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# Designing Learning Experiences within Learners' Zones of Proximal Development (ZPDs): Enabling Collaborative Learning On-Site and Online

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**ABSTRACT**: In recent years, learning has been reconceptualized from an additive process characterized by an individual's acquisition of knowledge to a socially enabled developmental process in which learners continually reorganize knowledge structures and create new representations. In the new view, learning is defined as the development that results from social interaction that affords learners increased access to roles in expert performances. Accepting the dual cognitive-social nature of learning creates a new problem for instructors: designing learning experiences that meld the cognitive and social aspects without subordinating either to the other. This article addresses the problem by presenting, justifying, and exemplifying an approach to designing learning experiences that support learners' development of capabilities so that they learn to do without assistance things that they could initially do only with assistance. The goal of this design approach is for learners to develop capabilities that they first experience in assisted or collaborative learning situations. Formally, this approach comprises designing learning experiences within learners' zones of proximal development (ZPDs), "the distance between the actual developmental level as determined by independent problem

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solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (see Vygotsky 1978, 86). The article illustrates the design phases with explanations of learning experiences for a master's course in information systems assurance.

**Keywords:** collaboration; collaborative learning; information systems assurance; instructional design; online learning; scaffolding; situated learning; zone of proximal development (ZPD).

## I. INTRODUCTION

The purpose of this article is to present, justify, and exemplify an approach for designing learning experiences that meld the cognitive and social aspects of learning without subordinating either to the other. The approach operationalizes Vygotsky's (1978, 1986) "zones of proximal development" to design learning experiences that support learners' development of capabilities so that they learn to do without assistance things that they could initially do only with assistance. The goal of this design approach is for learners to develop capabilities that they first experience in assisted or collaborative learning situations. The article provides guidance for designing such learning experiences, specifically for accounting information systems (AIS) and generally for accounting and other business subjects. Our contribution is the juxtaposition of elements into a model that lets the strengths of cognitive and social perspectives emerge, each enriching the other. We begin by placing our work in its historical context.

### Learning as Behavioral, Cognitive, and Sociocultural Phenomena

Fifty years ago, a premier rationale for learning was behaviorism, which framed education as teachers communicating predetermined, presequenced content knowledge to students, who were assumed to master the whole by accumulating parts, including skills (Bloom 1956, 1976; Gagné 1965). Learners were assumed to be passive, in need of external motivation including reinforcement (Skinner 1953). Although good at explaining behaviors on predetermined tasks, behaviorist theory was silent on explaining conceptual change in learners. A competing rationale was maturationism, which embraced conceptual knowledge as a function of a learner's developmental stage, a result of biological programming (Erikson 1950). In the maturation approach, educators matched cognitive requirements of a curriculum to the learner's presumed age-dependent stage of development. Because developmental stages were deemed a matter of maturation, the learner's role was to work through the developmental crises preceding successive stages.

Later, cognitivists viewed learning as a matter of developing problem-solving skills that transferred to new problems (Anderson 1981). In this computer-inspired information processing approach, the objective was to guide learners to recognize a problem, characterize what a solution would look like, search for relevant information, develop a solution strategy, and execute the chosen strategy (e.g., Anzai and Simon 1979; Gick and Holyoak 1980; Kulkarni and Simon 1988; Dunbar 1993). In this characterization of learning as problem solving, specific facts were irrelevant until they needed to be brought to bear on a particular problem. The focus was on formulating and evaluating problem representations and matching information to aspects of the problem during the development of a solution. Regrettably, from the cognitivists' viewpoint, the extent of transfer was highly variable, from high to low or even negative depending on prior learning and problem contexts (Anderson et al. 1996).

Independent of the behaviorists' and cognitivists' difficulties with their approaches, others were viewing learning not as the individual's *acquisition* of knowledge or skills, but as learners' *construction* of their own mental structures through collaboration with others. The lineage started with

Dewey's (1916) and Vygotsky's (1978, 1986)[1] focus on the learning activity rather than the individual learner as the unit of analysis. In this approach, learning is "a process of social negotiation or collaborative sense making, mentoring, and joint knowledge construction" (see Zhu 1998, 234). Vygotsky (1978, 1986) and Piaget (1977 [1928]) viewed peer interaction as crucial to learning because it set up circumstances in which learners perceive an internal need to reconcile different perspectives to resolve conflicts of interpretation. The learners' task was to resolve conflicts or contradictions by constructing new mental structures that integrated the different perspectives. This characterization of learning, known as constructivism (Tyler 2001), was consistent with and informed by the growing postmodern realization that a single metanarrative purporting to reveal discovered "truth" was giving way to multiple narratives revealing multiple truths informed by different perspectives (Lyotard 1984).

By the 1990s, two constructivist perspectives emerged: cognitive constructivism (subsuming the earlier cognitivist approach) for those convinced that individual mental processes dominate cognition and social constructivism for those convinced that sociocultural processes dominate cognition (Anderson et al. 1997). A five-year exchange about the relative merits of the two approaches in the pages of *Educational Researcher* resulted in the cognitive and social constructivists agreeing that both perspectives, individual and social, are important, that the social and cognitive approaches illuminate different aspects of learning, and that both approaches should be pursued (Anderson et al. 2000). This exchange confirmed what other researchers had proposed earlier, i.e., that learning is as much a social as an individual cognitive phenomenon (Vygotsky 1978, 1986; Roschelle 1992; Scardamalia and Bereiter 1994; Harasim et al. 1995; Wenger 1998). Integrating the two into a coherent whole, however, was left to subsequent efforts.

**Resolution of the Cognitive-Social Dilemma through Design**

The growing realization of the dual cognitive-social nature of learning creates a new problem for instructors: the need to design learning experiences that meld the cognitive and social aspects of learning without subordinating either to the other (Rogoff et al. 1995). In spite of a voluminous and growing literature in instructional design, e.g., Reigeluth (1999a), the needed integration does not seem to have occurred. That is, design prescriptions seem to emphasize one aspect at the expense of the other. This article is a response to that perceived omission in the context of learning for professional practice. It provides guidance for designing learning experiences, specifically for accounting information systems (AIS) and generally for accounting and other business subjects, that integrate cognitive and social aspects. Our approach for designing learning experiences comprises a synthesis of the best theory and practices that were known to us. That is, each individual element of the model originated elsewhere. Our contribution is the juxtaposition of elements into a model that lets the strengths of cognitive and social perspectives emerge, each enriching the other.

The unifying theme of the design approach we develop is from Vygotsky (1978, 1986), whose solution to the cognitive-social dilemma was to posit learning experiences that support learners' gradual development of capabilities so that they learn to do without assistance things that they could initially do only with assistance. From the viewpoint of the approach developed here, an appealing aspect of Vygotsky's (1978, 1986) resolution is that it permits cognitive and social processes to enable and support each other. Regardless of the source or form of the assistance, the goal is for learners to develop for themselves capabilities that they first experience in assisted or collaborative learning situations (Bereiter and Scardamalia 1985). Learning has occurred "when processes first performed with others on a social plane are successfully executed by a learner in an independent learning activity" (see Bonk and Cunningham 1998, 38).

[1] Although its first English translations (from Russian) appeared in 1929 and 1962, Vygotsky's work did not receive widespread attention in the U.S. until the 1978 translation. The hegemony of behavioral and information processing approaches may have been a factor in the timing (Rogoff 1998).

In practice, members of a group learn from each other by working together as they develop a common sense of purpose, including a common way of thinking about how work gets done and what is necessary to accomplish a task (Wenger 1998; Wenger and Snyder 2000). From this perspective, assuming greater task responsibility is synonymous with engaging in the sociocultural practices of the community of practice (Rogoff 1995), where the development of capabilities constitutes learning. In the sociocultural framework, neophytes perform authentic tasks, beginning with easy ones, until they develop sufficient competence to become bona fide members of the community (Lave and Wenger 1991). This kind of engagement, known as legitimate peripheral participation, guides neophytes' learning until they are able to assume more central roles in the activity.

