. Field dependent learners attend to environmental features of the learning environment, whereas, field independent learners are not distracted by dominant but irrelevant features of the learning environment. These individuals tend to have improved ability to organize information, especially within hypertext-rich learning environments. Research on differences in field dependence –independence learner performance within hypertext learning materials has been completed and is fascinating read-

Table 1. Stages of Expertise Development

Stage	Description
Stage 1: Acquisition	The learner attains knowledge of objective facts and rules for determining actions. The learner has little if any prior experience in the context of what is being learned.
Stage 2: Advanced Beginner	The learner's performance is improved by experiences in which authentic situations are presented and the learner is able to contextualize the learning.
Stage 3: Competence	The learner's performance is improved as the learner develops authentic decision-making ability.
Stage 4: Proficiency	This stage is characterized by the learner's ability to integrate knowledge, experience, and intuition to respond to novel situations in a fluent manner.
Stage 5: Expert	At this level of skill development, the learner acts in a manner consistent with what works in the workplace. Experts have a structured procedural knowledge base, use routines to automate recurring tasks (Berlinger, 1986), and can analyze situations and solve complex, novel problems (Behets, 1996).

ing. For further reading on this topic see (Chen & Rada, 1996).

An epistemic belief refers to how the learner views learning along the continuum of teacher-directed to learner-centered constructivist approaches. Learners preferences range from well-structured presentations as found in instruction that is linear and teacher directed to open-structured learning environments as found in discovery learning approaches.

Motivation to complete the course varies in learners from low internal motivation and interest in learning the content of the course to high internal motivation. Low motivation is exemplified by this statement, "I need to complete the course but don't know why I have to take it." This statement exemplifies a high level of internal motivation, "I have already had a course on assessment, but I can't wait to learn more about curriculum-based assessment". Frequently the learner's perception of the relevance of the course directly influences motivation. Individuals with high motivation, self-directedness, and comfort with the technology demands of the course can function better within more open structured online learning environments (Powers & Guan, 2000).

The final factor for consideration is the learner's preference or need for social interaction during learning. Some learners need the social environment of the classroom or small group interaction to gain deeper understanding of course content. In a study comparing learner's performance of individuals working individually and those working in pairs using a technology mediated learning environment Semrau, Carlson, Johnson, and Fitzgerald (1997) found that some learners working in pairs spent a longer time engaged in the learning task and achieved greater pretest-posttest score gains. Given this information, consideration should be given to providing the opportunity for synchronous discussion and perhaps team-based learning activities.

Variation in the learner's level of existing or prior content knowledge is an essential instructional consideration (Daley, 1999). Using a general model of the steps from novice to expert (Dreyfus & Dreyfus, 1986), it is possible to identify five stages of development, as shown in Table 1, that relate to varying instructional intent of the course.

In the professional preparation of teachers, we are basically trying to facilitate the movement of teachers from novices to higher levels of professional expertise as described above. In some university programs for the preparation of special education teachers, this process is confounded by the use of graduate-level courses for initial or entry-level novice teachers who attend the same classes with learners who have teaching experience and are seeking advanced instruction designed to

TESE, **Volume 27, No. 3**
Summer 2004

develop competence, rather than to develop the knowledge-base needed by novices. There is view that instruction should match the learner characteristics. For example, Jonassen in his *Manifesto for a Constructive Approach to Technology in Higher Education* (as cited in Mergel, 1998) identified the following three types of learners and matched them with what he believes to be the appropriate learning approaches. For learners with little or no background, he suggests an introductory learning design in which instruction is built on predetermined objectives, sequential organization, and is criterion-referenced. At the expertise level, he suggests a constructivist approach. Consequently, it appears that the level of learner expertise based on prior learning and experience becomes a critical factor in the design of courses. This factor is especially important in online courses where the instructor cannot readily assess and scaffold understanding for novice learners; therefore, embedded scaffolding such as "pop up hints" or optional tutorials may be needed and prove to be effective (Najjar, 1996).

Miller and Miller (2000) recommend considering the following learner characteristics in making instructional design decisions (a) cognitive characteristics (i.e., beliefs about how learning occurs, spatial ability, metacognitive skills, and learning styles), (b) motivation (i.e., interest, perceived importance of the information, and self-confidence), (c) knowledge-base of information to be learned or tasks to be performed, (d) technology expertise, and (e) the social context preferences of the learner for engaging in the learning process.

Technology Capabilities

Another consideration in the development of online courses mentioned by Miller and Miller (2000) is the technology capabilities and resources of the instructor and the institution. To develop quality online learning courses, the content expert will require knowledge of instructional design and instructional technology. The task of staying current in the knowledge base for the production of web pages, audio and video editing, multimedia authoring, videoconferencing, and web casting are enough to challenge any technology expert and overwhelm the content expert (i.e., instructor) who is assigned the task of developing an online course. For this reason, serious examination of the infrastructure and commitment of the institution to support online learning is necessary. For example, courses that go beyond the "correspondence course on the web" model involve the production of streaming media for and the creation of authentic case-based problem scenarios distributed on CD-ROM (Johnson, 2001; Tabata & Enomoto, 2001).

