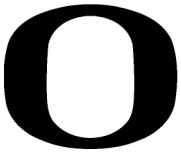

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Corporate Training, Constructivism, and Electronic Performance Support Systems: A Review of Literature

CAPSTONE REPORT

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Abstract

A deeper understanding of EPSS website construction has the potential to benefit web developers and the enterprise through improved EPSS practice, and may add consistency to instructional design. The target audience is corporate web authors. Selected literature, published from 2000-2007, examines the following areas: 1) corporate training, including the role of EPSS systems, 2) principles of a Constructivist Learning Theory, and 3) opportunities to align types of EPSS support structures and potential alignment to Constructivist pedagogy, within an EPSS framework.

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Introduction to the Literature Review

Brief Purpose

The purpose of this inquiry is to understand why Constructivist pedagogy should be applied to the design of an effective corporate Electronic Performance Support System (EPSS) website. Following Leedy and Ormrod's (2005) qualitative approach (p. 92), this inquiry examines selected literature published from 2000-2007 that examines the following areas: 1) on-the-job (also known as corporate) training, including the role of EPSS systems, 2) principles of a Constructivist Learning Theory, and 3) the types of EPSS support structures and potential alignment to Constructivist pedagogy, within an EPSS framework.

Research Problem

What is an EPSS?

Training in the workplace is often "de-contextualized and incongruent with workplace realities, resulting in a low fidelity between what occurs during classroom sessions and what is expected on-the-job" (Koh and Branch, 2006). Just because instruction is provided to employees, either in a face-to-face classroom setting or as a training program distributed on DVD, "doesn't mean that the knowledge is actually transferred or that any knowledge conveyed is what employees will need to succeed in the future" (Knowledge@Wharton, 2000). Isman et al. (2005) suggests that instructional experiences or environment lacking instructional strategy will not result in the "effective, efficient, and appealing learning of the desired outcome" (p. 2). Malcolm (1992)

additionally suggests that research in the area of on-the-job training reveals a lack of training consistency between trainers and may not be the most efficient training solution.

Research indicates employees learn best when they receive active support while "engaged in the normal business of the organization" (Stephenson, 2003). McGraw and McGraw (1993) suggest that an Electronic Performance Support System (EPSS) may offer a viable training alternative. However, information on how to design and develop EPSS sites is not always well documented because EPSS sites are considered to be proprietary (Winer et al., 1999). Gustafson (2000) acknowledges "some EPSS designers may be reluctant to talk about what they have done, since they are unable to clearly articulate specific and replicable procedures" (p. 42).

Stephenson (2003) suggests that an EPSS can provide contextual, personalized content that is self-managed by the employee, relevant to the employee's work, and presented in a learning environment that fully supports the employee. Four structural elements generally make up the support structures for EPSS sites: resources, context, tools, and content assistants [referred to as scaffolding by authors] (Bastiaens, 1999; Hannafin, 2000). Hannafin (2000) also notes that the elements within each EPSS site will have a slightly different configuration based on learners, the learning goals, and the context of the information.

The role of constructivist theory.

Dewey (1938) says that "No experience is educative that does not tend both to knowledge of more facts and entertaining of more ideas and to a better, a more orderly, arrangement of them" (p. 82). Extrapolating from the ideas of Dewey (1938), King (2001) posits that learning is rooted in experience and therefore educational systems

should build on learner experience within a social environment. This perspective is based on Constructivist theory, which takes the position that learning "should be organized in real-life experiences that provide a context for the information" (Grady, 2003).

In the context of real-life experience, Constructivist Learning Theory could support the foundational learning goal of EPSS websites. Fenwick cautions that "experience alone does not teach" (p. 19). Rather, new knowledge is constructed when an experience is paired with the learner's internal processing of that experience through reflective thought, is linked to previous knowledge, and results in a change from the learner's previous state of understanding (Dewey, 1938; Fenwick, 2001).

Audience and Significance

Gustafson and Branch (2002) acknowledge that the process for developing instructional materials can be complicated (p. 22). "The creation of a seamless EPSS information infrastructure comprised of user access devices, networks, developer skills, application policy, and financial support is a challenge to many organizations" (Maughan, 2001). Gustafin et al. (2002) also indicates that the development of successful EPSS or system-based instructional materials can require "substantial resources being made available to a team of highly trained developers" (p. 45). This may not always be the case, especially given corporate budget constraints where EPSS content development and implementation may be passed on to individual developers.

The target audience for this literature review is corporate web authors. The assumption underlying this inquiry is that imparting a deeper understanding of EPSS website construction to web authors has the potential to mutually benefit web developers

and the enterprise through improved EPSS practice, and consistency in the resulting instruction design.

Limitations

The references provided in this literature review [with limited exceptions] are published between 2000 and 2007. Reference exceptions include the original works of authors who either coined or defined specific terms, or previously had authored highly influential works for a given discipline (i.e., John Dewey's work from 1938). This seven year time frame provides the necessary currency to cover advances in educational and EPSS technology.

Literature is also limited by physical availability. Full text versions not available online, through library services, or by order from a major distributor are excluded.

EPSS can be defined "as a self-contained, online system which is designed to integrate a knowledge base, expert advice, learning experiences, and guidance with the goal of providing individuals with the ability to perform at a higher level in the workplace and requires minimal support and intervention by others" (Gery, 1989). For the purposes of this inquiry, the definition of EPSS technology is limited to web-based solutions with embedded multimedia content delivered via computer (Morrison & Dede, 2004).

The literature is limited to content written about adult learners in the context of workplace training. It is assumed that the readers are generally familiar with some of the basic training methods that occur in the workplace.

The majority of the literature originates from databases specializing in educational content (i.e., ERIC and Academic Premier Search databases). Literature selection was

also limited (mostly) to scholarly publications, trade conference presentations, research papers or non-fiction books.

