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Revisioning Theoretical Framework of Electronic Performance Support Systems (EPSS) within the Software Application Examples

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INTRODUCTION

An ideal educational or training system would be one in which every learner could be instructed by an expert tutor. This is the technique we actually use for some difficult, specialized skills, as in pilot training, the training of astronauts, musical performance, sports and athletics, and advanced studies of some kinds at the college level. In all of these cases, an instructor spends special time working with selected individual students. However, there are not enough instructors (or time and place) to go around for this kind of training when large numbers of learners (or different types of users / employees) are involved. Organizations today need more than empowered employees. Because of increasing team orientation, they need empowered employees who can work productively in teams. Also they need empowerment for (a) day-to day management, (b) maximizing organizational interactions, (c) managing performance, (d) managing chance and encouraging involvement, (e) handling difficult interactions, (f) interventions, and so on. Here is where Computer-Based Training and Management (CBT&M) can play a role. Likewise a types of CBT&M, Electronic Performance Support Systems (EPSS) is one way to make advantages of private tutoring, performance support, management, guidance, practice and online collaborative communication available any time any place any organization to large or special groups of people trained or worked in specific topics or skills.

Gloria Gery (1991) describes the sophisticated EPSS used in industry which combine hardware and software components to provide an 'infobase', computer-based management, expert tutoring, and job aids and tools within one system. EPSS is a concept, not a technology. Also it is a computer-based environment that facilitates skills and knowledge acquisition within a particular domain of study. It may consist of one or more software programs, it is typically designed as an integrated units that does not incorporate existing software applications. (i.e., IBM Lotus Notes 6 and Domino 6, Oracle 9i Collaboration Suite, and Microsoft SharePoint Server "v2.0" Beta 2). EPSS can include a range of support mechanisms and software tools, including advisory systems to help in structuring tasks and decision making, and other interactive capabilities with the alternative technical systems. Despite the variations in definitions, general agreement exists on the major goals of an EPSS: (1) generate performance and learning at the moment of need, (2) enable "day-one performance", (3) support higher levels of performance for work being done on time (Gery, 1991). The need to provide "just the right training" at "just the right time" to "just the right person" has caused some companies to begin developing performance-support systems that either replace or supplement traditional training.

Gamson (1994), Raybould (1995), Bayram & Crossman (1997), and Marion (2002) said that we know that EPSS has significant effects in collaborative learning, performance improvement and business communication but we do not have a theoretical basis for understanding how and why they occur. There is no study focused on the theoretical roots of the EPSS within the software application examples. There is a need to analyze this type of frameworks for well understanding, satisfied explanations, qualified developments, and future productions of the systems. From these reasons, constructed a theoretical framework is an important step for the continuance and the future of the EPSS. Thus, it is time for experts to explore some promising theoretical approaches that might help make sense of the effects of collaboration, social context, performance appraisal and interactions in electronic learning. In this view, the aim of this review is to develop a set of theoretical

construct that provide descriptive power for explanation of EPSS and its roots and features within the software application examples (i.e., CleaverPath Collaboration Option or Mac OS X v10.2 and its applications).

The practical and the application domains of the EPSS explained in the previous studies (e.g. Goodrum, et al, 1993; Schwen et al., 1993; Bayram et al., 1996; Bayram & Crossman, 1997), guide me to construct a new theoretical framework from the job training and educational point of view. Based on the literature, the theoretical framework is constructed under five interrelated domains including concepts, constructs and propositions that contribute to the body of EPSS knowledge in such context. The relationship among the domains is not linear, but synergistic. Each domain contributes to the other domains in practice and to shapes to the other in theory. The following figure 1 visualizes a pentagon model for the interrelated domains of the theoretical framework of EPSS.