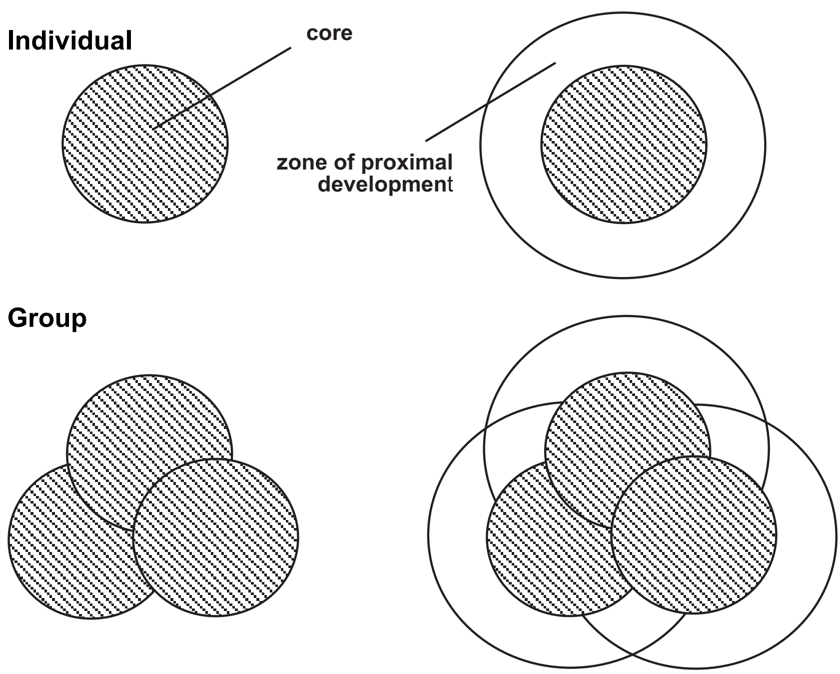
The next section explains the theoretical basis for and the phases in our approach for designing learning experiences. In the third section, the article illustrates the approach with the design of learning experiences for a master's course in information systems assurance implemented as collaborative learning online. The last section explains implications of applying this design approach.

## II. DESIGNING LEARNING EXPERIENCES WITHIN ZPDs

### The Meaning of Learning within a ZPD

The underlying premise of the design approach developed below is the concept of a zone within which a learner collaborating with more knowledgeable persons "can participate in performance at a higher level of complexity than that which she/he can manage alone" (see Hansen et al. 1999). As Lewis (1995) depicted it (see Figure 1), the zone can be represented as a band around the core of

**FIGURE 1**
**Vygotsky's Zone of Proximal Development (ZPD)**




Source: Lewis (1995) representing Vygotsky (1987).

capabilities that the learner already has. The core represents performance the learner can attain without assistance, and the zone represents what the learner can do with assistance. The zone is Vygotsky's zone of proximal development (ZPD), "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (see Vygotsky 1978, 86). The activity in the zone is focused not on the transfer of skills to the learner but on collaboration between an expert person and the learner that enables the learner to participate in sociocultural practices (Lave and Wenger 1991). From this perspective, "the development of cognitive structure happens when the individual internalizes a complexity that was formerly distributed over the system that she/he operates within" (see Hansen et al. 1999, 185).

As Figure 1 illustrates, the cores for a group of individuals overlap. However, the more important overlap is that of one individual's core with another individual's ZPD. In the region of overlap, a more expert person can assist a less expert person. Making use of each other's expertise depends, however, on the learners recognizing expertise asymmetries and being willing to collaborate to benefit from the expertise distributed among them. The overlapped cores "constitute a shared reference area or (recursive base) for exchanging information" (Hansen et al. 1999, 186) that permits shared meaning to develop as learners seek to understand each other. In the process of untangling "differences in understanding, participants are forced to make their assumptions explicit, to argue, to reason about and to exemplify them. In order to reach agreement, they need to construct a conception that allows for apparently insightful assumptions from both parties to be integrated, which will often require a conceptualization that is more complex than the individuals' original ones." (see Baker et al. 1999, 42). In this conception of learning, collaboration drives learners' construction of their mental structures.

Empirical evidence about the effects of collaborative learning is slowly accumulating. For example, Ploetzner et al.'s (1999) survey of empirical studies on learning by explaining revealed that elaborated explanations, but not rephrased explanations, are associated with greater learning. In a single study, Schwartz (1995) found that abstract knowledge acquisition was greater in collaborative problem solving than in individual problem solving. The rationale for this outcome was that collaborative problem solving prompts learners to construct representations that transcend different viewpoints, which are more abstract than a representation needed for one viewpoint alone. Palincsar and Brown (1984) found that, compared with the technique of answer locating, reciprocal teaching was associated with increased performance, a result attributed to the learners in reciprocal teaching being engaged in modeling the activities, identifying comprehension failures, formulating questions, assessing answers to these questions, and constructing explanations. Although they are certainly not definitive, these results are encouraging enough to prompt explicit use and evaluation of collaborative approaches to learning.

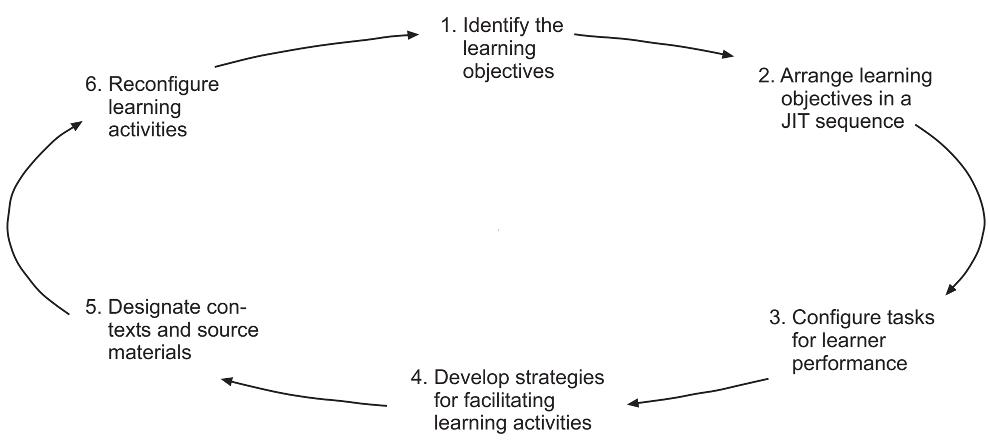
**The Need for a Design Approach**

Although the psychology and education literature contains numerous discussions of (1) cognition as a collaborative process (Rogoff 1998); (2) examples of learning experiences informed by social constructivist perspectives (Fosnot 1996; Palincsar 1998); and (3) analyses of learning gains and differences associated with collaborative learning (Dillenbourg 1999), the guidance to educators about how to design learning experiences based on learners' ZPDs is scant. Regardless of the reasons for this seeming omission, we believe it would be helpful to have some guidance on design choices. We present our contribution to such guidance in the form of an approach to designing learning experiences within learners' zones of proximal development (ZPDs) and situating learners in a community of practice in which learners construct their own competence. Because ZPDs are a function of the interactive context and learners' capabilities, the design approach attends to individual learners' capabilities and to the interaction among individual learners, the facilitator, and the tools and other resources that are involved in the common activity (Bonk and Cunningham 1998).

This section develops an approach to designing learning experiences within learners' zones of proximal development (ZPDs), a concept whose underlying premise is that cognitive development in social contexts precedes development of an individual's capabilities (Vygotsky 1978, 1986). The approach emerged over a five-year period in which the authors were redesigning courses for new environments, reflecting on the consequences of their design choices, and attempting to reify the design guidance leading to successful choices.

As shown in Figure 2, the first two phases of the approach, identifying the learning objectives and arranging them in a sequence that facilitates learning, reflect the mission-driven nature of business degree programs in which course learning outcomes enable students to acquire the knowledge, skills, and attitudes associated with completion of a program. In this framework, learning objectives of individual courses roll up into achievement of the mission. From a logical standpoint, the next three phases—configuring tasks for learner performance, developing strategies for facilitating learning activities, and designating contexts and source—materials, would occur in order. However, the realities of design in a changing environment may lead to these phases being conducted in an overlapped fashion with advances in one opening up possibilities in the others. Conversely, choices in one phase may preclude some moves in other phases. The purpose of the sixth phase, reconfiguring the learning activities, is to make sense of the evidence about learners' experience for informing the next round of design changes. In the large, e.g., designing a new course, one would start with phase one. In the small, e.g., taking advantage of a relevant business context or remedying an existing deficiency in learning, one could start with the most pertinent phase. The point is to cycle through the phases iteratively or in parallel rather than to insist that each one be perfected before undertaking the next one. This approach is analogous to the synch-and-stabilize model that companies have adopted for developing PC software to address quality problems and delayed deliveries while maximizing feature advances (Cusumano and Selby 1997). Course designers benefit from synch-and-stabilize behavior because it ensures that regardless of changes, a course comprises an integrated whole for enabling students' achievement of learning outcomes.