Literature evaluation criteria are based on Leedy and Ormrod's (2005) evaluation checklist design (p. 155). Evaluation criteria will limit selected literature based on currency, topic relevancy, the use of citations and references by the author, where the literature has originated, and the length, context and the intended audience of the literature.

The typical audience for EPSS structures and Constructivist pedagogy usually includes educators, corporate trainers, and instructional designers. For this literature review, corporate web developers who are often tasked with EPSS development have been selected as the intended audience (Smith, 2007).

Introduction to the Writing Plan

The Review of the Literature is written according to a thematic scheme as referenced by The Writing Center at the University of North Carolina (n.d.). According to this source, themes can be used for addressing specific topics and/or issues. Using this method, the literature is initially organized by three themes: general literature related to 1) corporate training, 2) selected principles of Constructivist pedagogy, and 3) EPSS structures. Lastly, any emerging themes among subtopics and possible relationships will be incorporated into the overall design.

Definitions

This section identifies and defines terms used to describe entities, environments, or activities related to corporate training, Constructivist pedagogy, or Electronic Performance Support Systems. These terms are generally sourced from the references used to frame the Review of Literature. Citations for these terms are also listed separately in the References section under the sub-category labeled *Literature that Supports Definitions*.

Conceptual Framework: A set concepts that when applied, provide a special perspective of a given phenomena (George Washington University, 2000).

Constructivist Pedagogy: An approach to teaching and learning that is based on learners' active participation in problem-solving tasks or in projects that encourage critical thinking (Fenwick, 2001). Constructivist pedagogy emphasizes:

- The learner having an active role
- Focuses learner's attention on pursuing answers to questions or solutions to problems
- Focuses instructor on creating learning experiences rich in constructivist experiences
- Emphasizes project or activity-based learning (King, 2001).

E-learning: The transfer of skills and/or knowledge enabled by a digital network and includes the following features:

- Content is delivered and managed via the Internet
- Pace and duration of learning is flexible
- Content access is geographically independent, on-demand, and just-in-time

- Exercises and testing capability enabled by electronic interaction (Stephenson, 2001; p. 12)

Electronic Performance Support System (EPSS): An online system which is self-contained that provides employees the ability to self-service with minimal intervention, and perform their job with greater efficiency. It may integrate "a knowledge base, expert advice, learning experiences, and guidance" (Gery, 1989; Hannafin, 2001).

Experiential learning: Learning and knowledge acquisition that is socially constructed from actively participating in current life opportunities (Dewey, 1938; Grady, 2003, Nunes, 2001).

Informal Learning: Activities involving the pursuit of understanding, knowledge or skill without externally imposed curricular criteria (Livingstone, 2001).

Instructional Design: The preparation of the learning process, tools and resources enabling the construction of knowledge (Fardanesh, 2006; p. 2).

Learning technology: Any technology or technology-driven device allowing learners decision-driven, customized information access during an inquiry process (Morrison and Dede, 2004).

Pedagogy: The science of teaching through instructional principles and methods (Princeton University, 2006).

Problem-based Learning: An instructional approach utilizing real world problems as a context for learners to obtain critical thinking and problem-solving skills (Putnam, 2001).

Technology and pedagogy: The range of methods used in educational technology that enables active learner participation in training sessions (Shaffer, 2003; p. 6).

Web developer: A person who performs design and development tasks for a website (Biz/Ed, 2007).

Web-based training (WBT): Educational content that is delivered through a web browser using the public Internet, a private intranet, or an extranet. WBT content may be stand-alone or instructor-led (Imperial College, n.d.).

Research Parameters

This inquiry is designed as a formal literature review (Leedy & Ormrod, 2005; p. 64). Selected literature comes from the areas of Constructivist pedagogy and EPSS structures. The Review of the Literature includes authors such as Dewey (1938), Gustafson (2000, 2001), and Hannafin (2000, 2001) who have each been recognized and referenced by the training industry as experts either in Constructivism or EPSS. Information provided in this section presents an overview of the methods used to develop the inquiry and is divided into four sub-sections:

1) ***Search Strategy.*** The search strategy section identifies how and where literature sources were located.
2) ***Documentation Approach.*** The documentation approach section identifies the process and mechanism by which potential sources were located, recorded and cited.
3) ***Evaluation Criteria***. The evaluation criteria section details the criteria used for selecting final literature for the process.
4) ***Writing Plan.*** The writing plan details the underlying process for organizing and structuring the Review of the Literature.

Search Strategy

Searches are conducted, and narrowed on topic relevance, availability of an online full text, and by date currency (see *Figure 1: Search Results*). A few exceptions are made (i.e., definition for EPSS was revised to use the original person who coined the term in

the 1980's). Sources are narrowed and selected based on an evaluation of the following criteria:

1) Subject relevance to one or more of the three topics areas,

2) Currency of literature (between 2000-2007),

3) Author knowledge and professional background (i.e., works by professors/experts given preference), and

4) Intended audience for the literature review.

References listed within papers are reviewed for additional topic leads. Searches are conducted at the following sites:

- Amazon.com (existing books & author names related to topic)
- Academic Premier Database
- ERIC (http://eric.ed.gov/) Database
- EServer Technical Communication Library (http://tc.eserver.org/)
- Google search engine for both Google Scholar and Internet sources
- Online journals (Educause, Innovate, Technology Source)
- University-affiliated Publications (Harvard Business Review and Wharton Knowledge Online)
- University of Oregon Library Portal

The variations of keywords used for searching include:

- Constructivist Learning, John Dewey, or Experiential Learning

- Educational, e-Learning, Instructional, Learning, or Performance Technology
- EPSS (Electronic Performance Support System)
- Learning Theories / Models

Literature residing in databases is generally selected from two main databases. Both databases have large repositories of academic materials related to learning, education, and training. These databases are:

- ***ERIC (Educational Resource Information Center).*** ERIC is sponsored by the U.S. Department of Education, and contains more than 1.2 million bibliographic records of journal articles and other education-related materials. Additionally, ERIC links to full text of the article if it is available (ERIC, n.d.).
- ***Academic Search Premier.*** Academic Search Premier contains more than 8,000 indexed journals in all academic disciplines, many of which are also peer reviewed. Over 4,500 records also include the literature's full text.