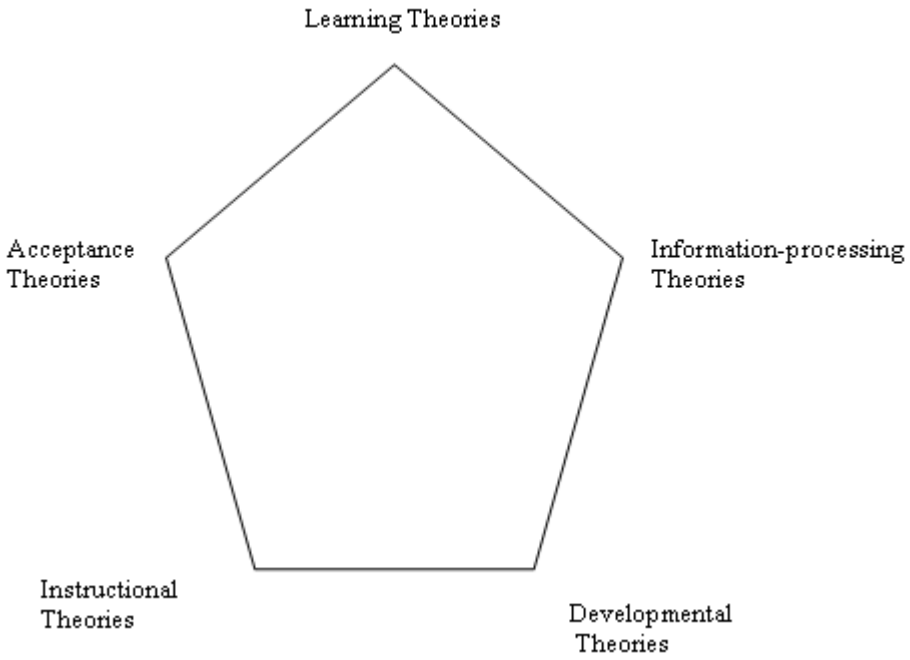

Figure 1. Theoretical Framework of EPSS

From the educational and training point of view, there are five interrelated domains in the theoretical framework of EPSS. They are: learning theories, information processing theories, developmental theories, instructional theories, and acceptance theories. There may be more than five domains of the EPSS. But the body of theory and the research studies are insufficient now. Thus, this task will be left for the future. At the moment, the study will be devoted to a discussion of each domain within the existence software examples. This descriptive framework explains a set of descriptions as to which outcomes occur under given theoretical conditions for a given EPSS model within software examples as follow.

LEARNING THEORIES

A learning theory such as Thorndike's connectionism, Hull's reinforcement theory, Skinner's behavioristic learning theory, Lewin's topological psychology or Tolman's gestalt theory, comprises a set of constructs linking observed changes in performance with what is thought to bring about those changes (Fleishman, 1967, p. 169). From the learning theories point of view, learning refers to "the relatively permanent change in a person's knowledge or behavior due to experience or peer interactions in training. Bandura's (1977, 1993) social learning theory emphasizes the reciprocal relationship among self-beliefs (self-efficacy), performance, and environmental (or peer) feedbacks. According to Assisted

Learning Theory (see Tharp & Gallimore, 1988), peer feedbacks motivate learner discussion, debate, and internal reflection. They are also provide various forms of learning, guidance, questioning, modeling, direct instruction, and instructional aids.

During the EPSS interactions for performance support, peer feedbacks might be mediate between expert and learner roles by stating the purpose and goals of the learning activity, asking and modeling questions and explanations, offering insights on their own new understandings, supporting learner inquiry, and offering generic procedural assistance and prompts. Also, the management system of the EPSS (i.e., Lotus Notes 6 & Domino 6 management system) might further encourage reflection and dialogue for learning events and training activities.