Theoretical Orientation

Theoretical orientation is the final factor presented by Miller and Miller (2000) for consideration to guide the course developer. They discuss the contribution of the information processing theory that strives to create accurate representations of the knowledge of experts as found in Gagne's Events of Instruction, Merrill's Component Display Theory, and Reigeluth's Elaboration Theory. They then follow this discussion by presenting principles of Constructivism, as found in Problem Based Learning, and Cognitive Flexibility Theory, in which collaboration through discussion is used as a process for constructing meaning. The course developer must remember that no one instructional design theoretical perspective serves all learning situations. Different instructional theories are needed to offer guidelines in each of the diverse domains of learning and address different instructional situations (Reigeluth & Squire, 1998).

Instructional Design Theory

Instructional design theory (IDT) is a set of prescriptions for designing instruction that requires two activities: (a) deciding what to teach and (b) determining how to teach it (Reigeluth, 1999a). Therefore, IDT offers explicit guidance on how to help people learn. IDT is design oriented and is useful for educators by providing guidance in how to achieve instructional goals by identifying the methods of instruction and the situations in which various methods should and should not be used.

Instructional design theories are based

on learning theories such as behaviorism, information processing, and constructivism. When one considers the basic theories and their variations they number in the dozens (see extensive list at: http://carbon.cudenver.edu/~mryder/itc/idmodels.html). Two primary characteristics differentiate between the instructional design theories. These factors are (a) the nature of the content to be learned, and (b) the degree to which the instructor directs the learner in the acquisition of knowledge and skills to address the learning style and needs of the learner. For example, Sonwalkar (2001) identifies five fundamental learning styles representing a continuum of teacher-centered (apprenticeship) to learner-centered (discovery) instruction. Clark (1998) identified four architectures of instruction based on varying amounts of learner control:

- Receptive- lecture, no control over content, rate, modality, no learner participation;
- Directive- lecture, questioning, discussion, and feedback;
- Guided Discovery- instructor provides problems, coaches and facilitates learning; and
- Exploratory- learners are provided all of the resources; learners select information as assistance based on their needs and mental models.

According to Reigeluth (1999b) several considerations relate to the matching of method to situation. These include (a) the nature of what is to be learned, (e.g., factual knowledge, theories, or problem solving skills), (b) the nature of the learner (e.g., prior learning, motivation, and experience), (c) the nature of the learning environment (e.g., independent study, group, face-to-face, or online instruction), and (d) the nature of the instructional development constraints (e.g., the amount of time for planning and developing and technology resources). Add to this, the desired instructional outcomes (e.g., introductory level attainment or advanced level of proficiency) and there is quite a list of instructional variables that must be considered when planning and developing instruction.

Continuum of Relevant Theories

In designing instruction that matches intended learning outcomes, learner characteristics, and the nature of the content, various learning theories will guide the instructional design process across a program of study and within the courses comprising a program. The development of basic declarative knowledge understandings within the short period of instructional time might best be approached through a behavioral learning approach. Then to develop procedural knowledge, a systems learning approach, such as Elaboration Theory might be useful. Finally, to develop the learner's problem solving ability within a content that contains ambiguity problem-based instruction built on the cognitive flexibility theory of learning would be appropriate. Schuman (1996) believes that all three major design perspectives are important to consider when designing instruction.

Behavioral Learning Perspective: Systems Approach Model

Schuman (1996) identified three critical theories for use in instructional design: Behaviorism, Cognitivism, and Constructivism. In her critical review of learning and instructional theories, Mergel (1998) identified those three basic theories as essential tools for instructional design. When an instructor needs to develop instruction for introductory-level learning for learners with little or no transferable prior knowledge, instruction based on classical (i.e., behavioral) design principles is preferred (Ertmer & Newby, 1993). When designing from a behavioral perspective, the designer has an objective view of the nature of the prespecified knowledge to be learned and establishes an instructional plan to facilitate the transfer of this knowledge to the learner in an efficient and effective manner. Therefore, the instruction is prescriptive in nature. This instructor-directed instruction is best suited for low-level learning outcomes where the forms of knowledge to be learned include verbal information and basic concepts as described by Gagne (1985).

Instruction designed from a behavioral perspective is viewed as a systems approach

TESE, **Volume 27, No. 3**
Summer 2004

model. An example of a systems approach is Gagne's Instructional Events Model (IEM). The nine events of the Instructional Events Model (IEM) (Gagne & Briggs, Wager, 1992) are as follows with the authors' explanation:

1. Gaining learner's attention-presentation of an advanced organizer or media introduction
2. Informing the learner of the objectives-list of performance expectations
3. Stimulating recall of prior learning-review of information or experiences
4. Presenting stimulus material-content in the form of readings, lecture, or video
5. Providing learner guidance-explanations and examples
6. Eliciting performance-questions, discussion topics or practice activities to complete
7. Providing feedback-formative feedback of responses
8. Assessing performance-tests, authentic performance tasks
9. Enhancing retention and transfer-practice in a variety of settings.

Most educators are familiar with this model for developing instruction. Variations are taught in instructional methods courses as components for writing lesson plans.

An example of the application of IEM can be seen in the instructional materials of the Online Academy produced by the University of Kansas. The Online Academy is an Office of Special Education Programs funded initiative to develop instructional modules in reading, positive behavioral support, and technology in education for preservice teacher education programs. (see: http://www.onlineacademy.org/acad/about_acad/welcome.html). These excellent instructional programs comprised of numerous modules organized into these components: (a) critical questions, (b) readings, (c) glossary, (d) lesson outlines, (e) media presentation of content, (f) activities, and (g) guided questions. These modules are an excellent means of instructing learners of varying levels of knowledge about the content needed to be effective teachers.