**FIGURE 2**
**Design Phases: ZPD Approach**



**Phase 1: Identify the Learning Objectives**

The first phase in designing learning experiences is to identify the learning objectives and state them in language that specifies what learners will be able to do upon mastering the capabilities the objectives represent. Statements of learning objectives include information concerning the learner's performance, the product created by the learner, and (optionally) the specific context of the performance. For example, an objective might be to *identify: (1) risks associated with the operation of a website that suppliers use to trade with a car maker and (2) ways to manage the risks.* This objective makes explicit the performance (identify), the product (a list of risks with corresponding ways to manage the risks), and the context (suppliers to a car maker). If the context is important for the articulation of objective, it can be stated as part of the objective. Alternatively, specification of the context can be delayed until phase 3, when the actual learning experience is designed.

The performances and products may be manifest in one or more media, e.g., text, hypertext, video, audio, or graphics, and may require interaction with other learners or participants. Performance-specifying verbs include words like *prepare*, *design*, *develop*, *implement*, *identify*, *analyze*, and *evaluate*. Regardless of the verb, each act of doing requires a situation (a context) that is rich enough to permit learners to apply their developing capabilities but that is sufficiently constrained to allow learners to attain completion.

This performance conception of understanding (Wiske 1988; Perkins and Unger 1999) emphasizes "performances that can be observed, critiqued, and improved." (See Gardner 1999.) Because the purpose of the learning is for neophytes to develop into bona fide members of a community of practice, the behaviors that are performed should be authentic, that is, they should match those expected of practicing members of the community (Collins et al. 1989).[2] Furthermore, situating the learning in the community of practice that the learners seek to enter has the advantage of promoting the learners' sense of identity with the community rather than with the passivity of just "learning school." Learning "becomes a progressive process of attempting more and more challenging understanding performances" (Perkins and Unger 1999, 97) that gradually expand the learners' capabilities.

***Relationship to Prior Educational Practice***

Up to a point, the ZPD-design approach to specifying learning objectives is consistent with current calls for intentional learning (Francis et al. 1995) and good learning objectives (Bonner 1999). It differs, however, with respect to the role and timing of concept understanding. In the ZPD approach, learners, rather than teachers, motivate the need for concept understanding. That is, when they realize that not understanding a concept impedes their work on a learning objective leading to a performance, learners set about constructing their understanding of it. Traditionally, learners have worked on concept understanding, as directed by teachers, in advance of beginning work on learning objectives with performance requirements. Although generally associated with efficiencies in learning facts, mastering all the concepts first defers the time when learners take up active roles in their learning, which results in fewer opportunities for them to participate in the roles they seek to assume.

A ZPD approach differs from prior educational practice in that a ZPD approach prompts transforming objectives with verbs such as *understand* or *appreciate* to make the performance capability explicit. For example, an objective like *understand business processes* does not specify a learner-created product that could be evaluated as an indication of the extent of learners' capabilities. A transformation of the objective that makes the intended behavior explicit is *redesign a specific business process to respond to a business need*. In this case, the performance is "redesign" in a specific context, and the product (implied) is the design manifest in objects that reveal the new design.

[2] When the nature of the desired learning does not have a direct practice analog, "authentic" may simply mean interesting or relevant to the learner (Petraglia 1998).

### Phase 2: Arrange the Learning Objectives in a Just-in-Time Capability Sequence

The second phase in designing learning experiences is to arrange them in sequences that permit learners to gain the requisite readiness for proceeding with the learning associated with the next objective in the sequence. Depending on the capabilities to be acquired, there may be several determinants of the scope and sequence of learning objectives (Reigeluth 1999b). For example, it may be helpful to think though the implications of choosing between a top-down order (high-level objective first) and a bottom-up order (low-level objectives first) or alternating between them. The scope and sequence are, of course, subject to variations in the learners' existing capabilities and the specific learning outcomes.

Sequencing learning objectives with a top-down approach permits reliance on authentic practice to motivate the need for otherwise isolated, seemingly unrelated practices. This means identifying the high-level objectives and the sub-objectives comprising each high-level objective. Then, each sub-objective set can be arranged into a precedence sequence in which subsequent sub-objectives depend on previous sub-objectives. For example, the high-level objective *redesign a specific business process to respond to a business need* might be achieved through the following sub-objectives: *define the business need, identify design choices, select a design alternative, create a redesign based on the selected alternatives.*

#### *Relationship to Prior Educational Practice*

Traditional pedagogy and a ZPD-design approach differ in this phase in that traditional learning assumes an additive process in which the learner adds new knowledge to existing knowledge structures. The traditional approach maps readily to the march of a textbook through topics. However, a ZPD-design approach views learning as a developmental process in which learners continually reorganize their knowledge structures, revise beliefs, master new representation systems, and create new representations (Vosniadou 1996). Furthermore, the developmental process stems from participation in sociocultural interaction rather than from memorizing definitions and procedures (Lave 1988; Saxe 1990).

### Phase 3: Design Experiences for Learner Performance of the Capabilities to Be Learned

A primary source of ideas for learning experiences is the practice community that learners are seeking to join. This source contributes in at least two ways. First, learning experiences could be taken from the major performances of practicing professionals in the course of providing their services or products. Second, professionals can reveal the kinds of performances that are new in practice, especially those for which they feel inadequately prepared, which can be used as a guide for aligning learning experiences with emerging practice. For example, the learning objective of *evaluate access control* might have been implemented formerly in learning experiences in the context of mainframes and PCs, but when business transactions began flowing through the web, some of the context shifted to web environments.

A central premise of ZPDs and the sociocultural theory associated with them is Vygotsky's (1978, 1986) idea that developing mental function depends on learners internalizing the performance of the capabilities they are learning. Internalization occurs faster when learners have assistance for the specific task aspects they cannot yet perform on their own. The assistance can be provided by an expert or a more capable peer. Because they are typically initially skilled at different task aspects, learners can often provide assistance to each other, a practice embodied in the overlapped zones and cores in Figure 1. Many modes of social interaction can enable collaboration that helps learners help each other, and physical presence is not required (Vygotsky 1987). Learners can help each other synchronously, e.g., face-to-face or through technology-mediation such as real-time audio (telephone or IP[Internet Protocol]) or web-based chat or video, or asynchronously, e.g., through an electronic bulletin board or email. Through collaboration with others, learners gradually internalize capabilities that in the beginning they could only perform with assistance (Bereiter and Scardamalia 1985; Brown and Palincsar 1989).

In addition to social interaction, learners need contexts for tasks for the new capabilities they are learning. Depending on their initial competencies, learners may need resources whose use ensures that they have attained sufficient readiness to begin the tasks, i.e., that the tasks lie within the learners' collective ZPD. For each capability that learners are to develop, the facilitator must provide tasks whose completion will elicit the intended performance and the assistance that helps learners proceed. The assistance can be manifest in a wide variety of ways, including background readings and vignettes, professional guidance, task contexts, directions or other structure for proceeding with the task, worked examples, and practice problems.

#### *Relationship to Prior Educational Practice*

Although accounting educators (Francis et al. 1995; Stone and Shelley 1997; Bonner 1999) strongly recommend active learning for building skills, they do not explain how they would ensure that learning experiences ensure active learning. In contrast, a ZPD approach ensures, by design, learning experiences that require learner rather than teacher performance of the capabilities. Without explicit design, it is easy for a teacher intending to stage collaborative activities to lapse into lecture mode when the chaos of collaboration or the shortness of time threatens topical coverage. Although teachers agree that student engagement and participation are essential for learning, the persistence of discrepancies between what teachers "say" and what they "do" in their classrooms (Bayer 1996) argues for explicit design of learning experiences that ensures faithful implementation of learning experiences.

