

# **Pedagogy and ERP: Designing Instructional Methods for Different Learning Styles**

Enterprise Resource Planning (ERP) Track

Abstract:

This paper describes the instructional methods for incorporating and integrating Enterprise Resource Planning in a business school curriculum. The paper discusses current definitions of learning and those factors that impact learning. It also focuses on two types of learning styles (holistic and sequential), and their application to designing an ERP program over four years and across the curriculum.

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## ***Introduction***

Colleges and universities create learning environments that enhance our students' skills and attributes, transfer knowledge through various courses, and, hopefully, engender the pursuit of lifelong learning. The stakeholders involved in this structured learning environment have an extensive set of explicit and implicit expectations. One of the implicit expectations is that the curriculum incorporates new knowledge and practices in the field. For curricula closely aligned with the professions, both students and employers expect new graduates to have both the knowledge and practical capability to be current with the demands of the profession. While these expectations are appropriate, successfully introducing change in an academic setting requires careful analysis of the existing curriculum, the developmental status of the students, the faculty's familiarity with the new content, instructional methods and learning styles.

Change usually begins with an external or internal stimulus that recognizes an unmet need or creates a new expectation. In this instance, the Salem State College School of Business (SSCSB) faculty recognized that some of our key stakeholders, local employers, were implementing enterprise resource planning and that some of our student interns and alumni were working at these companies. These facts ultimately led the SSCSB to apply to and obtain membership in SAP's University Alliance Program (McLanahan et al, 2001). After addressing the first question, "Why do we have to make this change?" the second question is "How do we make this change successfully?"

This paper describes how Salem State College's School of Business addressed this second question by designing instructional methods for different learning styles to introduce ERP in a business curriculum. The first section of the paper presents the learning environment considerations. The second part of the paper addresses the overall framework for designing instructional modules. It is this framework that guides the development of individual modules applicable to each course and ensures that the modules consistently address the learning environment considerations.

### ***The learning environment***

Colleges and universities generally create a community of learners and a learning environment. We begin this paper by explicitly examining key assumptions and considerations involved in these learning environments. Foremost among these questions is the meaning of learning.

### ***What is learning?***

According to Schunk (1991), "Learning involves the acquisition and modification of knowledge, skills, strategies, beliefs, and behaviors." Learning theorists also generally agree that the learning involves behavioral change that endures over time, and it occurs through practice and experience (Schunk, 1991; Bierly, 1999). Mentkowski and Associates (2000) extended this definition by identifying four, integrated domains (reasoning, self-reflection, development, performance) in learning that lasts. In addition, these domains of growth and learning correspond with four educational goals: (1) Developing thinking skills in relation to the declarative knowledge structure of the disciplines, (2) developing the whole person's capacity to make meaning, (3) developing self-reflection and cultural identity, and (4) developing the capacity to perform in work, family, and civic settings.<sup>1</sup>

Based on this research, we know that students initially acquire new knowledge and modify existing knowledge. They subsequently develop new skills and behaviors that enable them to apply this newly developed knowledge. The extent of mastering both the knowledge

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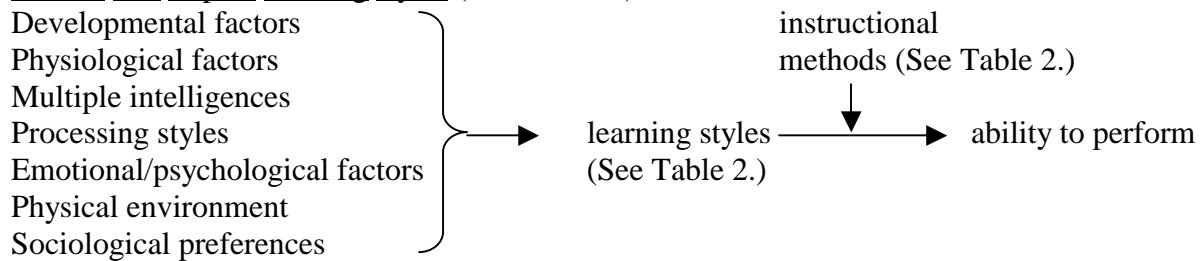
<sup>1</sup> Mentkowski and Associates. pp.180-182.

content and requisite skills then determines performance. While definition is adequate for learning content and expectations, it does not sufficiently reflect how students learn or the various learning styles that they use. Designing new curricula must include instructional methods that consider and address each student's different approach to learning, and requires an understanding of the factors that determine different styles of learning.