Source	Search Term	Criteria	Results
Academic Premier Search Database	"Constructivist Pedagogy"	Full Text Available 2000-2008	24 Listings. Selected Content: 1. Technology Education as Solo Activity or Socially Constructed Learning. By: J. Dakers.
Academic Premier Search Database	"EPSS"	Full Text Available 2000-2008	14 Listings. Selected Content: 1. Electronic Performance Support Systems and Technological Literacy by G. Maughan. 2. The Relationship Between the Performance and the Perceived Benefits of Using an EPSS by C.

Source	Search Term	Criteria	Results
			Chang.
Academic Premier Search Database	"Experiential Learning" and "Performance"	Full Text Available 2000-2008	52 Listings. Selected Content: none
Academic Premier Search Database	"Performance Technology"	Full Text Available 2000-2008	138 Listings. Selected Content: 1. Building a Competency-Based Curriculum Architecture to Educate 21st-Century Business Practitioners, by Seung et al.
Amazon	"Dewey, John"		9,613 Listings. Selected Content: 1. Education & Experience by J. Dewey.
ERIC Database	"Corporate" and "Instructional Design"	Full Text Available 2000-2008	17 Listings. Selected Content: 1. Online Learning Environments: A Report of an Instructional Design Case Event by M. Koh and R. Branch. 2. Valuing the Adult Learner in E-Learning: A Conceptual Model for Corporate Settings by C. Waight et al.
ERIC Database	"Corporate Training"	Full Text Available 2000-2008	134 Listings. Selected Content: 1. Linking Organizational Knowledge and Learning by B. Collis 2. Experience and Learning: Theorizing the Subjective Side of Work by H. Olesen.
ERIC Database	"Constructivist"	Full Text Available 2000-2008	315 Listings. Selected Content: 1. A New Model for the World of Instructional Design: A New Model by A. Isman et al. 2. An Interpretation of Dewey's Experiential Learning Theory by R. Grady. 3. Effects of Instructional Design on Learning by A. Isman et al. 4. Design Principles for the Information Architecture of a

Source	Search Term	Criteria	Results
			SMET Education Digital Library by A. Dong et al.
ERIC Database	"EPSS"	Full Text Available 2000-2008	9 Listings. Selected Content: 1. A Design & Development Model for Building Electronic Performance Support Systems by K Cagiltay. 2. Building Integrated EPSS by Seak-Zoon, R., Sungwook, H., and Byeong-Min, Y. 3. Scaffolding Performance in EPSSs: Bridging Theory and Practice by Hannafin et al.
ERIC Database	"Experiential"	Full Text Available 2000-2008	504 Listings. Selected Content: 1. Constructivist Instructional Design and Development of a Networked Skills (NICLS) Module for Continuing Professional Education Distance Learning by J. Nunes. 2. Experiential Learning: A Theoretical Critique from Five Perspectives by T. Fenwick. 3. Problem-Based Teachning and Learning in Technology Education by A. Putnam.
ERIC Database	"Human Performance"	Full Text Available 2000-2008	343 Listings. Selected Content:
ERIC Database	"Instructional Design Models"	Full Text Available 2000-2008	68 Listings. Selected Content: 1. Survey of Instructional Design Models by Gustafson and Branch
ERIC Database	"Performance Technology"	Full Text Available 2000-2008	32 Listings. Selected Content: 1. Online Learning Environments: A Report of an Instructional Design Case Event. A report by M. Koh & R. Branch.
ERIC Database	"Systems Training / Thinking" and	Full Text Available	2 Listings. Selected Content: none Systems Training / Thinking

Source	Search Term	Criteria	Results
	"Instructional Design"	2000-2008	keywords abandoned
ERIC Database	"Pedagogy" and "Learning Theory	Full Text Available 2000-2008	7 Listings. Selected Content: 1. Multimedia Learning Design Pedagogy: A Hybrid Learning Model by M. Tsoi et al. 2. Pedagogical Praxis: The Professions as Models for Learning in the Age of the Smart Machine by D. Shaffer.
Innovate Online Journal	"Experiential Learning"	Full Text Available 2000-2008	50+ Listings. Selected Content: 1. The Future of Learning Technologies - An Interview with Chris Dede by J. Morrison 2. Experiencing Knowledge. Technology and Pedagogy: Building Techno-Pedagogical Skills in Preservice by D. Norris, J. Mason, and P. Lefrere.

Figure 1: Search Results

Documentation Approach

When literature sources of interest are located, the related citations, keywords, abstracts, and URL's linking to the literature are recorded online using Connotea's web application (*Figure 2: Connotea Screen Capture* [www.connotea.org]). Personal notes record discoveries, topic connections, and varying viewpoints (Lester & Lester, 2005). Full citations and abstracts are exported to Word for final documentation.

Figure 2: Connotea Screen Capture

Evaluation Criteria

After literature has been initially selected as a possible source, the research report or journal is then scanned for relevancy and quality using the following criteria adopted from Leedy and Ormrod's (2005) evaluation checklist (p. 155):

1) ***Literature Currency.*** Literature is written after the year 2000 with the exception of original works by learning theorists.
2) ***Topic Relevancy.*** Topic presented offers clear information on EPSS in the workplace, Constructivist learning methods geared towards adults, or

insights into improving employee performance in the workplace. Table of contents is examined for topic direction and related pages visited.