### Phase 4: Develop Strategies for Facilitating Learning Activities

Once learning experiences for a learning objective have been identified and sequenced, the facilitator can develop strategies for facilitating the learning experiences. The facilitator's objective is to weave different kinds of assistance together to create a rich instructional conversation that supports rather than directs learners' performance (Gallimore and Tharp 1990; Tharp and Gallimore 1988; Tharp 1993). The objective of this kind of conversation is to textualize discourse among students to make their contributions to solving the problem visible and useful to other learners (Slatin 1992). Some techniques in the sociocultural tradition for supporting learner performance are: (1) modeling that sets performance standards and makes invisible processes evident; (2) coaching to guide learners to expert performance; (3) scaffolding to support otherwise unattainable performance and fading to remove the support as proficiency increases; (4) questioning to elicit responses that reveal logic sequences learners cannot produce on their own; (5) encouraging learner exploration and application of problem-solving capabilities; (6) fostering learner reflection and self-awareness of performance; (7) providing cognitive task structuring through explaining and organizing tasks within learners' ZPDs; (8) managing instruction with feedback so learners can proceed with confidence; and (9) using direct instruction for ensuring clarity, supplying missing information, and showing latent knowledge structures (Collins et al. 1989; Bonk and Kim 1998).

Except for scaffolding, these ways of providing assistance are likely already meaningful to instructors. The concept of scaffolding, attributed to Wood et al. (1976), is a way to actualize the ZPD by reducing learners' uncertainty in a task situation and providing support that is contingent upon learners' responses. The tutor's objective is twofold: to provide assistance to reduce learners' uncertainty about features of a task to a manageable level and to give learners as much control as they can profitably use. Wood (1998) characterized the tutor's levels of assistance as:

Level 0: Provides no assistance

Level 1: Offers a general verbal encouragement

Level 2: Gives specific verbal instruction
Level 3: Assists in choosing materials
Level 4: Prepares materials for use
Level 5: Demonstrates use or operation

The tutor's assistance is deemed successful if it: (1) leads to learners developing ownership of the task, (2) is appropriate to learners existing knowledge, (3) provides structure for the task, (4) stages collaboration between the tutor and learners, and (5) results in learners internalizing the capability, which happens when the tutor gradually withdraws the scaffolding and learners assumes control of the task (Langer and Applebee 1986).

***Relationship to Prior Educational Practice***

The biggest difference between traditional pedagogy and a ZPD-design approach for this phase is that traditionalists are apt to select a strategy at which they excel, e.g., lecturing, while ZPD designers are likely to match strategies to the specific learning objective and thus employ a wide range of strategies, which coincides with Brockbank and McGill's (1998) and Bonner's (1999) recommendations. By staging learner rather than teacher performance of the capabilities to be learned, a ZPD approach is more likely to ensure active learning.

**Phase 5: Designate Contexts and Source Materials for Each Learning Activity**

For each learning experience, the facilitator must designate the situation (the context) in which learners are to perform the capability they are learning and source materials that set the stage for learners' performance of it. The source materials provide the context at an appropriate level of richness, a rationale for why the capability is worthy of performance in the community of practice, a portrayal of the consequences of performing the task at different levels of proficiency, authoritative literature or other reifications pertaining to the performance of the task, guidance for getting started with the task, and guidance for participating in synchronous and asynchronous collaboration in performing the task. Some of these objectives can be achieved with materials in the form of stories from which learners derive cases that they incorporate into their memory structures (Schank 1995). Although the complexity of the source materials may vary as a function of the learners' ZPDs, the objective of providing them is to simplify the learners' role rather than the task (Daniels 2001).

***Relationship to Prior Educational Practice***

Rather than being situated in practice, traditional educational materials are often intentionally decontexualized on the premise that the messiness of real situations obscures the principles to be learned. In the ZPD-design approach, learning is situated in context such "that meaning, understanding, and learning are all defined relative to actional contexts, not to self-contained structures" (see Lave and Wenger 1991, 15). Whereas traditionalists view learning as a function of mental operations in a person's head, ZPD designers define learning as participating in social interaction that affords learners increased access to roles in expert performances. In the ZPD interpretation of learning, "thinking occurs as much among as within individuals" (see Cole and Engeström 1993, 43).

The ZPD-design approach forces explicit decisions concerning topical coverage of source materials based on the learning objectives. This contrasts with the traditional approach, where topics may be included in materials because the instructor once learned them or because textbook publishers attempt to cover all possible needs of every instructor in the target market for the purpose of promoting textbook sales. Thus, compared to the traditional approach, the ZPD approach excludes topical material not explicitly required to support specific learning objectives. Given the scarcity of students' time and the tendency of some textbooks to approach encyclopedic dimensions, ensuring the relevance of reading materials appears to be a positive aspect of the ZPD-design approach.

### Phase 6: Reconfigure the Learning Activities Based on the Learning That Emerges

With each set of learners who perform a task, the facilitator has the opportunity to observe whether the learners attained the desired level of mastery. Evidence about mastery may be manifest in the form of team submissions and discussion of them, learner ratings of team submissions, facilitator assessment of team submissions, learner participation in discussions (including the questions learners ask, how they respond to probing questions, and learners' level of impatience when the group consensus is that sufficient competence has been attained), exam performance, and interim practice question performance. Mastery can also be evaluated based on learners' ability to move to the next task.

At junctures where learners did not achieve the desired mastery, the facilitator could develop a strategy for improving the learning experience by reconfiguring one or more aspects of the learning assistance or enhancing learners' ZPDs through prior learning experiences. If learners exceeded the desired mastery, the facilitator has an opportunity to prompt a higher level of mastery by adjusting the context or to maintain the mastery level while removing some of the assistance. The situation of learners failing to attain the desired mastery should prompt the facilitator to reconstitute one or more of the task, the context, the assistance, or prior learning experiences. In addition to prompting a recalibration of the learning experiences based on learner performance, the reconfiguration phase can also prompt recalibrating learning experiences consistent with shifts in the essential capabilities required of graduates in the subject area (Albrecht and Sack 2000).

#### *Relationship to Prior Educational Practice*

Although consistent with forward-looking educational practice (Angelo and Cross 1993; Harwood and Cohen 1999; Heywood 2000; Huba and Freed 2000), outcomes assessment for the ZPD-design approach can incorporate new possibilities. Having full text in digital forms of all work products facilitates the analysis of what learners are able to do, e.g., making the products easily accessible to professionals for their comment. Having some of learners' participation recorded in digital forms, e.g., discussion forum postings and chat discussions, creates the possibility of analyzing the text to determine the extent and scope of the collaboration that occurred and the learning that emerged during collaboration, e.g., Borthick (2000). Furthermore, the availability of full text for learning activities permits the evaluation of the instructor's facilitative performance.

## III. ZPD APPROACH INSTANTIATED FOR INFORMATION SYSTEMS ASSURANCE

This section illustrates the application of a ZPD approach to designing learning experiences for a master's course in information systems assurance implemented as collaborative learning online.[3] The need to redesign the course arose in planning to offer online what had previously been an on-site course. Even though it embodied significant active learning components such as student completion of assurance projects with software tools, the on-site version of the course could not simply be enacted online because of differences in the affordances for communication in the two modes. For example, the on-site mode relied on physical presence of short duration with paper resources of limited content, while the online mode afforded web-based text communication of any duration with web resources of almost unlimited content. Furthermore, failing to redesign the course would reduce the likelihood of taking advantage of new affordances for collaboration in virtual spaces (Bolter

[3] The syllabus for the course is available at http://www.gsu.edu/~wwwsys/ac863.htm. The motivation for and results from the course are discussed in Borthick and Jones (2000) and Borthick (2000). Graduate students from other universities can enroll in the course (Acct 8630) as transient students for transferring the credit to their home universities. The procedure for being admitted as a transient student is available at http://robinson.gsu.edu/academic/oaa/bulletin/toc.html (select *Transient Students* from the table of contents). The course is also available through the Southern Regional Educational Board's electronic campus: http://www.electroniccampus.org/.

1991; Lanham 1993; Landow 1997; O'Donnell 1998; Bolter and Grusin 1999) that suggest the possibility of new ways of working together to create knowledge and achieve individual and societal goals (Castells 1996; Deibert 1997; Lévy 1997).

Taken together, instructors' and learners' lack of experience with virtual collaboration, instructors' newness in facilitative roles, and learners' lack of acculturation to active learner roles may create barriers to online collaboration for developing learner capability. By inheriting them from other instructors or developing them from experience, instructors with primarily on-site teaching experience have likely already routinized their instructional design choices. Although online instructors may share the same inheritance and experience from on-site settings, aspects of that repertoire may not apply in online environments. For this reason, it is especially helpful for online instructors to make instructional design choices explicit. Furthermore, making design choices explicit would facilitate the analysis of relationships "among technology capabilities, instructional strategy, psychological processes, and contextual factors involved in learning" (see Alavi and Leidner 2001, 1).