**Learning styles**

Learning styles research has evolved to focus on the many factors that impact learning and how these factors combine in different ways to create a typology of learning styles. Figure 1 provides an illustration of how various groups of factors combine and lead to learning style typologies. This figure also implies that instructional methods impact the quality of learning that results by matching appropriate instructional methods to the student's learning style. In turn, this impacts the student's ability to perform, the fourth component of Mentkowski's (2000) definition of learning.

Factors that impact learning styles (See Table 1.)



Each of the factors that impacts learning styles subsumes a significant body of theoretical, conceptual and empirical research. Space limitations preclude a review of the literature in the field and appropriate citations. Table One provides a list of some of the research within each group.

Table-1 Factors that Determine Learning Styles

Factors that impact learning styles	Research topics within each of the factors
Developmental status	age, gender, experiences, culture, beliefs, race, prior content (extent and mastery), skills (extent and mastery)
Physiological	perceptual (visual, auditory, kinesthetic, tactile), mobility/static, time of day
Multiple intelligences	logical/mathematical, linguistic, musical, spatial, bodily/kinesthetic, interpersonal, intra-personal
Processing	hemispheres, cognitive/behavioral
Emotional/psychological	motivation, persistence/discipline, responsibility, safety/comfort, self esteem, readiness to learn, locus of control
Physical environment	light, sound, temperature, (design) features, mobility, intake (food and liquid)
Sociological	self, pairs, peers, team, group, varied, authority figure present/led

Consensus on a definition of learning styles still eludes learning scholars. The lack of consensus primarily stems from individual researcher's focus on a limited set of factors listed in Table 1. The field is replete with learning style theories based on one or more subject areas. The

behavioral-cognitive approach represents the dominant paradigm used in the categorization of various reviews of learning style theory (Schmeck, 1988, Schunk, 1991). While the learning style theory discussion initially took an either/or approach to the paradigm, it evolved towards acknowledging both behavioral and cognitive processes concurrently in both the definitions of learning and learning styles. While learning style research continues along this continuum, more recent research focuses on differences in information processing by each hemisphere of the brain<sup>2</sup> and how an individual's preference for either the left or right hemisphere tends to correlate with the factors listed in Table 1 and the empiricism/behaviorism continuum. Dunn and Dunn (1972), and Dunn and Griggs (2000) found that many of the topics and factors tended to cluster around the holistic and sequential hemisphere dimensions. They also found that the typical behavioral and cognitive separation also clustered on the hemisphere dimensions. Based on this current research we chose to use the hemispheric learning style orientation when designing our instructional methods. The next section continues with a brief review of hemispheric learning style research.

### **Hemispheric learning style research**

Hemispheric research (Entwistle, 1981; Schmeck, 1988), attributes a holistic learning style to the right hemisphere. Individuals with this learning style use a global context and relationships between topics. Holistic (global) learners learn by creating a 'map' or 'picture' from informational cues. Their 'maps' extend beyond the cues to include prior knowledge and self-induced information that must exist to complete the 'map' or 'picture'. Holistic learners intuit and impose relationships between the information cues beyond those presented by instruction or the situation. In contrast, the sequential learning style correlates with the left hemisphere of the brain and is a step-by-step approach to learning. An individual with a sequential learning style learns A, learns B and then learns the relationship between A and B. This learning must occur before introducing C. While a sequential learner proceeds step-by-step from A to Z, a holistic learner must first know that the picture entails A (a beginning), and Z (an end). With a few intermediary cues, the holistic learner creates the logical cues that span the gaps from A to Z.

The behavioral/cognitive and the hemispheric approaches suggest that learning style is a function of biological and experiential (developmental) factors. Dunn and Dunn (1972) and other researchers found that certain factors (See Table 1), clustered around the holistic and sequential learning styles. This tendency led Dunn and Griggs (1993) to associate many of the characteristics listed in Table 2 with each of the learning styles. Entwistle's (1981) and Sarasin's (1999) research extended this association by suggesting instructional methods appropriate for each of the learning styles.

While the characteristics of each learning style are distinct, researchers indicate that individuals tend to have preferences for one style versus the other, although it is possible for an individual to switch from one style to the other based on context and situational demand. The relative ability to make this switch varies according to each individual. Instructional methods that correspond with an individual's learning style improve the overall learning environment and knowledge transfer (Table 2 lists instructional methods that suit each learning style. Those methods that are used in the SSCSB SAP course modules are emboldened and italicized).

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<sup>2</sup> The left-right hemisphere discussion assumes an individual with a right hand preference. For an individual with a left hand preference, reverse the hemispheres.