This model is similar to Welsh's Event-Oriented Design Model (EOD) that was revised to suit the needs of instructional designers of traditional and distance education technologies (Welsh, 1997). In EOD Welsh suggests that the design process begins with conducting a learner analysis that considers the differences between individual learning styles. The second step replaces task analysis with an analysis of the technology resources and requirements. The relationship between this design model and Gagne's instructional design theory is evident. His theory has three major elements. First, it is based on a taxonomy of learning outcomes based on the notion of levels or forms of knowledge (verbal associations to cognitive strategies). Second, it recognizes certain conditions are necessary for achieving the learning outcomes. And third, it offers nine events of instruction to guide the instructional designer (Gagne et al., 1992).

Schieman, Teare and McLaren (1992) noted a review of the literature on developing graduate level distance education courses resulted in very little theory-based guidelines. They stated that the lack of theory is problematic and consequently generated a course design model based on Ausubel's work on advanced organizers and Barron's work on graphic organizers and concept mapping. The resulting model is similar to those already presented, however it includes some aspects of social learning theory: (a) pre-session readings, (b) objectives, (c) session agenda-advanced organizer, (d) structured note-taking, (e) interaction- discussion forums, (f) dialogue journals, (g) break-away activities, (h) flexible assignments and grading, and (i) access to resources. This is the model commonly found in many online courses. Their proposed structured approach and components of a course do not address the application of learning theory to varying learning styles, various types of content, or higher-order learning outcomes.

Information Processing Perspective: Elaboration Theory

In planning for instruction at the macro level within the cognitive domain Elaboration Theory (ET) of instruction (Reigeluth, 1999b) provides a framework for teaching content that may be causal and sequential in

nature, rather than factual or problem solving in nature. This theory is an extension of the work of Ausubel in advanced organizers and Bruner in the spiral curriculum (Merrill, Wilson, & Kelety, 1981). According to ET, instruction should be organized so that content is in a sequence of increasing complexity. Instruction built on this theory focuses on core concepts then moves on to specifics of increased detail and complexity. It is thought that instruction built on this theory results in the formation of more stable cognitive structures leading to improved retention and transfer of knowledge.

ET (Reigeluth, 1999b) provides a framework for making scope and sequence decisions when designing a program of studies or a course. According to Reigeluth (1999b) the new paradigm of learner-centered instruction includes creating new needs for sequencing instruction using a holistic approach, rather than an approach that breaks the knowledge or skill down into small parts and teaches those parts one at a time. Sequencing becomes important when there is a strong relationship among the topics covered in a course. Therefore, selecting topics to include in a course is a critical curriculum design issue. For example, in the situation of using assessment for instructional planning, the content expert/course developer will need to sequence topics of instructional task analysis, curriculum content sequence, and principles of curriculum-based assessment. The types of sequencing strategies described by Reigeluth include relationship, topical and spiral.

In relationship sequencing, topics are arranged in an order based on some order of events in a procedure (e.g., the referral to eligibility determination process). In topical sequencing, a topic is taught to a level of understanding that is required of the learner before moving on to the next topic (e.g., assessment when students learn about the technical adequacy of assessment instruments). In spiral sequencing, the learner is taught the content or skills in successive stages, with each stage allowing for more in-depth understanding until the content is mastered. The question is not what strategy is best. The question is when is each most appropriate. This approach may be useful for designing instruction that presents assessment instruments that are (a) easy to administer and interpret assessment instruments and then (b) present more difficult instruments and batteries of tests to address more complex assessment questions. There are three elaboration sequences described by Reigeluth to address the varying nature of content to be learned. These sequences are: the conceptual elaboration sequence, the theoretical elaboration sequence, and the procedural elaboration sequence.

In teaching a complex course like assessment of individuals with special needs, instruction focuses on the creation of cognitive structures of understanding the content and the creation of skills in the performance of a task. At the core of ET is the notion of identifying the "simplest real-world version of the task and gradually progressing to evermore complex versions as each are mastered" (Reigeluth, 1999b, p.435). The strategy of ET is to design instruction so that each successive elaboration is within the learner's zone of proximal development. One method is the simplifying conditions method (SCM) where the task is presented and scaffolding is provided to permit the learner to build an accurate simplified schema onto which additional understanding can be assimilated. Each successive elaboration of the task should be:

> Another whole version of the task,
> A slightly more complex version of the task,
> Equally or more authentic than the preceding task,
> Equally or less representative of the whole task.

In designing the instruction from the first learning episode to the last, the course designer must consider (a) which information is critical to the initial performance of the task, (b) what subsequent information is needed and how it will be sequenced throughout the learning episodes, and (c) the guidelines and decision rules an expert uses to perform the task.

Instructional planning begins with the development of an elaboration strategy comprised of motivators, analogies, summaries, and synthesizers. Steps in the design of instruction using ET principles are:

TESE, **Volume 27, No. 3**
Summer 2004

1. Conduct an analysis of the program content and content within courses and determine its organizing structure (i.e., conceptual, procedural, or theoretical). For example, a course in understanding the characteristics of children with disabilities will be conceptual in its organizing structure, whereas, a course in collaborative consultation will likely be procedural in structure.
2. Identify the most fundamental and representative ideas and work from these simple ideas to more complex understandings by adding successive layers of complexity.
3. Design lessons based on principles associated with each content type. For conceptually or theoretically organized instruction, proceed from easy concepts to complex concepts. For procedurally organized instruction, present the steps in their order of performance.
4. Create summarizers to review content.
5. Create synthesizers to help make the content structure explicit to the learner. These organizing structures could be in the form of concept maps or procedural flow charts.
6. Create analogies that relate the learner's prior knowledge to the content of the course unit or lesson.
7. Create cognitive strategy activators that contain a variety of cues that trigger cognitive strategies needed for processing the content.
8. Provide for learner control in accessing the content in steps of increasing complexity and the learning strategies, in addition to the rate of progression through the content (Wilson & Cole, 1992).