The following subsections step through the ZPD design phases as they have been applied to the example information systems assurance course. The text about phases 1–2 shows how individual objectives support the overall course goal, enabling learners to provide assurance services for information systems, and explains how the objectives sequence arose from authentic practice. The text about phases 3–5 treats a single objective, *develop proficiency using computer-assisted audit techniques (CAATs),* in the depth required to illustrate the phases. The CAAT is realized in the form of using software tools to manipulate data in client files. The text about phase 6 reveals instances in which reflection on course outcomes prompted changes to the course design.

**Phase 1 Example: Identify the Learning Objectives**

An overall statement of the goal of the information systems assurance course is to enable learners to provide assurance services for information systems. The overall goal can be achieved through objectives like these: *identify risks associated with the business situation*, *prepare the assurance plan, implement the assurance plan to collect evidence*, *evaluate the evidence,* and *report the findings*. The objective *prepare the assurance plan* comprises the steps of *determining assurance objectives for the context*, *evaluating internal control for the context*, and *designing assurance procedures for the assurance objectives*. Other objectives can be expanded similarly. Each objective specifies a performance on the part of the learner and indicates (or implies) the result of each learner performance. The order for the objectives reflects authentic assurance practice, which has evolved over time and has been reified in auditing standards (AICPA 1999). Table 1 shows these objectives.

**Phase 2 Example: Arrange the Learning Objectives in a Just-in-Time Capability Sequence**

There are two main timing variants for providing assurance for information systems: after all results for a period are known (periodic) and concurrent with the generation of the results (continuous).

**TABLE 1**
**Objectives for Providing Assurance Services for Information Systems from Practice**

1. Identify risks associated with the business situation
2. Prepare the assurance plan
   a. Determine assurance objectives for the context
   b. Evaluate internal control for the business situation
   c. Design assurance procedures for the assurance objectives
3. Implement the assurance plan to collect evidence
4. Evaluate the evidence
5. Report the findings

Periodic assurance has commonly been applied to financial accounting and reporting, for which assurance on the results is provided through an annual financial statement audit. This variant has an historical perspective because the assurance is provided at intervals and the assurors usually have some time after the end of the reporting period to prepare the audit report. Existing auditing standards (AICPA 1999) reflect this perspective. An example of continuous assurance is a long-distance telephone company's continuous monitoring of the results of its billing system with heuristic procedures that evaluate the reasonableness of processing results (Vasarhelyi and Halper 1991). In this instance, the purpose of the monitoring is to detect processing errors soon enough to change the outcome of the process. Because the monitoring occurs in real time, the assurors do not have the luxury of having time after the end of the reporting period to analyze outcomes.

With respect to processes, recipients of assurance services are interested in the current state of the process, e.g., the extent to which the system is performing as designed and thus is producing reliable results now (and is likely to produce reliable results in the future). A long-recommended assurance service for a process is the system development audit, in which the intent is to ensure the quality of the eventual application system by assuring the quality of its development process (Braithwaite 1994; Doughty 1994, 1996). Two examples of evolving branded assurance services for processes are CPA WebTrust$^{SM}$, to assure that websites for electronic commerce "meet standards of consumer protection, transaction integrity, and sound business practices" (AICPA 2000a), and CPA SysTrust$^{SM}$, "to increase the comfort of management, customers, and business partners with the systems that support a business or a particular activity" (AICPA 2000b). Assurance services are appropriate for specific applications, e.g., assurance that lottery tickets conform to the rules of a lottery game.

The existence of the periodic and continuous variants of assurance services presents dilemmas about the scope and sequence of learning experiences across the course. Because of the growing computerization in organizations, it is important to enable learners to provide periodic assurance using computer-assisted audit techniques (CAATs). Because of the growing use of the web for applications for which assurance on electronic processes may be essential, it is crucial to enable learners to provide continuous assurance services. But should continuous assurance occur in the course before learning experiences focused on periodic assurance? What should be the relative proportions of course time between the two? Furthermore, these questions need to be answered in light of the fact that the course is taken by students with an accounting background and students with an information systems background.

From the authors' earlier experience with the course, learners with an accounting background are usually more familiar with periodic assurance services, but many traditional assurance concepts and practices can be transformed or extended for use in continuous assurance contexts. Some learners with an accounting background have such a thorough grounding in traditional, periodic auditing practices that they never completely embrace a continuous assurance approach. For example, they never fully grasp the need and opportunity for working with a whole population rather than just a sample (McFadden 1998). Learners with an information systems background are typically unfamiliar with both variants, but they seem to be more receptive to the continuous assurance approach, probably because of its structural similarities to systems that are familiar to them.

One resolution of the dilemma of how much of what to learn in what order is to arrange an introduction to both in a way that motivates the need for the less familiar continuous assurance approach. For example, suppose the first class session is an experience in identifying the risks associated with the operation of a website that suppliers use to trade with manufacturers and each other. It soon becomes apparent that periodic assurance services cannot be used to control for the risks inherent in real-time operation. In subsequent sessions, learners realize that traditional approaches still predominate because applying continuous approaches has not yet become routine.

Continuous assurance approaches are perceived to be expensive to design and implement, and not many assurors have the capabilities for deploying them. The tension between periodic and continuous assurance is not just a matter affecting the organization of the course—practitioners sense it, too. Because they have only provided periodic assurance services, most current practitioners are unfamiliar with continuous assurance services for web-delivered information systems. Thus, arranging for learners to experience the tension between periodic and continuous assurance is an important aspect of their professional development, and the dilemma of what to learn in what order has an authentic practice counterpart.

The emergence of the tension between periodic and continuous assurance early in the course creates the need for its resolution, which can be achieved by learners experiencing both, including experiences in preparing effective approaches to assurance plans for specific business situations. These experiences might require about two-thirds of the course. Some learning objectives such as *prepare an assurance plan* may be repeated, but the scope and context will be richer each time. That leaves the remaining third of the course for system development audits and learners' original projects in implementing assurance plans and explicating assurance matters to others.[4] This approach incorporates elements of both topical and spiral sequencing (Bruner 1960). One example of instantiating this approach appears in Table 2.

**TABLE 2**
**Course Organization by Performance Objective**

| Week Number | Performance Objective | Kind of Context |
|---|---|---|
| 1 | Identify information system risks | Continuous |
| 2 | a. Evaluate internal control and remedy control lapses<br>b. Develop proficiency using computer-assisted audit techniques (CAATs) | a. Periodic<br>b. Periodic or continuous |
| 3 | a. Evaluate internal control and remedy control lapses<br>b. Develop proficiency using CAATs | a. Periodic<br>b. Periodic or continuous |
| 4 | a. Prepare an audit plan using CAATs<br>b. Develop proficiency using CAATs | a. Periodic<br>b. Periodic or continuous |
| 5 | Prepare an audit plan using CAATs | Periodic |
| 6 | Exam: Demonstrate mastery of evaluating internal control and using CAATs | Periodic |
| 7 | Perform analytical review: Digital analysis | Periodic |
| 8 | Prepare a plan for providing continuous assurance | Continuous |
| 9 | Prepare a plan for a system development audit | Continuous |
| 10 | Project: Implement an assurance plan | Continuous |
| 11 | Exam: Demonstrate mastery of planning periodic and continuous assurance services | Periodic or continuous |
| 12 | Prepare a plan for a system development audit | Continuous |
| 13 | Prepare a plan for a system development audit | Continuous |
| 14 | Prepare a plan for recovering from processing interruptions | Continuous |
| 15 | Paper: Explicate information systems assurance matters to others | Periodic or continuous |
| 16 | Exam: Demonstrate mastery of planning periodic and continuous assurance services | Periodic or continuous |

[4] Security and privacy of information systems are covered in a separate course.