Paralleling the recent advances in technology for global collaboration and dialogue, many educators and human learning researchers are turning to the sociocultural ideas of Vygotsky (1978, 1986) analyze learning in a social context (The Cognition and Technology Group at Vanderbilt, 1991; Alexander & Murphy, 1994; Radcliffe, 2002). Neo-Vygotskians Salomon & Perkins (1989) stated that during the learning processes, advanced electronic communication technologies (or EPSS of the CleaverPath Collaboration Suite) encourage teamwork, networking, written communication, brainstorming, problem solving, and mental functioning. Also, in the EPSS learning environments (i.e.,Lotus Notes 6 & Domino 6, Oracle 9i Collaboration Suite or Mac OS X v10.2 and its applications), collaboration logs, chat boxes, and transcript replays might provide a window on how managers lend their expertise to a document, how responsibilities are assigned, how questions become raised and revisions accepted, how textual ideas evolve, how minor modifications in the writing environments impact forms of discussion and collaboration patterns.

Galegher et al. (1990), and Schrage (1990) said that with the EPSS, collaborative work, social interaction, sharing of minds, critical thinking, and intellectual teamwork are all bound to increase in the workplace. Educational researchers supported the importance of active learner-centered instruction, learning strategies and example case studies in training (Duffy & Jonassen, 1991; Tharp, 1993). In this view, socio-cultural principles might be applied through the creation of EPSS scenarios of actual or virtual classroom situations that effectively pose questions within an individual's zone of proximal development. Also, modeling, coaching, encouragement, feedback, and other support of learners' cognitive abilities are important for effective learning, problem solving and performance empowering in such social context (Garcia, 2001; Schrage, 1990). EPSS collaborative learning environment (i.e., Micosoft SharePoint or Oracle 9i Collaboration Suite) designed to support such generative learning and social dialogue also may foster the learner inquiry, problem finding, reflection, goal setting, and other mental effort deemed critical for user-centered environments.

INFORMATION-PROCESSING THEORISIES

Based on the cognitive science, information processing is an interdisciplinary field that has arisen from the convergence on a common set of questions by psychology, linguistics, computer science, philosophy and neuroscience. In this view, information processing is a theoretical perspective that focuses on the realms of human perception, attention, memory, and thought (Bruning, et al 1995). Perception and attention are the two important terms in the information processing theories. Perception is the assignments of meaning to incoming stimuli; attention is the allocation of cognitive resources to the tasks at hand. According to the cognitive information processing view, the human learner is conceived to be a processor of information in much the same way a computer is. When learning occurs, information is input from the environmental (or EPSS learning context), processed and stored in memory, and output in the form of some learned capability (Kelly, 1955).

From this perspective, scientist view the human mind as a complex system that receives, stores, retrieves, transforms, and transmits information. These operations on information are called computations or information processes, and the view of the mind is called the computational or information-processing view. Most models of information processing (i.e., Newell, 1990; Simon, 1990; McCloskey, 1991) can be traced to Atkinson and Shiffrin

(1968), who proposed a multistore, multistage theory of memory. That is, from the time information is received by the processing system, it undergoes a series of transformation until it can be permanently stored in memory.

Tulving & Thompson (1973) showed that memory was strongly influenced by learners' actions as they attempted to encode information. This viewpoint is coming to fruition in the strong current interest in cognitive strategy instruction (e.g., see Pressley et al., 1992). The goal is to help learners manage their own learning. Similar to this, EPSS experience (i.e., Oracle 9i Collaboration Suite) tell us that it not only can help learners conceptualize their goals for training in education but also aid them in developing highly motivated learners who can reason well, reflect on their thinking, and articulate what they know. Metacognitive strategies and conscious cognition (that is, self-regulation) of learning which implies a high level of cognitive engagement include: actively receiving and selecting information; making connection with existing knowledge; identifying what one need to know; efficiently using one's time and cognitive resources; continuously monitoring one's learning progress such as rehearsal and self-checking (Bandura, 1993).

From this viewpoint, when users in an electronic community or in an EPSS learning environment (i.e., Lotus Notes 6 and Domino 6 learning environment or Mac OS X v10.2 and its applications) are confronted by alternative problem simulations or views, example solution options of the cases, decision models or cognitive dissonance, thereby causing individuals to seek additional information to resolve that conflict since they do not want to look dumb to their new peer group. Shared experiences among participants on a computer screen (i.e., Microsoft SharePoint or CleaverPath Collaboration Option) stimulate interpersonal understanding (Burkhardt, 1994), mutual knowledge (Krauss & Fussell, 1990), social cognition (Bruning et al., 1995), and group cohesiveness (Delacey and Leonard, 2002).