3) ***Author Objectivity***. Author presents both sides of the issue.
4) ***Citations or References.*** Selected literature references the works of other field experts, demonstrated by footnotes, citations, or website URL's.
5) ***Origination of Literature.*** Literature originates from universities or other scholarly sources; works by professors and published field researchers is preferred over student work. Thought leaders who have authored books are also considered for inclusion. Primary sources presenting research for the first time are preferred over secondary sources.
6) ***Literature Length.*** Literature is perused for length to determine how thorough or detailed of an investigation is provided. Longer, relevant works are desirable if the work is adequately describing context and setting.
7) ***Literature Context.*** The literature addresses a similar setting or application that is relevant to the research problem (George Washington University, 2000). Works with topics that are deemed tangental are discarded.
8) ***Audience.*** Literature audience is limited to works addressing corporate trainers or instructional designers. Relevant literature addressing pre-college educators or learners will be discarded since the subject is limited to adult learners in the context of on-the-job training.

Writing Plan

Development of the Review of the Literature uses a thematic approach as noted by the University of North Carolina (n.d.). Arranging selected content by theme provides a format for categorizing, comparing, and making topic connections among writers who have authored works during different years examining similar business or learning problems (Rapple, 2005).

Content is divided into three initial themes: 1) Corporate Training, 2) Constructivist Pedagogy, and 3) EPSS. The stage is set by first presenting the reader with the foundational knowledge of corporate training. Next, Constructivism is introduced by way of definition, identifying experts, and explaining instructional design models. Lastly, EPSS and EPSS applications are explored with the intent of understanding its relationship with Constructivism. The goal is to understand why Constructivist pedagogy should be applied to the design of an effective corporate EPSS website.

Literature are arranged and examined using the following outline pattern:

1) ***Corporate training and the role of EPSS.*** Literature that fall into this theme address:
    a) E-learning (Collis, 2001; Stephenson, 2003)
    b) Motivation and Content
    c) Social context for learning (Dakers, 2005)
2) ***Constructivist Pedagogy.*** Selected literature reports on the following:
    a) What is Constructivism? (Dewy, 1938)
    b) Constructivist Instructional Design Model(s) (Fardanesh, 2006)

3) ***Electronic Performance Support Systems (EPSS).*** Selected literature address:

   a) What is EPSS? (Cagiltay, 2001; p. 434; Gery, 1989)

   b) Advantages of EPSS (Chang, 2004; p. 350)

   c) Limitations of EPSS

   d) EPSS Frameworks Dimensions

      i) Pedagogical structure (Fardanesh, 2006; p. 6)

      ii) Contextual Design Methodology

      iii) Information Design

      iv) Online Support

      v) Development considerations (Stephenson, 2003; p. 11)

      vi) EPSS Components

Review of the Literature Bibliography

This section presents 40 references selected as the basis for the Review of the Literature. Each selection is accompanied with an abstract summarizing the content for the reader (abstracts are excerpted from those published with the reference). The literature and related abstracts are organized by the themes established in the writing plan and grouped under at least one of the following topics: 1) Corporate Training (10 entries), 2) Constructivist pedagogy (20 entries), and 3) EPSS (10 entries).

Theme 1: Literature that Examines Corporate Training

Abdon, B., Ninomiya, S., and Raab, R. (2007, March 31). e-Learning in Higher| Education Makes Its Debut in Cambodia: Implications of the Provincial Business Education Project, *Review of Research in Open and Distance Learning* 8 (1).

Abstract: Developing countries face a number of challenges in their efforts to compete successfully in the new global economy. Perhaps the most critical resource needed to achieve these goals is trained human capital. While many developing countries are trying to address this need through traditional means, this may not be the most effective or efficient response. e-Learning has been suggested as an alternative approach that can overcome many of the challenges involved in reaching underserved students. But most educational institutions in developing countries are unfamiliar with e-Learning, have low levels of computer availability, access, familiarity and Internet penetration which leads to skepticism about the feasibility of this approach. In an effort to assess the potential of e-Learning in meeting the needs for developing human capital in Cambodia, this paper reports on the experience and achievements of the "Provincial Business Education through the Community Information Centers" (CICs) project. Key findings are that e-Learning was able to successfully deliver tertiary educational opportunities to underserved provincial students, Cambodian students were able to overcome serious challenges and that female Cambodian students demonstrated superior performance in online classes. These results suggest that e-Learning is an effective alternative for delivering tertiary education in Cambodia.

Bianco, M., and Collis, B. (2004). *Tools and Strategies for Engaging the Supervisor in Technology-Supported Work-Based Learning, Evaluation Research*. Online Submission, Paper presented at the Academy of Human Resource Development International Conference (AHRD) (Austin, TX, Mar 3-7, 2004) 505-512 (Symp. 24-3).

Abstract: This study reports the results of the formative evaluations of two computer-supported tools and the associated strategies for their use. Tools and strategies embedded in web-based courses can increase a supervisor's involvement in helping employees transfer learning onto the workplace. Issues relating to characteristics of the tools and strategies as well as factors influencing their likelihood of use are identified via summaries of the two evaluation studies.

Collis, B. (2001, June). *Linking Organizational Knowledge and Learning.* Retrieved on November 26, 2007 from ERIC database.

Abstract: Universities and corporate training centers are under pressure to offer increasingly flexible, as well as individually relevant, learning. Instead of trying to develop a stream of Web-based courses to run parallel to "business as usual" courses, a department can focus on gradually building a knowledge base in which key resources from individuals in the department or organization, from external sources, produced by learners, or re-used from previous courses can all be available for reuse in various combinations and in different views for different learning situations including learners in varying locations. With a focus that changes from "distributing content" to "building and (re)using resources," a new way of thinking about "courses" occurs. These processes require good technology; agreement on locally relevant standards; simple procedures for adding, finding, managing, and reusing resources; and a change in mindset for all those involved.

Holsapple, C., and Lee-Post, A. (2006, January). Defining, Assessing, and Promoting E-Learning Success: An Information Systems Perspective. *Decision Sciences Journal of Innovative Education*, 4 (1), 7-85.

Abstract: This research advances the understanding of how to define, evaluate, and promote e-learning success from an information systems perspective. It introduces the E-Learning Success Model, which posits that the overall success of an e-learning initiative depends on the attainment of success at each of the three stages of e-learning systems development: system design, system delivery, and system outcome.