Wilson and Cole (1992) examined and challenged ET as a basis for organizing courses and concluded that the prescriptive nature of ET is inconsistent with the current view of content structure being represented only in the mind of the learner, while content in itself does not have a structure. They go on to question the notion that expertise can be defined by concepts and rules, as suggested by ET. Additionally, they question the top-down sequencing (i.e., working from the most general conceptualization or procedure to the detailed subcategory as suggested by ET), on the basis that it fails to accommodate learners' varying levels of prior knowledge. Wilson and Cole (1992) question the rigid approach to structuring a course based on one of three structures and recommend multiple entry points for the learner. In conclusion, Wilson and Cole state that when the course content is representative of very complex and "ill-defined domains of knowledge" ET fails to offer adequate guidance for designing courses. Instead they suggest consideration of instruction designed from a cognitive flexibility theory perspective (Spiro, Coulson, Feltovich, & Anderson, 1988).

Constructivist Perspective: Cognitive Flexibility Theory

While instruction based on ET attempts to present the content structure to the learner as it is represented in the expert's mind, there are times when a general schema is not representative of the nature of the content. When the learner is ready to extend knowledge of content to an advanced or expert level of understanding (e.g., the development of higher-order thinking skills) or when a more dynamic view of learning is needed constructivist approaches like situated learning (Herrington & Oliver, 1998), cognitive flexibility theory-based instruction is needed (Spiro et al., 1988). Cognitive flexibility theory (CFT) is based on the premise that content structure cannot easily be analyzed, categorized and used to organize instruction or courses, especially for advanced learners. Expert-level knowledge is viewed as dynamic and explainable from a variety of theoretical perspectives due to its complex nature. Therefore, the learner must experience a variety of situations representing various perspectives in order to fully appreciate and understand the complexity of the knowledge.

CFT is a constructivist learning paradigm that emphasizes the real-world complexity and ill-structuredness of knowledge. According to constructivist learning theory, learners should be provided with a variety of experiences and multiple perspectives in order to develop personal cognitive structures (Spiro et al., 1988). Cognitive flexibility involves the *selective use* of knowledge to *adap-*

tively fit decision making in a particular situation. The potential for maximally adaptive *knowledge assembly* depends upon having as full a representation of complexity to draw upon as possible. In ill-structured problems, concepts which may apply to one case may not apply across cases of the same nominal type due to inconsistent combinations of factors. Ill-structured problems are more complex and require cognitive flexibility for understanding and making decisions (Spiro et al., 1988). Finally, with increased access to instructional technology and ease of development, interest in employing problem-based multimedia materials using authentic cases in teacher education has increased (Albion & Gibson, 2002).

The instructional approach used in advanced case-based, authentic problem-oriented instructional materials strives to develop cognitive flexibility for problem solving within an ill-structured knowledge domain. A major difference in cognitive flexibility theory from traditional constructivist theory is the change in emphasis from developing a knowledge structure based on intact preexisting knowledge *to flexible* adaptation of preexisting knowledge to fit the needs of a new situation. Instruction in ill-structured domains is different from instruction in well-structured domains where knowledge may be taught in compartmentalized units and later integrated. In ill-structured domains, instruction must focus on regular principles and interconnected knowledge across a wide scope of cases. Ill-structured knowledge domains are defined by two properties: (1) each case involves the interaction of complex multiple schemas or perspectives, and (2) considerable case irregularity exists across nominally similar situations due to complex interactions (Spiro, Feltovich, Jacobson & Coulson, 1991). Application of knowledge in ill-structured domains is typically unpredictable in clinical cases that are full of complexity, irregularity, and inconsistency (Jonassen, Ambruso, & Olesen, 1992).

Hypertext is used extensively in the preparation of materials based on CFT. However, while hypertext-based materials contributes to learning (Ayersman, 1996) hypertext alone is not sufficient to develop cognitive flexibility. Hypertext systems must be designed so that knowledge is reorganized in different contexts to produce different understandings. Learners need the opportunity to explore through different pathways, link information together in multiple ways, and develop personalized explanations and analogies (Nelson & Palumbo, 1992). To avoid confusion from out-of-sequence criss-crossings (nonlinearity) of information, a metacognitive framework can be provided that incorporates background information for each context and guides the user through case differences by such means as providing models or expert commentary. Case commentaries should provide information on conceptual themes, cross-reference applications to other case situations, and stress specialized aspects of the concept within the given context. (Spiro et al., 1991). Cognitive flexibility can be enhanced through effective design of hypermedia programs by situating problem solving in authentic case scenarios, providing factual and procedural knowledge within the discipline, scaffolding the learner through guided activities, and modeling the reasoning processes of experts.