DEVELOPMENTAL THEORIES

The theories of Piaget (1970, 1972) in cognitive development , Case (1984) in automatization (to reduce operating space in short term memory), Kohlberg (1981) in moral judgment (attitudes of reasoning about moral and social dilemmas'), Loevinger (1976) in ego development (sets of perceptions toward oneself and others'), Ericson (1963) in psychosocial stages (eight stages characterize the human life cycle), Hunt (1975) in conceptual development (attitudes towards learning and preferred style of learning), all posited a sequence of hierarchical, invaried stages of human development. In each theory subsequent stages are considered to be successively better frameworks for managing one's life in a complex society.

Knowledge of developmental theory helps one to recognize and deal more effectively with individual differences. The value in knowing the progressions in developmental theory and these approximates sets of individual differences or world-views can help one to be less dogmatic about one solution for everybody. Research (Oja & Sumulyan, 1989) suggested a number of strategies for appropriate supports and challenges providing collaborative learning with light of development theories. These strategies are: (1) provide many options for growth, (2) mentoring, (3) develop flexible time options, (4) facilitate networking, (5) encourage self-growth, (6) differentiate roles, (7) share power, (8) group supervision, (9) becoming a change agent. In fact, EPSS environments provide all the above strategies (such as mentoring or group supervision) for electronic learning and performance support. Sugar and Bonk (1995) explained and showed that Bloom's (1956) taxonomy of educational objectives and Selman's (1980) development theory of social cognitive training was useful for cognitive analysis of the electronic discourse. They also discussed the nature of the online educational technologies from the perspectives of the above theories. Freedman (1987) pointed out that when applying Vygotskian theory to electronic learning environment (or Lotus Notes 6 and Domino 6 or Oracle 9i Collaboration Option), the intervention should include : (1) collaboration among users, (2) assistance in solving the problems, and (3) guidance and support for empowering the potentials.

Vygotsky's (1978, 1986) sociocultural theory of human learning and development specifically lends insight to research in the are of electronic collaborative learning with

Lotus Notes. His arguments that social interaction with capable peers would scaffold learner to developmental levels they might not independently attain can be extended to notions of the computer (i.e., Microsoft SharePoint, CleaverPath Collaboration) as a conversational partner and assistor of student learning. As predicted by Vygotsky, expert guidance or scaffolding leads employees into new communication tasks and capabilities, thereby spurring issues important in the design of technologies (i.e., Mac OS X v10.2 and its applications) that support co-authoring and commenting (Bonk & Reynolds, 1992).

INSTRUCTIONAL THEORIES

Behaviourists tend to describe their instructional theories in terms of stimulus and response (S-R). Learning has occurred when a specific response is elicited by a specific situation with a high degree of probability. Bloom (1956) used cognitive, affective and psychomotor objectives as the domains of learning. Then, Gagné (1965) suggested a hierarchical list of eight categories of learning. The list is hierarchical in the sense that it proceeds from simple conditioning type of learning, up to complex learning, such as involved in problem solving. In the late 70's, M. D. Merrill and his associates, integrating much of the existing knowledge about microdesign considerations, developed the Component Display Theory which has refined the general heuristics offered by Gagné and Briggs (1979) into a set of specific and detailed procedures for exercise design (Merrill, 1983). Later, C. M. Reigeluth and Merrill began to integrate much of the existing knowledge about macro design considerations and John Keller's ARCS motivational model considerations into the models of instruction (Reigeluth, 1983). These sets of models are primarily concerned with strategies to optimize the quality of instruction.