Gustafson, K., and Branch, R. (2002). *Survey of Instructional Design Models*. Retrieved on November 5, 2007, from ERIC Database at: http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/802b/6e/12.pdf

Abstract: This text, now in its fourth edition, provides an understanding of the diversity and use of models used to portray the instructional development (ID) process, while reflecting the many changes in the field that have occurred since publication of the last edition in 1997. Beginning with the belief that an ID model should be selected based on the specific context of the project, a classification schema for ID models is presented that indicates whether a given model is best applied to: (1) developing individual classroom instruction; (2) products for implementation by users other than the developers; or (3) large and complex instructional systems directed at an organization's problems or goals. A schema that will help guide the way in which instructional development models are adopted or adapted is offered. The authors also present a brief history of ID models, explore numerous examples from each of the three categories in the schema, and discuss the latest trends in instructional development affecting the use of ID models.

Kim, M., and Hannafin, M. (2004). Designing Online Learning Environments to Support Scientific Inquiry. *Quarterly Review of Distance Education*, Spring2004, 5 (1), 1-10, 10p.

Abstract: The proliferation of online courses underscores the need to re-examine the foundations upon which courses are grounded. In particular, an emerging perspective in science education requires designers to account for scientific inquiry in student-centered science learning environments. With a focus on open-ended learning environments and grounded design perspectives, this paper examines emerging issues in science education and provides a framework and design principles to support scientific inquiry in online science courses.

Livingstone, D. (2001, January). *Adults' Informal Learning: Definitions, Findings, Gaps, and Future Research.* Retrieved on December 14, 2007 from ERIC database.

Abstract: This paper on adult informal learning is divided into four sections. Section 1 examines different conceptions of informal learning and the issues and limitations associated with alternative definitions of informal learning. Section 2 is a review of empirical research on the estimated extent, role, and outcomes of informal learning and posited linkages between informal and formal methods of learning. It reports that, according to the New Approaches to Lifelong Learning (NALL) 2000 national survey, over 95 percent of Canadian adults are involved in some form of informal learning activities that they identify as significant. Section 3 critically assesses current research approaches to studying informal learning and identifies policy-relevant knowledge gaps concerning the general level and nature of informal learning, distribution of informal learning across the adult population, impact of informal learning on individual and firm performance, and relationship

of informal learning to formal skills development. Section 4 recommends optimal approaches to future research on informal learning practices with a particular focus on survey research in Canada and finds it imperative to establish benchmarks of the general incidence, basic contents and modes, and any differential patterns of intentional informal learning and training, and to continue to track trends in relation to other dimensions of adult learning.

Moreno, R. (2006, April). Learning in High-Tech and Multimedia Environments. *Current Directions in Psychological Science* 15 (2), 63-67, 5p. Retrieved on October 30, 2007 from Academic Premier Search database.

Abstract: When do high-tech environments promote learning? The goal of this article is to offer one answer to this question by examining the classic distinction between media and method, in terms of their roles in promoting learning with technology. To this end, I first propose a cognitive theory of learning with media, from which a set of instructional design principles are derived. Then I review research in which the relative learning contributions of method and media are investigated, and I offer final reflections for future research.

Stephenson, J. (2003, April). *A Review of Research and Practice in E-Learning in the Work-Place and Proposals for Its Effective Use.* Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.

Abstract: Following an abstract and introduction, this document reviews five research projects on the learning experiences of workers. The first two concern the environment required for successful learning in the workplace, and the last three address implementation of e-learning programs. (The findings from the first two studies revealed 24 conditions that must be met for successful learning in the workplace, including linking learning to improved performance, valuing collaborations in learning, and management awareness of the need for learning. Conditions for successful e-learning revealed by the last three studies included the relevance of training to the current job, user ownership and control of the process, a culture of support by the training provider and employer, and personal recognition for learning achieved.)

Waight, C., and Stewart, B. (2005, February).*Valuing the Adult Learner in E-Learning: A Conceptual Model for Corporate Settings.* Online Submission, Paper presented at the Academy of Human Resource Development International Conference (AHRD) (Estes Park, CO, Feb 24-27, 2005) 1118-1123 (Symp. 48-3).

Abstract: The framework describes that e-Learning engagement, learning and transfer within corporate settings can possibly be achieved if antecedents such as needs assessment, learner analysis, for example, and moderators such as return on investment, learning theories, for example, are adhered. The realization of antecedents and moderators, however, are dependent on championing factors such as leadership, learning culture, technology infrastructure and finance.

Theme 2: Literature that Describes Constructivist Pedagogy

Altun, S., and Büyükduman, F. (2007, January). Teacher and Student Beliefs on Constructivist Instructional Design: A Case Study. *Educational Sciences: Theory & Practice*, Jan2007, 7 (1), 30-39, 10p.

Abstract: The main purpose of this research is to evaluate the effects of a constructivist instructional design on a group of students and their teacher. The sample consisted of 26 students and one teacher. The research was conducted at Istanbul Technical University, School of Foreign Languages, English Preparatory Program. The instructional design based on the constructivist learning principles that is developed by the teachers together with the class teacher was applied to the sample group. The data were gathered using quantitative data collection techniques, analyzed and interpreted. The findings emphasize that, in general, constructivist instructional design has a positive effect both on the students and the teacher. On the other hand, because most schools in Turkey have an exam-oriented system, constructivist ins tructional design does not appeal to some students.

Brandon, B. (2004, June). *Applying Instructional Systems Processes to Constructivist Learning Environments*. Retrieved on January 15, 2007 from the E-Learning Guild.

Abstract: If you've spent years learning to use Instructional Systems Design processes to create e-Learning, the slight anarchy inherent in constructivist design may leave you feeling a little dizzy. Before you decide that constructivism has nothing to offer your organization, read this article to get a more complete perspective on the techniques and the resources available. You'll be glad you did!