An example of this learning situation that requires cognitive flexibility is the application of various eligibility criteria and consideration of other factors in the assessment and identification of children with behavioral disorders. When this is the case, it is desirable to use a learning theory that facilitates development of cognitive flexibility. The problem-based CD-ROM program, *Teacher Problem Solving Skills in Emotional and Behavioral Disorders* (Semrau & Fitzgerald, 1995), is an example of instructional materials based on Cognitive Flexibility Theory. These materials, which are being used in many university courses, present the conditions and learning resources to enable the learner to develop their own expert knowledge schema. Instructional programs built on this theory frequently include problem-based situated learning scenarios (microworlds), a database of information needed to explore the problem, and multiple representations and solutions to the problem situations (Jonassen, 1999).

Learners with sufficient prior knowledge are able to make use of these programs and develop advanced understanding of the content and procedures. Wilson and Cole (1992)

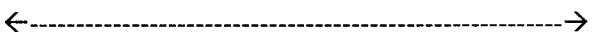
TESE, **Volume 27, No. 3**
Summer 2004

Dimensions of Interactive Learning

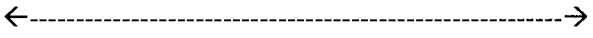
Input Factors

Course Goals and Instructional Intent

Introductory to Advanced Knowledge and Skill Performance in Various Settings

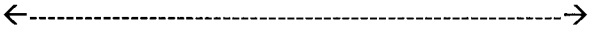


Levels of Knowing: Comprehension of Content to Analysis and Evaluation



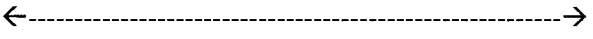
Nature of the Content

Simple Facts - Concepts to Rules to Problem Solving

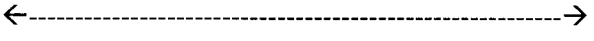


Content Structure and Complexity

Objective and Well-established to Subjective



Sequence: Sequential, Top Down to Nonlinear



Technology Resources Instructional infrastructure

Well Equipped to Basic Equipment

Support Personnel (designers and technologists) to "own your own"

Allocated Time or Compensation to No Time or Compensation

Figure 1. Dimensions of Interactive Learning

Expert in Content, Instructional Design and Instructional Technology to Novice

←----------→

Learner Characteristics

Field Dependent to Field Independent

←----------→

Epistemic Belief / Pedagogical Philosophy-Instructivist (explicit) to Constructivist

←----------→

Source of Motivation -Extrinsic to Intrinsic

←----------→

Collaborative Learning Strategies (learner groups, group projects)

←----------→

Unsupported Communication to Integral Social Interaction (discussion and chat)

←----------→

Prior content knowledge and experiences – Novice – Advanced Beginner –Expert

←----------→

Technology Expertise and Resources: Expert to Novice

←----------→

Decision Options

Learning Theory

Behavioral to Cognitive

←----------→

Task Orientation

Task Orientation (level of task relevance to the learner): Academic to Authentic

←----------→

Figure 1. Continued

TESE, **Volume 27, No. 3**
Summer 2004

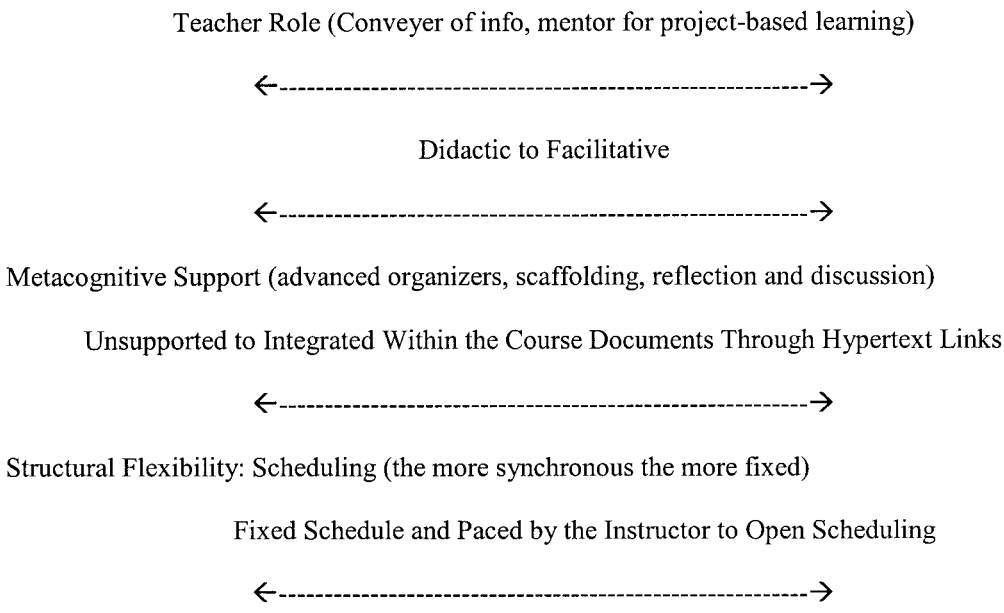


Figure 1. Continued

describe microworlds, or extended cases including authentic artifacts and audio/video media contained in these programs help move the learner with novice level knowledge to expert understanding as they "debug" their understanding of the content. The use of supports and expert assistance in solving the authentic problems presented in the programs utilizes scaffolding in the form of cognitive apprenticeships (Collins, Brown, & Newman, 1989). It is possible that the instructor could group learners working on these learning materials and match advanced learners with novice learners to accomplish this scaffolding. Given sufficient learning time and supports, advanced knowledge acquisition is possible even with novice learners because content knowledge can be linked to authentic application activities like problem solving. Also, prompts and assistance are available within the program to provide instructional "scaffolding" (Hannafin, Land, & Oliver, 1999).