Instructional quality refers to the degree to which instruction is effective, efficient, and appealing effectively promoting learner performance on a task toward learning. The common goals of an instructional strategy are maximum effectiveness (i.e., the fewest errors and least time to perform), maximum efficiency (i.e., the least time to learn), maximum retention (i.e., continued low error rate and low performance time), maximum transfer (i.e., maximum effectiveness in new contexts), and maximum appeal (i.e., learner to perceive they are learning and seek additional opportunity to interact with the task or similar task) (Merrill, et al., 1979, p. 170). From the above perspectives, it can be said that EPSS environment's (i.e., IBM Lotus Notes 6 and Domino 6; Mac OS X v10.2 and its applications) features match the considerations of the instructional quality. For example, users spend less time to learn a fact or to perform a task. They perceive they are learning and seek additional opportunities to interact with a task or solve a problem for effectiveness and efficiency in the online electronic context such as Microsoft SharePoint Learning Environments.

Brown et al., (1989) spells out the epistemological shifts that take place when we move from a cognitivist paradigm to a situated learning paradigm. They said that situated learning focuses a number of shifts for the design of instructional systems. The epistemological paradigm shift upon some points such as contextualization, practice, expectancy, interactional case activities, coordinations, dilemma handling, and rationality. An instructional system that is sensitive to the situated learning paradigm, has to respect and encourage the very socio-linguistic processes by which rationality is constructed. Oracle 9i Collaboration Option or CleaverPath Collaboration Option online environment is also constructed based on situated learning epistemology. It provide a number of example case practices, alternative rational solutions to the problems for troubleshooting and dilemma handling considerations .

ACCEPTANCE THEORIES

The roots of acceptance theories can be found in the old personality theories such as Henry Murry's need theory, Gordon Allport's trait theory, Abraham Maslow's humanistic theory, and Carl Rogers' phenomenological theory. All posited the importance of the human needs, values, and self-actualization in attitudes and behaviors. In this view, the Theory of Reasoned Action (TRA) articulated by Fishbein and Ajzen (1975) explains people's actions by identifying the causal connections between various components: beliefs, attitudes, intentions, and behavior. Then, Davis (1989) adapted the TRA model to develop the

Technology Acceptance Model (TAM), which is specifically meant to explain computer usage behavior. The TAM replaces the attitudinal determinants of TRA with two distinct variables-perceived ease of use and perceived usefulness. Like TRA, TAM theorizes that actual computer usage is determined by behavioral intention, but differs in that the intention is jointly determined by the person's attitude toward using the system (or EPSS) and perceived usefulness. The attitude toward computers is also jointly determined by perceived usefulness and perceived ease of use.

Specifically, three main motivations affecting technology acceptance were examined: (a) intrinsic motivations (such as enjoyment and fun); (b) extrinsic motivations (such as usefulness); and (c) social pressure. User acceptance is defined as the demonstrable willingness among a user group to employ information technology (i.e., Oracle 9i Collaboration Suite) for the tasks it is designed to support. User acceptance has been viewed as the pivotal factor in determining the success or failure of any information system projects (Davis, 1993; Dillon and Morris, 1996). Both practitioners and researchers have a strong interest in understanding why people accept information technology (i.e.,Microsoft Share Point or Mac OS X v10.2 and its applications) so that they can develop better methods for designing, for evaluating, and for predicting how users will respond to new technology.

Diffusion is defined as the process by which an innovation is adopted and gains acceptance by members of a certain community. A number of factors interact to influence the diffusion of an innovation (i.e., CleaverPath). The four major factors that influence the diffusion process are the innovation itself, how information about the innovation is communicated, time, and the nature of the social system into which the innovation is being introduced (Rogers, 1995). The Innovation Decision Process theory (Rogers, 1995) states that diffusion is a process that occurs over time and can be seen as having five distinct stages. The stages in the process are knowledge, persuasion, decision, implementation, and confirmation. According to this theory, potential adopters of an innovation (i.e., SharePoint Collaboration) must learn about the innovation, be persuaded as to the merits of the innovation, decide to adopt, implement the innovation, and confirm (reaffirm or reject) the decision to adopt the innovation (i.e., Collaboration Suite).