**Phase 3 Example: Design Experiences for Learner Performance of the Capabilities to Be Learned**

Because space limitations do not permit this article to discuss all the learning experiences in the course, we selected the objective *develop proficiency using computer-assisted audit techniques (CAATs)* from Table 2 to illustrate phases 3–5. The specific CAAT is the use of software tools to manipulate data in client files, a practice whose use is growing in many assurance services for both periodic and continuous assurance. The software tools could be generalized audit software (GAS) such as ACL or IDEA, general-purpose statistical analysis software such as SAS or SPSS, or a database tool such as a query language. To analyze client data, assurors must think in two problem spaces at the same time—the space of the analysis itself and the space of the software—and map the analysis onto the syntax of the software (Kim and Lerch 1997). Neophyte learners, who have neither used such software nor mapped an analysis into the syntax of this kind of software, face a steep learning curve. While struggling with the syntax of the software and the representation of the data in the database, they may become discouraged if they cannot immediately express their understanding of the meaning of the desired analysis. This situation can be overcome by helping neophytes gain confidence in formulating analyses in natural language, in using the software, and in expressing analyses that they formulated in the syntax of the software.

Staging the learning experiences for neophytes leads to the following order for the learning sub-objectives: (1) formulate the analysis in natural language, which demonstrates understanding of the meaning of the analysis to be performed, (2) acquire fluency in using the software to represent analyses, (3) express the meaning of the analysis to be performed in the syntax of the software, and (4) verify that the expression of the analysis gives the intended result and revise the analysis if not. This order is consistent with Suh and Jenkins (1992) and Hutchins et al. (1985).

For the purpose of illustrating the design of learning experiences for using software tools to manipulate data for learners in different ZPDs, learners can be characterized at two ZPD levels: those with no mastery and those with partial mastery of the capability. In reality, the ZPDs are probably not distinct, but a dichotomy facilitates characterizing differences in learners' ZPDs. The first sub-objective is for learners to internalize the meaning of the analysis they are to perform by formulating it in natural language. As represented in Table 3, learners with no prior mastery related to the learning objective "need assistance" in (1) characterizing the overall objective and detailed sub-objectives of the analysis and (2) developing precise analysis objectives and arranging them in effective sequences. Learners with some prior mastery of the objective may only need assistance in developing precise analysis objectives. Similarly, for the objective of acquiring fluency in using the software to represent analyses, learners with no prior mastery need instruction in using the software and practice in representing prespecified analyses. Learners in both ZPDs need practice using the software in new contexts and to collaborate with peers to refine their proficiency in using the software to implement query strategies. Borthick et al. (2001) present a learning experience for database query proficiency that provides assistance appropriate for the whole ZPD range, from no mastery to significant mastery of database querying.

For the sub-objective of expressing the meaning of analyses in constructs of the syntax, neophytes need models of correctly expressed analyses to illustrate the concept and complexity of a whole analysis. Both sets of learners need to practice representing analyses in the software and to collaborate with peers to learn to verify representations. To achieve the remaining sub-objective, to learn to verify that analyses give the intended results and revise the analyses if not, neophytes need the assistance of questioning to prompt realization of the possibility of erroneous representation. Both the no-mastery and partial-mastery learners require coaching to develop mental models for testing the results from analyses.

**TABLE 3**
**Design of Learning Experiences within Learners' ZPDs for the Objective of Learning to Use Software to Manipulate Client Data**

| | Appropriate Assistance by Learner ZPD | |
|---|---|---|
| **Learning Sub-Objective** | **ZPD Characterized by Learners Having *No Mastery* Related to the Learning Sub-Objective** | **ZPD Characterized by Learners Having *Partial Mastery* Related to the Learning Sub-Objective** |
| 1. Formulate analyses in natural language | a. Assistance in characterizing overall and detailed analysis objectives | |
| | b. Assistance in developing precise analysis objectives and arranging them in effective sequences | b. Assistance in developing precise analysis objectives and arranging them in effective sequences |
| 2. Acquire fluency in using the software to represent analyses | a. Instruction in using the software | |
| | b. Practice in using the software for prespecified analyses | |
| | c. Practice in using the software in new contexts | c. Practice in using the software in new contexts |
| | d. Collaboration with peers to refine proficiency with the software | d. Collaboration with peers to refine proficiency with the software |
| 3. Express the meaning of analyses in the syntax of the software | a. Study of models of correctly expressed analyses | |
| | b. Practice in representing analyses with the software | b. Practice in representing analyses with the software |
| | c. Collaboration with peers to learn to verify representations | c. Collaboration with peers to learn to verify representations |
| 4. Verify that analyses give intended results; revise analyses if not | a. Questioning to prompt realization of the possibility of erroneous representation | |
| | b. Coaching to develop mental models of testing results | b. Coaching to develop mental models of testing results |

**Phase 4 Example: Develop Strategies for Facilitating Learning Activities**

The facilitative techniques in Table 4 have been used to support the learning sub-objectives in Table 3 for the objective of learning to use software to manipulate client data. Depending on the sub-objective and the technique, the assistance has been afforded in multiple ways, e.g., through web pages, on the bulletin board, with web-administered quiz questions, and in chat. For example, for the first learning sub-objective, formulating analyses in natural language, the facilitator modeled the development of one high-level problem statement in chat and prompted students to develop statements for other aspects of the problem with questions that got them thinking about what they had failed to include in their early attempts at formulating the problem.

For the second sub-objective, acquiring fluency in using the software to represent analyses, the facilitator encouraged students' learning through exploration and application by providing examples on web pages of queries that were close to the queries that students were developing. Once they saw those queries, students adapted them to their analyses, asking questions about aspects that puzzled

**TABLE 4**
**Facilitative Techniques for Supporting Learning for the Objective of Learning to Use Software to Manipulate Client Data**

| Learning Sub-Objective | Function of Assistance: Help the learners: | Assistance Techniques |
|---|---|---|
| 1. Formulate analyses in natural language | a. Characterize overall and detailed analysis objectives | a. Modeling; coaching; questioning |
| | b. Develop precise analysis objectives and arrange them in effective sequences | b. Modeling; coaching; questioning |
| 2. Acquire fluency in using the software to represent analyses | a. Develop skill in using the software | a. Scaffolding |
| | b. Improve skill in using the software for prespecified analyses | b. Encouraging learner exploration and application |
| | c. Improve skill by using the software in new contexts | c. Encouraging learner exploration and application; coaching |
| | d. Collaborate with peers to refine knowledge of syntax and use of the software | d. Fostering learner reflection and self-awareness |
| 3. Express the meaning of analyses in constructs of the syntax | a. Model correctly expressed analyses | a. Modeling; managing instruction with feedback |
| | b. Represent analyses with the software | b. Managing instruction with feedback |
| | c. Collaborate with peers to learn to verify representations | c. Fostering learner reflection and self-awareness |
| 4. Verify that analyses give the intended results and revise the analyses accordingly | a. Examine queries for erroneous representations | a. Questioning |
| | b. Develop mental models for testing results for reasonableness | b. Coaching |

them. Students obtained answers to their questions in chat and on the bulletin board, mostly from other students rather than the facilitator. Because they collectively possessed the understanding required to complete the queries, students were able to scaffold each other's learning within the group ZPD.

To promote achievement of the third sub-objective, expressing the meaning of analyses in constructs of the syntax, the facilitator provided a set of multiple-choice questions (Borthick et al. 2001) that were automatically scored on the web. Some of the questions asked students to select the query constructs that represented a slightly different analysis, and some of the questions asked for the analysis that a specific query represented. Each choice included feedback that pertained to that choice, i.e., if the choice was incorrect, the feedback explained why but did not reveal the correct response. If the choice was correct, the feedback explained why that was the best response. Students could take the question set as many times as they wished, and between attempts they took advantage of the bulletin board to ask other students to explain some of the more complex aspects. Collectively, the questions probed the extent to which students understood the translation between analyses and the queries required to perform them, and the automatic feedback ensured that students were kept apprised of their performance.

For attaining the last sub-objective, verifying that analyses give the intended results, the facilitator used two techniques. First, some of the web-staged multiple-choice questions asked students to calculate the number of rows in the result for different ways of joining tables as a means of checking the likely correctness of their queries. Even if students had not thought about this way of checking their queries, the feedback for each choice explained the approach. Second, the facilitator provided a second set of questions about another business problem with a different database, which enabled students to verify that they had learned to develop queries rather than just memorized the querying associated with the first database. Students wanting assistance with a question asked for it on the bulletin board, and other students responded, which created a collaboration that helped everyone.