Table 2 Learning Style Characteristics and Corresponding Instructional Methods

<p style="text-align: center;"><u>Sequential Learning Style</u></p> <ul style="list-style-type: none"> <li>• Recognize/remember names</li> <li>• Respond to verbal instructions</li> <li>• <b>Systematic and controlled when learning</b></li> <li>• Inhibited emotionally</li> <li>• Dependent on words for meaning</li> <li>• <b>Produce logical ideas</b></li> <li>• Process verbal stimuli</li> <li>• <b>Process information objectively</b></li> <li>• Serious and <b>systematic when solving problems</b></li> <li>• <b>Task oriented</b></li> <li>• Dislike improvising</li> <li>• Not psychic</li> <li>• Rarely use metaphors and analogies</li> <li>• <b>Responsive to logical appeals</b></li> <li>• <b>Cope with one problem at a time</b></li> <li>• <b>Think sequentially</b></li> <li>• Use language when thinking</li> <li>• Time conscious</li> <li>• <b>Analyze pieces of information</b></li> <li>• <b>Understand relationships</b></li> </ul>	<p style="text-align: center;"><u>Successful instructional methods for sequential learners</u></p> <ul style="list-style-type: none"> <li>• <b>Lecture</b></li> <li>• <b>Discussion</b></li> <li>• <b>Independent work</b></li> <li>• <b>Objective presentation and practice</b></li> <li>• Questions that require exact answers</li> <li>• Activities that involve memorization</li> <li>• Verbal sorting</li> <li>• <b>Sequential presentation</b></li> </ul>
<p style="text-align: center;"><u>Holistic Learning Style</u></p> <ul style="list-style-type: none"> <li>• Recognize/remember faces</li> <li>• <b>Respond to visual and kinesthetic instructions</b></li> <li>• Playful and <b>relaxed when learning</b></li> <li>• Responsive emotionally</li> <li>• Interpret body language easily</li> <li>• Produce unusual ideas</li> <li>• <b>Process kinesthetic stimuli</b></li> <li>• <b>Process information subjectively</b></li> <li>• Playful and non-conforming when solving problems</li> <li>• Generally people and group oriented</li> <li>• <b>Like improvising</b></li> <li>• Highly psychic</li> <li>• Frequently use metaphors and analogies</li> <li>• Cope with several problems simultaneously</li> <li>• <b>Think holistically</b></li> <li>• <b>Use images when thinking</b></li> <li>• Time indifferent</li> <li>• Take in information from many, varied sources and need environmental cues to learn</li> <li>• Values are important</li> </ul>	<p style="text-align: center;"><u>Successful instructional methods for holistic learners</u></p> <ul style="list-style-type: none"> <li>• <b>Visual formats</b></li> <li>• Social cues</li> <li>• <b>Group learning</b></li> <li>• <b>Graphic organizers</b></li> <li>• Models</li> <li>• <b>Demonstrations</b></li> <li>• Role-playing</li> <li>• <b>Presentations</b></li> <li>• Field trips</li> <li>• Motivational accounts/stories</li> <li>• <b>Computer aided instruction</b></li> <li>• Webbing</li> <li>• <b>Activities that allow freedom to emphasize creativity</b></li> <li>• <b>Teaching to the senses</b></li> <li>• <b>Web pages</b></li> <li>• DVD and CD-ROM</li> <li>• <b>Power Point presentations</b></li> <li>• E bulletin boards, chat rooms, and email, <b>Distance learning</b></li> </ul>

### ***Enterprise Resource Planning Systems***

Enterprise Resource Planning Systems (ERPS) are information systems that use an integrated approach towards the business applications (software and databases) required to manage a business in today's complex, globally competitive business environment. Each functional area within the business (e.g., accounting, human resources, operations, logistics) requires distinct business applications, yet they share many common data elements. ERPS use a common database that allows each of these functional areas to conduct their specific tasks while automatically modifying and updating the database. Leading companies across the world use some form of enterprise software systems. Our graduates, the business managers of the future, must be familiar with Information Technology across the full range of business functions so that they may be prepared to effectively manage in today's complex, competitive, global business environment.

SAP is a global leader in the ERPS industry. They established a University Alliance Program to "expand awareness of the SAP R/3 Software in the university arena and to implement R/3 as a fundamental teaching tool in university curricula." The SSCSB business curriculum content incorporates SAP as an example of a business information system. We use discrete applications for analysis, synthesis, and evaluation in Accounting, Finance, Sales and Marketing, Distribution, Information management, Production and Operations and Report generation. We utilize SAP to help students develop enterprise information system skills and competencies, critical thinking skills, teamwork, and decision-making. Consistent with the School's stated mission, SAP enables the SSCSB to be responsive to the needs and expectations of our students and external stakeholders.