Finally, the introduction of software designed to help people schedule meetings and facilitate decision or learning processes is changing interpersonal communication dynamics. Information technology (i.e., EPSS) is also dramatically affecting the way people teach and learn (DeLacey & Leonard, 2002; Radcliffe, 2002). Studies report that individual perceptions of information technologies are likely to be influenced by objective characteristics of technology (i.e., database management or example case studies of Lotus Notes 6 and Domino 6), as well as interaction with others. For example, the extent to which one evaluates new technology (i.e. Oracle 9i Collaboration Suit) as useful, s/he is likely to use it. At the same time, her/his perception of the system (or EPSS) is influenced by the way people around her/him evaluate and use the system (Trevino et al., 1987).

CONCLUSION

Electronic Performance Support Systems (EPSS) are generally being developed for use by knowledge workers who already work with computer technology. Thus, it becomes possible to provide them with ready access to various forms of online help, databases, completed examples, and demonstrations, as well as system and human guidance, to assist them in completing their current task. From the educational and training point of view, this paper describes a pentagon model for the interrelated domains of the theoretical framework of EPSS. Each synergistic domain contributes to the other nonlinear domain in order to shape it in such EPSS context. Based on the theoretical framework, the following Table 1 summarizes some of the theoretical concepts supporting to the EPSS related features and showing how such concepts sharing same features with the examples software programs such as Lotus Notes 6 & Domino 6 and Oracle 9i Collaboration Suite.

Table 1. Theoretical concepts sharing and supporting to the EPSS examples

Theoretical concepts supporting to the EPSS's features	CBT Environments supporting to the EPSS' features
Performance Support (Performance information, support mechanism, improvement, productivity, empowering) Problem Solving-Decision Making (Conflict- resolution, dilemma-handling, troubleshooting, alternative solutions) Work Practice (Groupwork, training exercises, demonstrations, integrated units, and role playing) Guidance- Advisory System (Online help, peer dialogue, sharing of mind, work, questioning, and discussion) Collaboration-Cooperation (Effective communication, social context, team work, peer dialogue, and interactivity) Learning Environment (Situated learning, anchor instructional , brainstorming, feedback, human memory, perception) Management System (Instructional- learning environment, databases, knowledge skills, acquisition, and negotiation) Motivation (Satisfaction, self-efficiency, intrinsic motivation-enjoyment, and extrinsic motivation- usefulness) Case Studies-Examples (Modeling, role taking, alternative solutions, and practicing) User-Acceptance (Self-regulation, easy of use, user-centered, perceived usefulness, perceptions, beliefs and needs)	IBM Lotus Notes 6 and Domino 6 Mac OS X v10.2 and its applications Microsoft SharePointServer"v2.0"Beta 2 Oracle 9i Collaboration Suite CleaverPath Collaboration Option

In this study, (1) learning theories, (2) information-processing theories, (3) developmental theories, (4) instructional theories, and (5) acceptance theories and their some relevant or similar features are selected to support the aim of this review. The study shows that the examples of computer-based training environments and their specific software programs are also sharing the similar theoretical concepts with such theories within EPSS learning environment.

This theoretical framework is a helpful guide to understand how and why empowerment develops in an organization within the software examples. From the empowerment, interaction, collaboration and service management point of view the theoretical framework might be helpful to describe the nature and the nurture of effective online communication, practical skills for real-life problem situations, flexible and friendly interaction facilities, on (in) the job training implications, guidance, reinforcement and performance support within the educational perspective

As theoretical framework become more sophisticated, the demarcations between domains blur and the dimensions of one domain are inescapably dependent on the views of another. The future work of theoretical frameworks will shape more finite explanations of the domains and the features within them. This paper provides an insight about the innovation or adoption of the EPSS in/on the job training implications. Finally it is not only addressing the present state of the theoretical framework of the EPSS, but also pointing out the trends for the future cyberlearning projects.

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