Chyung, Y., Stepich, D. Cox, D. (2006, July/August). Building a Competency-Based Curriculum Architecture to Educate 21st-Century Business Practitioners. *Journal of Education for Business*, Jul/Aug2006, 81 (6), 307-314, 8p; (*AN 22079522*). Retrieved on November 12, 2007 from Academic Premier Search Database.

Abstract: Competency-based instruction can be applied to a military setting, an academic program, or a corporate environment with a focus on producing *performance*-based learning outcomes. In this article, the authors provide theoretical and practical information about underlying characteristics of competencies and explain how the Department of Instructional & *Performance Technology* at Boise State University developed a set of competencies and has been modifying its curriculum on the basis of these competencies. The department's curriculum architecture flowchart illustrates the process of developing and applying competencies to curriculum design for producing

performance-based learning outcomes. Detailed steps taken in developing a competency-based course are described.

Dakers, J., (2005, March). Technology Education as Solo Activity or Socially Constructed Learning. *International Journal of Technology & Design Education*, Mar2005, 15 (1), 73-89, 17p; DOI: 10.1007/s10798-004-6196-1; (*AN 16312001*). Retrieved on November 12, 2007, from Academic Search Premier Database.

Abstract: This paper will investigate how factors relating to these two contributions affect the delivery of technological education. It will begin by discussing the derivation of the word 'technology' and how its modern incarnation has become not only amorphous, but confusing for technology education, in that the term can be taken to mean production on the one hand or process on the other. It will then explore technology teachers' perceptions (and misperceptions) of what constitutes technology education, and discuss why this can lead to confusion. It will further consider how this can affect the ***pedagogy*** adopted. It will then examine two pedagogical frameworks which result from teachers' perceptions of technology education as either; a process of internalization of technological skills and functions as representations exclusively within the mind and unique to the individual, thus solo, or; a process of technological skills and functions embedded in socio-cultural activity in which cognition is distributed across the internal mind and the external environment. Finally, the paper will offer a framework for the delivery of technology education set within a 'community of learners' paradigm.

Dewey, J. (1938). *Experience and Education*. New York: Kappa Delta Pi, p. 82.
Abstract: Analyzing both "traditional" and "progressive" education, Dr. Dewey here insists that neither the old nor the new education is adequate and that each is miseducative because neither of them applies the principles of a carefully developed philosophy of experience. Many pages of this volume illustrate Dr. Dewey's ideas for a philosophy of experience and its relation to education. He particularly urges that all teachers and educators looking for a new movement in education should think in terms of the deep and larger issues of education rather than in terms of some divisive "ism" about education, even such an "ism" as "progressivism."

Dickinson, G. (2006, December). The Spirit of Inquiry in Information Literacy. *Teacher Librarian*, Dec2006, 34 (2), 23-27, 5p.

Abstract: The article relates the American Association of School Librarians Information Literacy Standards with John Dewey's writings on thinking and learning. Dewey's writings can be a theoretical base for the study of information skills. Collaborative teaching of integrated information skills aligns precisely with Dewey's writings.

Fardanesh, H. (2006, May).A Classification of Constructivist Instructional Design Models Based on Learning and Teaching Approaches. Retrieved on November13, 2007 from ERIC database.

Abstract: In a conceptual-analytical study using a deductive classificatory content analysis method ten constructivist instructional design models were selected, and learning/teaching approaches within each model were appraised. Using the original writings of the originators of each design model, the learning and teaching approaches employed or permitted to be used it each model were classified as: (1) individual; (2) group; and (3) dual-purpose approaches. A six-category classification of constructive instructional design models was achieved. Findings show that none of the models has both dual-purpose teaching/learning approaches, and in teaching and learning approaches, most of the models fall in the "individual" category, and only few models fall in the "group" category with regard to teaching and learning approaches.

Fenwich, T. (2001). *Experiential Learning: A Theoretical Critique from Five Perspectives.* Retrieved December 3, 2007 from ERIC database, http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=D454418

Abstract: This monograph presents an overview of experiential learning from five perspectives. Following a history of experiential learning in 20th century adult education, the essay first offers a summary of the reflective constructivist view of experiential learning. The constructivist approach is taken by educators seeking to enhance the process of adult learners' reflections on experience, by instigating holistic experiences in instructional settings, by coaching and mentoring adults to enhance their learning in the midst of experience, and by assessing adults' experience. For each of these five orientations to experiential learning, influential theories and models are presented, followed by a critique of the orientation from other perspectives.

Fox, R. (2001, March). Constructivism Examined. *Oxford Review of Education*, Mar2001, 27 (1), 23-35, 13p.

Abstract: In this paper I examine *constructivism* as a view of learning which has come to dominate educational debates about learning in the field of teacher education. The major claims of a variety of constructivist theories are considered and found to be largely wanting, in that they either differ little from common sense empiricist views, or else provide misleading and incomplete views of human learning, with consequently misleading implications for teaching in classrooms.

Grady, R. (2003, August). An Interpretation of Dewey's Experiential Learning Theory. Retrieved on November 5, 2007 from ERIC database, http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/801b/82/92.pdf.

Abstract: "Experience and Education" (John Dewey, 1938) serves as a foundation piece of literature when discussing experiential learning. To facilitate a better understanding, a conceptual model was developed. In John Dewey's experiential learning theory, everything occurs within a social environment. Knowledge is socially constructed and based on experiences. This knowledge should be organized in real-life experiences that provide a context for the information. The teacher's role is to organize this content and to facilitate the actual experiences. The experiences are based on the capabilities and readiness of the learners. The quality of the experience is the primary component of the theory. Upon completion of the experience, learners have the knowledge and ability to apply it to differing situations. Thus, they have created new knowledge and are at a different level of readiness for continued acquisition and construction of new knowledge.