**Phase 5 Example: Designate Contexts and Source Materials for Each Learning Activity**

For the experience of learning to use software to manipulate client data, a context that has been used in the information systems assurance course is giving assurance to a car maker that its dealers are complying with company policy for responding to website referrals of customers and assurance to car dealers that the car maker is referring customers as agreed upon (Borthick et al. 2001). The context includes a description of the situation and accompanying data tables and a database file containing the data. For the partial-mastery learners in the course (Table 3 distinguishes the ZPDs of no-mastery and partial-mastery learners), the context contains general statements of the task, i.e., develop queries that characterize: (1) the extent to which car dealers are contacting customers referred to them within 48 hours, and (2) the extent to which the car maker is referring website customers to the nearest dealer. To fit the ZPD of no-mastery learners, the general statements of the tasks need to be expanded to indicate a sequence of specific queries, i.e., car dealer compliance is expanded to statements of queries for determining (1) the dealers' self-reported response times, (2) the average of dealers' self-reported response times, (3) the email response times, (4) the average of email response times, and (5) the difference between self-reported and email response times.

The description makes apparent the rationale for performing the task of manipulating the data: ascertaining that the extent of car maker and car dealer compliance is associated with increased car sales and thus increased profitability. Although there are authoritative bodies responsible for practice standards for some information systems assurance capabilities, there are none that are directly applicable to this task.

In the partial-mastery ZPD, guidance for getting started is implicit in the materials provided. In the no-mastery ZPD, guidance for getting started could consist of a narrative explaining the query strategy and the use of the software for that strategy for the first query sequence to be developed. Depending on the multimedia production technology available to the facilitator, the narrative could be made available to learners in any of several forms: a hypertext that lets learners link to increasing levels of detail for query strategy and development, a streaming video presentation with voice-over text and graphics frames, or an animated graphical sequence. Regardless of the technology used, the narrative is an example of a worked problem (Sweller and Cooper 1985) from which learners can experience how an expert solved the first portion of the problem.

With respect to directions for participating in asynchronous and synchronous collaboration, directions for the partial-mastery ZPD instruct learners to prepare the queries in teams at their convenience over a multiday period, to post (in a bulletin board forum for this task) questions and comments about developing the queries, and to answer the queries and respond to the comments of other learners. At a designated time, all the learners join a synchronous discussion (chat) to answer remaining questions about query development for the task, develop a class query strategy, and interpret the meaning of the query results for car dealers and the car maker. After the chat session, one or more teams (or the facilitator if the facilitator is modeling expected behavior for this learning experience) post a synthesis of all teams' work combined with the insights emerging in the chat session. For learners in the no-mastery ZPD, the activity might be divided into smaller segments, each consisting of asynchronous work in teams followed by a synchronous session for which the facilitator prepares the synthesis.

**Phase 6 Example: Reconfigure the Learning Activities Based on the Learning That Emerges**

In each of the five years the course has been offered online, the design has been reconfigured based on the learning that emerged. For example, with respect to the objective of learning to use software to manipulate client data, the development of the learning experience explained in phases 3–5 was prompted by the realization that an earlier learning experience for this purpose was inadequate for the variance in learners' ZPDs. In single classes, students have ranged across the no-mastery and partial-mastery ZPDs with respect to using software to manipulate client data. Furthermore, students' ZPDs overlapped in configurations like that shown in Figure 1, i.e., the combined cores of all students reflected many aspects of mastery. The earlier learning experience was adequate for learners in the partial-mastery ZPD but not those in the no-mastery ZPD. The no-mastery students could have obtained assistance from the partial-mastery students, but they did not do so in the time permitted. The revised learning experience, beginning with querying for car maker-car dealer assurance, was designed to provide the needed assistance to the no-mastery students while affording partial-mastery students an opportunity to practice their skills.

While it afforded a learning opportunity for using software to manipulate client data, the car maker-car dealer experience did not provide a means of assessing whether students had developed the needed skills or had just learned that context. Thus, for a subsequent offering of the course, we did two things. We developed another context and a set of objective questions based on it for assessing students' capabilities for formulating analyses and executing them with the query language. To familiarize students with the question types, we created analogous questions for the car maker-car dealer context and made them available to students in a learning management system that provided feedback on responses.

In year one, before the learning experience for querying was enhanced, students did not seem able to undertake ambitious projects requiring software tool manipulation of client data. By year four, however, data manipulation skills no longer seemed to be an impediment to students' projects even though entering skills seemed constant. We believe this sequence illustrates the power of applying a ZPD design approach iteratively, in this case, within a learning objective.

## IV. IMPLICATIONS OF DESIGNING LEARNING EXPERIENCES WITHIN ZPDS

This article explained an approach for designing learning experiences within learners' zones of proximal development (ZPDs) and situating learners in a community of practice in which learners construct their own competence. The phases in the approach were to identify the learning objectives, arrange the learning objectives in a just-in-time capability sequence, configure tasks for learner performance of the capabilities to be learned, develop strategies for facilitating learning activities, designate contexts and source materials for learning activities, and reconfigure the learning experiences based on the learning that emerges. This section explains some behavior shifts due to, benefits of, and evidence for the effectiveness of a ZPD approach to course design. In addition, it explains how a ZPD design approach is particularly suited to AIS and concludes with some comments about the generalizability of the approach.

### Behavior Shifts from Designing Learning Experiences in ZPDs

Designing learning experiences in ZPDs shifts the role of the teacher from communicating content to engaging learners in the construction of their own competence. Rather than being passive recipients of knowledge, learners negotiate their own meanings in social contexts. Instead of simply absorbing others' ideas, the learners discuss, analyze, evaluate, and build their own understandings in the domain. Instead of presenting knowledge, the teacher designs learning experiences and facilitates interaction between teacher and learners and, more importantly, among learners.

In this environment, in which learners construct their own solutions (Jonassen 1999), acquiring facts ceases to be the principal learning activity. Instead, the valuable capability is the ability to characterize relevant information, find required information, manipulate relationships, shift between problem representations, and make inferences. The objective is for the learner to be able to solve any problem in the domain at that level of difficulty rather than just current problems (Mallach 1996; Sfard 1998). Learning in this constructivist model permits learners to approach "problems that do not yet exist at the moment of his or her learning. To achieve this capability, the student should be oriented toward productive, rather than reproductive, knowledge. Knowledge should thus appear not in the form of results and solutions, but rather as a process of authoring" (see Kozulin 1998, 151).

Thus, we believe arranging for learners to build their own competence has the potential to prepare learners for work environments in which new problems are the norm and groups of professionals work together to solve them (Schrage 1990; Brown and Duguid 1993, 1998; Nonaka 1994; Vega and Lacey 1996; Raelin 1997). Because professional work requires continued learning with others, we believe immersing learners in a community of practice in which they solve problems together is more likely to be effective in preparing students for changing work environments than learning events characterized by teachers dispensing knowledge.

### Benefits of a ZPD Approach to Course Design

Applying a ZPD approach to course design helps instructors makes choices about learning experiences and how to stage them. It ought to be especially helpful for instructors wanting to shift gradually from mostly lecture-based teaching to more student-centered learning. For example, instructors could identify the lecture knowledge from which students seemed to be the least well prepared to learn. A sign that students are not prepared to learn from a lecture is their treating new information as facts to be remembered rather than integrating new information into an already differentiated knowledge structure (Schwartz and Bransford 1998). Without adequate domain knowledge, learners will not have the relevant prior knowledge and will not be able to activate an appropriate knowledge structure. Thus, a ZPD approach could help instructors design learning experiences that get students ready to benefit from the integration of related knowledge that an instructor can provide through a lecture and discussion.

An implication of designing learning experiences within learners' ZPDs and enabling interaction among learners is that the approach provides a guide to instructional designers and course facilitators for incorporating the use of information and communications technologies into learning experiences. The spreading conversation on this matter, occurring within educational institutions and across educational associations, attests to the perceived urgency of insisting that curriculum and instruction drive technology use rather than vice versa (Snelbecker 1999).

Another implication is that the approach enables an assessment model in which the results of continuous monitoring prompt continuous improvement in the learning experiences. For each learning experience, whether the learning exceeded, met, or failed to meet expectations, the facilitator receives evidence helpful in reconfiguring the learning experiences to improve learning outcomes.

This approach to designing learning experiences creates opportunities for faculty to develop their own repertoire of capabilities for designing and facilitating learning experiences. Faculty can design new learning experiences one at a time, starting with familiar contexts for existing learning objectives. As they gain experience and confidence with a ZPD design approach, faculty will likely develop a better basis for allocating their time and energy in course redesign.