Summary and Recommendations

Online learning is quickly becoming ubiquitous in higher education for supporting traditional course instruction as well as emerging as an avenue for delivering entire courses. With this innovation comes the use of multimedia materials to support learning and the ability to tailor the course content to meet a wider range of learner interests and abilities. As an instructional innovation at its best it holds great promise for improving instruction; however, at its worst it is no better than reading a textbook. As the planning process begins, it is essential to remember that the characteristics of quality instruction are the same regardless of how the instruction is delivered, and that technology should be viewed as a means to accomplish the task of providing distance education.

To aid in the discussion, comparison, and evaluation of online learning Reeves and Reeves (1996) identified 10 dimensions of interactive learning. Through the integration of additional dimensions or factors a new list of considerations was developed to aid in the design of online learning programs and courses. Each of the dimensions can be represented by a continuum as shown in Figure 1.

A Proposed Course Development Model

Taken together, the current knowledge base on instructional design and the emerg-

ing knowledge base on online learning suggest these steps for effective course development:

Steps:

1. Examine the course in relationship to the continuum of courses in the program of studies. This process begins with a review of the goals of the course that should reflect the instructional intention of the course. Introductory-level courses may be designed to build background knowledge of novice learners, individuals with little experience or prior knowledge about the subject of special education. In this case the instructor may follow a systems approach to planning instruction and integrate an instructional events model into this step-by-step series of lessons. This course may include computer-based multimedia information presentations or tutorials that appear to offer general learning advantages over traditional classroom lecture presentation of information, especially with learners with low prior knowledge or aptitude for the domain to be learned (Najjar, 1996). Whereas, a course for advanced learners may be more problem-based.
2. Using the instructional intention and the goals as a guide, specify the objectives of the course and the content and skills to be included in the course. The performance objectives will indicate what level of mastery the instructor expects from the learner and guide the instructor in selecting an instructional methodology to match the objective. According to Ertmer and Newby (1993), it will not be uncommon to design a course that utilizes the full range of instructor-directed to learner-directed instructional design models.
3. Examine the content of the course.
   a. Is the content orientation of the course primarily factual information and concepts, theory, or procedures? Factual information can be presented in text or multimedia form, with frequent assessments for learner feedback. Procedures may require modeling and multiple opportunities to practice the task. Provision for the learner to access assistance through scaffolding is helpful in building comprehension. And once a complex task is completed by the learner, the ability to compare his/her performance to that of an expert is essential for feedback for higher-order learning.
   b. How is the content organized? Is it sequential, or does it begin with a central core of understandings and expand on them to develop a rich inter-related set of understandings? If it is important for the learner to develop a mental schema similar to that of an expert, then advanced organizers, concept maps and flow charts are essential components of a course.
   c. How well defined is the content or skills to be learned? If the content is objective in nature and not complex, then an instructional approach that is objective will likely be appropriate. Whereas, if the content is subjective and complex, meaning it is not easily represented by concept maps from a single perspective, then multiple representations in the form of case examples and problems may be needed to develop cognitive flexibility.
4. Consider the characteristics of the learners who will be enrolled in this course. Match the learners' characteristics to the course design.
   a. What level of knowledge and experience in special education do the learners possess? It may be difficult to accommodate graduate students who have prior course work in the topic and teaching experience and novice learners within the same class. The approach used in most of the courses designed for the SE program at this author's university permits multiple avenues for learners to access course content and work through the lesson. Some of the courses encourage completion of pretests, and if the knowledge base exists in the learner, then the learner pursues a higher-order line of instruction such as case-based problems or case-based reasoning (Schank, Berman, & Macpherson, 1999). As Levin (1999) suggests, too often people use technology to build a uniform

TESE, **Volume 27, No. 3**
Summer 2004

approach to teaching and learning based on the perceived advantages of consistency. Therefore, there is a need to provide several avenues for learners, especially adults, to access course content using multiple instructional formats, contexts for learning, activities and assessments. Novice learners may complete different activities and assessments than advanced learners.

b. Motivators are presented in the form of introductory commentaries for each chapter or module. These are written in a personal style using experiences of the instructor to highlight the relevance of the content or skills to be learned.
c. Social learning opportunities are included in the form of discussion forums and chats. A minimum level of participation is encouraged for all learners, but small group meetings (e.g., study groups) should not be discouraged.

In summary, advanced learning environments like courses are likely to include a blend of direct instruction as a source of basic knowledge, using technology as a cognitive tool for learning with authentic background building experiences, to more constructivist open-ended learning environments (Jonassen & Reeves, 1996). Therefore, the instructor is likely to utilize the full range of instructional design theories in developing teacher education courses. The intent of this discussion has been to create an awareness of the need for considering factors that affect instructional decisions (e.g., the nature of the content, the goals of instruction, and learner characteristics). This examination of the foundations of the course design process prepares the instructor and instructional designer to embark on the last step in the process and examine the technology resources needed to produce a quality online course.

As special educators in higher education engaged in the preparation of teachers to meet the teacher shortage, we must consider the potential of online courses to address the distance learning needs of teachers who are seeking a cost-effective, flexible and quality courses. An extensive and quickly growing collection of valuable resources are available from the Internet. In the process of course design and creation, the Internet provides the most up-to-date information.