Isman, A., Caglar, M., Dabai, F., and Ersozlu, H. (July, 2005). A New Model for the World of Instructional Design: A New Model. Online Submission, *Turkish Online Journal of Educational Technology--TOJET* , 4 (3).

Abstract: Like all models, the new model is also based on a theoretical foundation; constructivism, which emphasis is placed on the learner or the student rather than the teacher or the instructor. Students learn by fitting new information together with what they already know. People learn best when they actively construct their own understanding. The new constructivist based model is composed of four processes; input, process, output, and feedback. In constructivist approach experiencing is important, so the teacher should create authentic environment in order to let the students to experience it. If something is practiced, then it means it has a meaning for the learners.

Juniu, S. (2006). Use of Technology for Constructivist Learning in a Performance Assessment Class. *Measurement in Physical Education & Exercise Science,* 2006, 10 (1), 67-79, 13p, 2 charts; DOI: 10.1207/s15327841mpee1001_5.

Abstract: The use of educational technologies in teaching and learning presents pedagogical concerns and challenges to educators. Combining multimedia technologies with the Web has created new possibilities for the development of instructional materials to deliver course content. However, this use of technology continues to represent traditional conceptions regarding the use of computers. The question remains as to when and how to use various forms of educational technology and how to best integrate them into the classroom. Disciplines such as measurement and evaluation are not free from these challenges, especially when instructors are looking for ways to improve learning of statistical concepts that are

hard to retain. Using educational technology as a constructivist tool could aid students to represent their ideas, articulate what they know, and explore, manipulate, and process information, while actively collaborating with each other (Jonassen, Peck, & Wilson, 1999). The purpose of this article is to describe constructivist uses of technology and to present a curriculum unit for a performance assessment class in health and physical education, which is presented as an example of a project-based learning activity that exemplifies a constructivist use of software to support problem solving.

Kirkley, S., and Kirkley, J. (2005, May / June). Creating Next Generation Blended Learning Environments Using Mixed Reality, Video Games and Simulations. *TechTrends: Linking Research & Practice to Improve Learning*, May/Jun2005, 49 (3), 42-89, 13p.

Abstract: The goal of this article has been to discuss next generation learning environments and next generation training technologies as well as the learning and design challenges faced in using these. Specifically, we discuss theoretical and design principles of constructivist learning environments and how advanced technologies can potentially support meeting these principles as well as the challenges they may pose to various types of designers, instructional, game, graphic and programming. To address methods for designing complex environments, we also address the use of methodologies and authoring systems with various tools to support the design process. In this context, to illstrate how tools can be used to help instructional design teams manage the complexities of developing for these environments. As an example, we discuss one tool, IIPI CREATE, that supports this process and organizes the develoment pocess.

Kirschner, P.,Sweller, J., and Clark, R. (2006). Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist**,** Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching. *Educational Psychologist*, Spring2006, 41 (2), 75-86, 12p.

Abstract: Evidence for the superiority of guided instruction is explained in the context of our knowledge of human cognitive architecture, expert–novice differences, and cognitive load. Although unguided or minimally guided *instructional* approaches are very popular and intuitively appealing, the point is made that these approaches ignore both the structures that constitute human cognitive architecture and evidence from empirical studies over the past half-century that consistently indicate that minimally guided instruction is less effective and less efficient than *instructional* approaches that place a strong emphasis on guidance of the student learning process. The advantage of guidance begins to recede only when learners have sufficiently high prior knowledge to provide "internal" guidance. Recent developments in *instructional* research and *instructional design* models that support guidance during instruction are briefly described.

Koh, M., and Branch, R. (2004, October). Online Learning Environments:A Report of an Instructional Design Case Event. *Association for Educational Communications and Technology*, 27th, Chicago, IL, October 19-23, 2004. Retrieved on November 12, 2007 from ERIC database: http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/000001b/80/1b/a8/53.pdf

Abstract: This is a discussion about the role of a case or authentic scenario in an online learning environment. Using authentic cases for intentional learning promotes effective, cognitive, and affective transfer between learning space and performance space. Creating an online case event provides an opportunity for learning design professionals to use instructional systems design in an authentic, teamoriented, web-based learning environment. A case approach aids the Instructional Systems Design (ISD) learning process and helps to facilitate further research of online learning environments. Case studies have been an effective tool for developing professional knowledge across disciplines, however, case events dedicated to the study and practice of instructional design is limited among learning services professionals. The purpose of this discussion is to offer educational benefits about learning and practicing instructional design within an online learning environment.

Norris, D., Mason, J. and P. Lefrere. (2004). Experiencing Knowledge. Technology and Pedagogy: Building Techno-Pedagogical Skills in Preservice Teachers. Innovate: *The Journal of Online Education.* V1, #1. Retrieved on November 4, 2007, from: http://innovateonline.info/index.php?view=article&id=5

Abstract: In this article, Donald Norris, Jon Mason, and Paul Lefrere propose that the future of education in the "Knowledge Age" will entail not only a change in the technical means through which we access knowledge, but also a more substantive transformation in the way we experience knowledge. Fundamental to this transformation is a blurring of physical boundaries through which learning is separated from other aspects of daily life; a greater capacity to multitask, manage, and synthesize multiple threads of information; and much more convenient, timely access to experts and authorities in the learning process. In assessing the prospect of such transformation, the authors consider the obstacles that currently face scholars and professionals as well as the critical role of "pervasive" or "ubiquitous" computing environments as precedents for the future.

Nunes, J. (2001, June). Constructivist Instructional Design and Development of a Networked Learning Skills (NICLS) Modue for Continuing Professional Education Distance Learning. ED-MEDIA 2001 World Conference on Educational Multimedia, Hypermedia & Telecommunications. Retrieved on December 3, 2007 from ERIC database: http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED466132

Abstract: This paper proposes an instructional systems design (ISD) approach for the design and development of a basic Networked Information and Communication Literacy Skills (NICLS) module. It concentrates on the design and development of a NICLS core skills pre-module for the Master of Arts in Information Technology Management (MA ITM) program at the University of Sheffield (United Kingdom). The course is entirely a distance learning program and course participants are professionals in the Information Technology (IT) sector. The need for such courses as pre-modules for online distance education programs for professional adults is presented and discussed. Furthermore, and as a part of the design process, the paper discusses and defines information and communication literacy and its main aspects. The curriculum is designed using an experiential learning approach and the resulting Web-based educational approach is presented and described.