Any individual exposed to an ERPS quickly realizes the magnitude (breadth and depth) and sophistication of these systems. Very few practitioners develop proficiency in more than one application. This fact led the SSCSB faculty to take a deliberate approach towards incorporating SAP in the overall business curriculum and individual courses. The next section describes the course module design approach that SSCSB used to develop instructional methods for the learning styles described above.

### **Course Module Design**

The complexity of SAP, educational objectives for the curriculum and each course, faculty proficiency with SAP, our students' familiarity with business applications and their learning styles were the parameters that drove the course module design. The first key decision entailed the design of a phased introduction of SAP over the traditional four-year undergraduate and two-year MBA programs. We began with introductory courses to build student (and faculty) proficiency. In each subsequent year, students would re-visit SAP in greater depth and with more exposure. In the fourth year, students will have case based experiences requiring the use of the full range of the SAP applications.

The design of specific course modules must be consistent to ensure full integration across the curriculum. Each SAP course module uses a standard set of components. The components include the scope of the module, a set of learning objectives that match the course objectives with the appropriate SAP business applications, a Power Point presentation (with teaching notes embedded in the presentation slides), a hands-on application as part of the presentation, post presentation exercises (homework), a post-exercise competency assessment, and a student satisfaction survey. Before teaching any module, the faculty develops a complete, written module, presents the Power Point presentation, and completes the exercises. The module design components also maximize the instructional methods to address the sequential and holistic

learning styles. The bold, italicized instructional methods in Table 2 are incorporated in each of the SAP project's course module instructional methods.

### ***Sequential learning style and corresponding instructional methods***

Differences between the characteristics in Table 2 distinguish the sequential from the holistic learning styles. These differences correspond with parallel differences in the instructional methods appropriate to each learning style. A challenge when designing the course modules is to include instructional methods conducive to each learning style. The sequential learner processes new material in an objective, logical, systematic, and controlled fashion. The new input and its described relationship is accepted at face value if deemed logical. There is little effort to extend the new input with new and different relationships or possible meanings. This learner is more responsive to auditory input and likes to focus on one task at a time. Lectures with sequential, step-by-step presentations, discussion based classes, and time for independent, self-paced practice are some of the instructional methods suited to sequential learners.

To address the sequential learning style, each course module includes a Power Point based lecture with a list of objectives for the module. The lecture content also includes a general structure followed by a sequential presentation. A subsequent hands-on exercise (guided by a written instruction sheet), reinforces the sequence and relationships verbally and visually presented during the lecture. The assigned homework exercise(s) reinforces the logical sequence steps for the SAP application and the connections with the course content information needs (i.e. accounts payable information in an accounting course). These methods tend to match the characteristics for individuals with sequential learning styles (See Table 2, column 1, bold, italicized).

### ***Holistic learning style and corresponding instructional methods***

The holistic learner processes information in a subjective and contextual manner from multiple sources simultaneously. All new inputs are processed in the context of their individual and collective meaning where the meanings derive from the current and potential relationships with other knowledge. Holistic learners favor visual and kinesthetic inputs. This supports their tendency to create mental maps, use images when thinking, and to use metaphors and analogies when communicating with others. Presentations, with a visual format (e.g. Power Point), that include organizing frameworks (e.g. causal maps, matrices), appeal to holistic learners. These individuals also like to receive information in context via simulations, demonstrations, experiments, role-playing, field trips, and motivational accounts and stories. Computer based learning (e.g. web based, CD-ROM) also correspond with both visual input and organizing preferences.

To address the holistic learning style, the course module Power Point presentations use models and copies of the screens from the SAP application. These are strong graphic organizers and visual formats. The course module hands-on exercises are guided demonstrations and presentations of the SAP application, relationships between SAP data fields, and the relationship with the information requirements for the course. The subsequent homework includes computer-guided activities. The exercises encourage exploration that emphasizes initiative, curiosity and creativity. These instructional methods correlate with the visual and tactile senses, and processing methods for individuals with holistic learning styles. (Refer to Table 2, column 1 ).

### *Preliminary Conclusions*

Without pre-testing each student for their learning style in the context of the course and SAP application, it is not possible to design learning style specific course modules. Therefore, the course module design challenge is to concurrently use sequential and holistic instructional methods. The student satisfaction surveys for every section of every course that introduced SAP in the fall 2000 semester revealed uniformly high positive results. These results, while not specifically examining instructional methods, are encouraging. With only one data set from one semester, it is premature to go beyond guarded speculation that the course module design approach is satisfying the learning definition and learning style criteria. The next steps in our project are to design the second phase course modules for the fall 2001 semester and to develop competency assessments that more accurately gauge the learning that has actually occurred. This last step will be the litmus test for the effectiveness of the course module design and instructional methods.

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