References

Albion, P. R., & Gibson, I. W. (2002) *Designing Multimedia Materials using a Problem-Based Learning Design.* Retrieved June 15, 2002 from, http://www.usq.edu.au/users/albion/papers/ascilite98.html

Ayersman, D. J. (1996). Reviewing the research on hypermedia-based learning. *Journal of Research on Computing in Education, 28,* 500–525.

Behets, D. (1996). Comparison of visual information processing between preservice students and experienced physical education teachers. *Journal of Teaching in Physical Education, 16,* 79–87.

Berlinger, D. C. (1986). In pursuit of the expert pedagogue. *Educational Researcher, 15*(7), 5–13.

Chapman, B. L. (1995). *Accelerating the design process: A tool for instructional design.* Retrieved on May 22 from, http://www.mentergy.com/products/authoring_design/designer/whitepap/whitepap.html

Chen, C., & Rada, R. (1996). Interacting in hypertext: A meta-analysis of experimental studies. Human Computer Interaction, *11,* 125–156.

Clark, R. (1998). *Building expertise: Cognitive methods for training and performance development.* Washington DC: International Society for Performance Improvement.

Collins, A., Brown, J. S., & Newman, E. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453–494). Hillsdale, NJ: Erlbaum.

Cooper, L. (1999). Anatomy of an online course. *T.H.E. Journal, 26,* 49–51.

Council for Exceptional Children (2002). *CEC International Standards for Entry into Professional Practice.* Retrieved on May 22, 2002, from http://www.cec.sped.org/ps/ps-entry.html

Daley, B. J. (1999). Novice to expert: An exploration of how professionals learn. *Adult Education Quarterly, 49*(4), 33–148.

Dreyfus, H. L., & Dreyfus, S. E. (1986). *Mind over machine: The power of human intuition and expertise in the era of the computer.* New York: The Free Press.

Ertmer, P. A., & Newby, T. J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 6*(4), 50–70.

Firdyiwek, Y. (1999). Web-based courseware tools: Where is the pedagogy? *Educational Technology,* 29–34.

Gagne, R. M. (1985). *The conditions of learning* (4th ed.), New York: Holt, Rinehart and Winston.

Gagne, R. M., Briggs, L. J., & Wager, W. W. (1992).

Principles of instructional design. (4th ed.) New York: Harcourt Brace Jovanovich.

Hannafin,M., Land, S., & Oliver, K. (1999). Open learning environments. In C. M. Reigeluth (Ed.), *Instructional-design theories and models.* (pp. 115–140). Mahwah, NJ: Lawrence Erlbaum.

Herrington, J, & Oliver, R. (1998). Using situated learning and multimedia to promote higher-order thinking. *Journal of Interactive Learning and Research, 10*(1), 3–24.

Institute for Higher Education Policy. (2001). *Quality online: Benchmarks for success in Internet based distance education.* Author.

Khan, B. H. (1997). Web-based instruction (WBI): What is it and why is it? (pp. 5–18). In B. H. Khan (Ed.), *Web-based instruction.* Englewood Cliffs, NJ: Educational Technology Publications.

Johnson, L. R. (2001, November). *Meeting the challenge of teacher education through a technology-enhanced program of studies.* Paper presented at the meeting of the Teacher Education Division (CEC), St. Petersburg, FL.

Jonassen, D. H. (1986). Hypertext principles for text and courseware design. *Educational Psychologist, 21*(4), 269–292.

Jonassen, D. H. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional-design theories and models.* (pp. 215–239). Mahwah, NJ: Lawrence Erlbaum.

Jonassen, D. H., Ambruso, D. R., & Olesen, J. (1992). Designing a hypertext on transfusion medicine using cognitive flexibility theory. *Journal of Educational Hypermedia and Multimedia, 1,* 309–322.

Jonassen, D. H., & Reeves, T. C. (1996). Learning with technology: Using computers as cognitive tools. In D. H. Jonassen, (Ed.), *Handbook of research on educational communications and technology.* (pp. 693–719) New York: Macmillan.

Langone, J., Malone, D. M., & Clinton, G. N. (1999). The effects of technology-enhanced anchored instruction on the knowledge of preservice special educators. *Teacher Education and Special Education, 22,* 85–96.

Leflore, D. (2000). Theory supported design guidelines for web-based instruction. (102–117). In B. Abbey (Ed.), *Instructional and cognitive impacts of web-based education.* Hershey, PA: Idea Group Publishing.

Levin, J. (1999). Multiplicity in learning and teaching: A framework for developing innovative online education. *Journal of Research on Computing in Education, 32,* 256–270.

Ludlow, B., & Spooner, F. (2001). *Distance education applications in teacher education in special education.* Arlington, VA: TED-CEC.

Merrill, M. D., Wilson, J. C., & Kelety, B. (1981). Elaboration theory and cognitive psychology. *Instructional Science, 10,* 217–235.

Mergel, B. (1998). *Instructional design & learning theory.* Retrieved June 14, 2002, from http://www.usask.ca/education/coursework/802papers/mergel/brenda.htm

Meyen, E. L., Lian, C. H. T., & Tangen, P. (1997). Developing on-line instruction: One model. *Focus on Autism and other Developmental Disabilities, 12*(3), 159–165.

Miller, S. M., & Miller, K. L. (2000). Theoretical and practical considerations in the design of web-based instruction (156–177). In B. Abbey (Ed.), *Instructional and cognitive impacts of web-based education.* Hershey, PA: Idea Group Publishing.