Last, deploying this approach for learning experiences in virtual spaces has the potential to help learners develop their capabilities for professional practice in virtual work environments. In these environments, professionals collaborate electronically, which allows them to transcend time and distance constraints (Gundry 1992; Jarvenpaa and Ives 1996; Dennis et al. 1998; Fritz et al. 1998). As virtual work environments become more commonplace, learners will benefit from having experienced them in authentic settings, supported by learning assistance configured in their ZPDs. These learners will be more likely to move readily into the "temporary, self-managed gathering[s] of diverse individuals engaged in a common task" (Malone and Laubacher 1998, 146) that has been proposed as the model for knowledge work in the future.

**Effectiveness of a ZPD Approach to Course Design**

The most immediate evidence of the effectiveness of this design approach is a change in the authors' behavior, not just with respect to this course, but for all the courses they teach. Specifically, following this approach has prompted a continuing, conscious attention to course design focused on students achieving intended learning outcomes. The things instructors do enter into the picture because they enable student learning, not because instructors like or are good at specific skills, e.g., lecturing. Rather than simply embracing prior design choices, their own and others' choices, the authors are now actively engaged in questioning why they teach the way they do, identifying unproductive design elements and discarding or improving them. From this stance, a course is never "done" in the sense of "being on the shelf." Instead, teaching has become a continuous process of reconstructing learning experiences to align them with emerging business practices and enable student learning. This kind of questioning, a form of reflection, is the essence of critical thinking—the examination of assumptions for the purpose of understanding what is taken for granted (and why) in order to construct a better basis for one's participation in practice (Foucault 1988). Thus, this approach has led to the authors' being more reflective in their practice of teaching (Schön 1987).

Over the five-year period spanning the development of this approach to course design and its instantiation in an information systems assurance course, students have performed on cognitive tasks at least as well as they did before the design approach was applied (Borthick and Jones 2000). Maintaining student performance is significant because at the same time students were being asked to acquire new skills in collaboration and web presentation. With respect to collaboration skills, we believe that students have improved their collaboration capabilities. Students' opinions about the value of the collaborative tasks and the collaborative skills they developed in the course have been increasing as the course was redesigned for successive offerings with increasing reliance on collaboration for learning. In the most recent offering, some students said that the collaboration was the best they had experienced in any team effort in an educational setting.

Although the initial motivation for being conscious of course design was the need to transform an on-site course into an online course, the design approach seems equally applicable to many courses regardless of their locations on the continuum between on-site and online offerings, including the growing middle ground of hybrid or blended courses (Young 2002). Because of its focus on learning objectives, the approach ensures that a course is not suboptimized around the prevailing pedagogy when it was established. For example, if a course was originally structured in a "talk-and-chalk" mode, it is difficult to change the pedagogy to more learner-centered modes. Moving to "talk-and-PowerPoint" is easy because it preserves the underlying pedagogy, but moving to more active modes such as problem-based learning (Evensen and Hmelo 2000; Duch et al. 2001) is more difficult. Even in AIS courses, which are often imbued with active learning experiences, it is difficult to shift courses deeper into active, collaborative approaches due to resistance from students and other faculty members. The greater the resistance from students and other faculty, the more effort an instructor has to exert to establish a more active approach as a preferred one.

Students often resist assuming more responsibility for their learning because more active learning modes are usually unfamiliar and make greater demands on learners (Perkins 1991). When instructors embrace active learning modes in courses where students are accustomed to being spectators of teachers' presentation performances, students' reaction may be that they learned more in the course than they ever had but that the instructor did not teach, e.g., "We did all the work; he just assigned the problems and helped out. He doesn't know how to teach" (see Spence 2001, 11).

Resistance from other faculty can spring from several sources. Faculty, like students, may resist unfamiliar pedagogy because its worth has not been proved conclusively (Brown and Jackson 2001). From this conservative viewpoint, no new pedagogy or implementing technology would be embraced until there is positive evidence of its association with improved learning. At the extreme, this conservatism would result in no experimentation in pedagogy. Faculty may also resist new pedagogy because instantiating it may, at least in the short run, increase the time and effort required in teaching activities, for the initial implementation and subsequent refinements.

**Application of ZPD-Driven Design in AIS**

The previous section on the effectiveness of a ZPD design approach explained its role in ensuring that instructors operate in a continuous improvement mode that focuses on students achieving intended learning outcomes. The ZPD approach fosters continuous assessment of pedagogy, prompting design changes in existing courses and reasoned choices for new learning experiences. The ZPD approach facilitates the development of learning experiences that prompt students to assume responsibility for constructing their own mental models as they solve authentic problems in AIS.

An aspect of this approach that is particularly relevant to AIS faculty is the guidance it provides in matching technology use to learning experiences to achieve intended student learning outcomes. Compared to other accounting courses, AIS courses feel the technology bite sooner. Indeed, an objective of AIS courses is to help students learn to make technology serve the organizational needs for accounting and related information. Compared to other accounting faculty, AIS faculty are typically more adroit users of technology in pedagogy. Thus, when the next new technology innovation appears, the ZPD approach could help AIS faculty evaluate whether its use is likely to enhance the achievement of student learning outcomes or simply add to the technology burden without much prospect of improving teaching or learning.

Having thought through this logic makes it easier for AIS faculty to respond to questions about why they use particular technologies in specific ways in specific courses. Their responses can be based on rationales for the attainment of learning objectives rather than technology use for technology's sake. Similarly, practicing a ZPD approach to course design could help AIS faculty respond to their colleagues seeking assistance in integrating technology into their courses. Although they may not be able to articulate why, colleagues will likely appreciate assistance that keeps the focus on learning objectives and helps them construct their own understandings of when and how to use technology in teaching and learning. Such conversations also create opportunities for AIS faculty to point out to colleagues where on campus they can get assistance for developing their technology skills and applications once they have constructed their own models of the role of specific technology in pedagogy.

Faculty in all disciplines receive continuing exhortations to use technology to improve teaching and learning and to realize a return on their institutions' technology investments (Twigg 2000). In these admonitions to use technology, there is often little recognition of the ways in which technology use might vary as a function of intended learning outcomes. Thus, the guidance to use a ZPD approach to matching technology to learning experience seems necessary, if only to counter the well-intentioned voices of those advocating increased technology use without regard to learning objectives. Understanding these dynamics might enable AIS faculty to make greater contributions to campus-wide and national/international discourse on the roles and uses of technology in teaching and learning.

**Generalizability of a ZPD Approach to Design**

Although the illustration of the application of a ZPD approach to course design featured learning experiences in virtual spaces, the approach is equally applicable to on-site courses. To the extent class time is conducted on-site, the community of learners would be meeting in person rather than over the web. If learning experiences call for learners to view each others' work, then it would be helpful for learners to have access to facilities that would let them publish their work on the web. Depending on the learning objectives, it might or might not be helpful for each learner to have access to a networked computer during class sessions. For example, if it were sufficient for one learner at a time to be guiding the discussion by controlling displayed information or applications, one computer with overhead projection might be adequate. If it were important for learners to share electronic access to an application or resources, then it would be appropriate for every learner to have access to a networked computer, enabling their collaboration on any document or application. With this capability, learners could show each other their work in real time and take turns taking control of the application to create or demonstrate alternatives.

As the preceding paragraph shows, on-site courses could benefit from the application of a ZPD design approach. Indeed, the power of the approach comes from its applicability to a wide range of learning experiences for which collaborative learning is desired. For new or substantially revised courses, phase 1 is a natural starting point because it prompts top-down analysis of a whole course. For making incremental changes to existing courses, phase 6 may be the best starting point because it focuses the designer's attention on comparisons between desired and attained learning. Further increasing its applicability, the approach is silent on how fast the designer should proceed, i.e., a designer may redo a whole course at once or redesign learning experiences one at a time.

The design approach is counter-indicated in courses for which: (1) a community of learners is not needed or (2) existing knowledge, skills, and attitudes will always be adequate in professional practice. In professional education, a way to identify instances for which such a community is unnecessary is to determine whether professional practitioners applying the knowledge, skills, and attitudes embodied in the course engage in practice in the company of other practitioners. If practitioners never need to consult with other professionals on specific practice aspects, then learning experiences for those aspects of practice may not need to be conducted in a community of learners.

Similarly, if practice can be conducted based on a fixed body of knowledge, then a constructivist approach to learning may not be necessary. The accounting profession's continuing calls for graduates with better skills for life-long learning, communication, and teamwork suggest that the instances for which collaborative learning would be inappropriate appear to comprise a small set.

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