Najjar, L. J. (1996). Multimedia information and learning. *Journal of Educational Multimedia and Hypermedia, 5,* 129–150.

Nelson, W. A., & Palumbo, D. B. (1992). Learning, instruction, and hypermedia. *Journal of Educational Multimedia and Hypermedia, 1,* 287–299.

Newman, F., & Scurry, J. (2001). ONLINE Technology pushes pedagogy to the forefront. Chronicle of Higher Education, 47, B7. (Issue 44 7/13/2001)

Parsons, A. S. (2001, November). *The design of multimodal online teacher education courses: Preparing candidates for work with learners with severe disabilities.* Paper presented during the online conference Teaching Online in Higher Education.

Powers, S. M., & Guan, S. (2000). Examining the range of student needs in the design and development of a web-based course 200–216). In B. Abbey (Ed.), *Instructional and cognitive impacts of web-based education.* Hershey, PA: Idea Group Publishing.

Reeves, T. C., & Reeves, P. M. (1997). Effective dimensions of interactive learning on the world wide web. In B. H. Khan (Ed.), *Web-based instruction.* (pp. 59–66) Englewood Cliffs, NJ: Educational Technology Publications.

Reigeluth, C. M. (1999a). What is instructional-design theory and how is it changing? In C. M. Reigeluth (Ed.), *Instructional-design theories and models.* (pp. 5–29) Mahwah, NJ: Lawrence Erlbaum.

Reigeluth, C. M. (1999b). The Elaboration Theory: Guidance for scope and sequence decisions. In C. M. Reigeluth (Ed.), *Instructional-design theories and models.* (pp. 425–453) Mahwah, NJ: Lawrence Erlbaum.

Reigeluth, C. M., & Squire, K. (1998). Emerging work on the new paradigm of instructional theories. *Educational Technology,* 41–47.

Richie, D. C., & Hoffman, B. (1997). Incorporating instructional design principles with the world wide web (pp.135–138). In B. H. Khan (Ed.), *Web-based instruction.* Englewood Cliffs, NJ: Educational Technology Publications.

Schank, R. C., Berman, T. R., & Macpherson, K. A. (1999). Learn by doing. In C. M. Reigeluth (Ed.), *Instructional-design theories and models.* (pp. 161–181) Mahwah, NJ: Lawrence Erlbaum.

Schieman, E., Teare, S., & McLaren, J. (1992). Towards a course development model for graduate level distance education. *CADE: Journal of Distance Educa-*

***TESE,* Volume 27, No. 3**
Summer 2004

tion/Revue de l'enseignement a' Distance, 7. Retrieved May 26, 2002 from, http://cade.athabascau.ca/vol7.2/09_schieman_et_al_119.html

Schlosser, C. A., & Anderson, M. L. (1994). *Distance education: review of the literature. Ames Research Institute for Studies in Education.* (ERIC Document Reproduction Service No. ED382159)

Schnorr, J. M. (1999). Developing and using technology for course delivery. *Teacher Education and Special Education, 22,* 114–122.

Schuman, L. (1996). *Perspectives on instruction: Behaviorism, Cognitivism, and Constructivism.* Retrieved June 14, 2002, from, http://edweb.sdsu.edu/courses/edtec540/perspectives/perspectives.html

Semrau, L. P., Carlson, K. A., Johnson, L. R, Fitzgerald, G. (1997, June). *The impact of group v individual use of multimedia-based instruction.* Paper presented at the World Conference on Educational Media and Multimedia, Calgary, Canada.

Semrau, L. P., & Fitzgerald, G. E. (1995). Interactive case studies in behavioral disorders: Looking at children from multiple perspectives. *Education and Treatment of Children, 18*(3), 348–359.

Sonwalkar, N. (2001). The sharp edge of the cube: Pedagogically driven instructional design for online education. *Syllabus,* December.

Spiro, R., Coulson, R. Feltovich, P, & Anderson, D. (1988). *Cognitive flexibility theory: Advanced knowledge acquisition in ill-structured domains.* Technical Report # 441.Champaign, IL: University of Illinois at Urbana-Champaign. (ERIC Document Reproduction Service No. ED302821)

Spiro, R. Feltovich, P., Jacobson, M., & Coulson, R. (1991). Cognitive flexibility, constructivism, and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains. *Educational Technology, 31*(5), 24–35.

Spooner, F. Jordan, L. Algozzine, B., & Spooner, M. (1999). Student ratings of instruction in distance learning and on-campus classes. *Journal of Educational Research, 92,* 132–141.

Spooner, F., Spooner, M. Algozzine, B., & Jordan, L. (1998). Distance education and special education: Promises, practices, and potential pitfalls. *Teacher Education and Special Education, 21,* 121–131.

Tabata, L. N., & Enomoto, E. (2001, November). *Integrating multimedia components into an online course.* Paper presented at the Teaching Online in Higher Education virtual conference. Retrieved May 18, 2002, from http://www/ipfw.edu/as/tohe/2001/papers/tabata2.htm

Welsh, T. M. (1997). An event-oriented design model for web-based instruction. (pp. 159–165). In B. H. Khan (Ed.), *Web-based instruction.* Englewood Cliffs, NJ: Educational Technology Publications.

Wilson, B., & Cole, P. (1992). A critical review of elaboration theory. *Educational Technology Research and Development, 40*(3), 63–79.

Lewis R. Johnson, The University of North Carolina Greensboro.