Olesen, H. (2000). *Experience and Learning: Theorizing the Subjective Side of Work.* Retrieved on November 26, 2007 from ERIC database.

Abstract: This document argues that the new reality of work, which reintegrates learning and learning potential in a qualitative change of the work process itself, has made it necessary to theorize the subjective side of work and study and understand learning within a comprehensive context of the subjective experience. The following are among the specific topics considered: (1) changes in work and human resources (including the post-Fordist turn of the industrialized countries, the extremely rapid transformation of skill needs, new criteria of social inclusion, and the new human resource development agenda); (2) the subjective importance of work; (3) the concept of identity; (4) the basic theoretical problem of linking the two independent dynamics of social history and life history; (5) recent efforts to develop a conceptual model of competence; (6) recent explorations of the concept of identity; (7) contradiction and ambivalence; (8) experience and learning; and (9) learning and culture and the concept of collective learning. Collective learning is differentiated from organizational learning. It is concluded that new work identities will likely include expectations for learning and experience in work processes and that work will likely be included in a more reflexive shaping of life in general.

Putnam, A. (2001, December). Problem-Based Teaching and Learning in Technology Education. Presented at the Annual Conference of the Association for Career and Technical Education (75th, New Orleans, LA, December 13-16, 2001). Retrieved on December 3, 2007 from Eric database: http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/10/c4.pdf

Abstract: Research on how the brain works has resulted in wider-scale adoption of the principles of problem-based learning (PBL) in many areas of education, including technology education. The PBL approach is attractive to curriculum developers because it is based on interdisciplinary learning, results in multiple outcomes, is integrated and competency-based, and emphasizes metacognitive or higher-order skills and real-life perspectives. A model of PBL has been proposed that includes a nine-step self-directed procedure for approaching a problem, a resource critique, reassessment of the problem, summary and integration of what has been learned, and evaluation. PBL can be used in areas of technology education such as communication, manufacturing, transportation, and construction.

Tsoi, M., and Khang, N. (2005, September).Multimedia Learning Design Pedagogy: A Hybrid Learning Model. US-China Education Review, 2 (9), 59-62. Retrieved on October 28, 2007 from ERIC database.

Abstract: This paper provides insights on a hybrid learning model for multimedia learning design conceptualized from the Piagetian science learning cycle model and the Kolb's experiential learning model. This model represents learning as a cognitive process in a cycle of four phases, namely, Translating, Sculpting, Operationalizing, and Integrating and is intended to address both concept learning and learning style inclinations. Pedagogical principles of the model are applied to develop an e-learning product for multimedia learning in chemical education in a postgraduate teacher-training program using the Mole, an abstract and complex concept as an example. Instructional storyboarding is provided to illustrate some of the processes elicited, for example, thinking skills and self-questioning. The science of instruction in multimedia learning design principles, for example, principles of contiguity, modality, redundancy, personalization and coherence, is also discussed.

Theme 3: Literature that Describes EPSS Support Structures

Cagiltay, K. (2001, November). *A Design and Development Model for Building Electronic Performance Support Systems*. Annual Proceedings of Selected Research and Development [and] Practice Papers Presented at the National Convention of the Association for Educational Communications and Technology (24th, Atlanta, GA, November 8-12, 2001). Volumes 1-2. Retrieved on November 4, 2007 from ERIC Database at: http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/87/c9.pdf

Abstract: This proposed study is to investigate the design and development process of electronic performance support systems (EPSSs). The primary purpose of this study is to help the EPSS designers by proposing a more effective and productive EPSS design and developmental model. By analyzing EPSS products and observing EPSS design projects, the research will propose a design model for future EPSS designers. Discussion includes what makes EPSS different; the need for an EPSS design/development approach; current approaches to EPSS design/development and their problems; help from other fields; information systems design and EPSS; and Chaos theory (dynamic systems or adaptive development). The paper concludes that EPSS development is at the edge of technology, and it requires a mixture of Chaos-based top-down and bottom-up processes.

Chang, C. (2004).The relationship between the performance and the perceived benefits of using an electronic performance support system (EPSS). *Innovations in Education & Teaching Internationa*l, 41 (3), 343-363, 22p (2004). Retrieved on October 29, 2007 from Academic Search Premier database.

Abstract: Survey instrument developed to measure the perceived performance of the six components of an electronic performance support system (EPSS) and the perceived benefits of EPSS use was mailed to 182 target EPSS co-ordinators. A total of 98 (54.0%) questionnaires were returned. Of these, there were 79 (80.6%) usable surveys. Research results indicate that all six components of an EPSS were perceived to be effective by survey respondents during their use of EPSS. The user interface and online help/reference components were perceived as the most effective components, but they were not the components that made the greatest contribution to the perceived overall benefit of EPSS use. The highest relative contributors to the perceived overall benefit of EPSS use were the data/information base and an advisory system of job-oriented or problem-solving components. However, these two components were not perceived to be the most effective ones. This result also reveals that the perceived level of performance of the components of an EPSS was not absolutely reflected in the perceived level of overall benefit associated with EPSS use.

Ge, X., and Er, N. (2005, December) . An online support system to scaffold real-world problem solving. *Interactive Learning Environments*, Dec2005, 13 (3),139-157, 19p.

Abstract: The article presents a reusable online support system, in which an open-ended learning environment is created to scaffold complex, real-world problem solving activities. The major learning components of the system are specifically described, and the internal interactions between different components within the system and the external interactions among the system, learners (who also interact with one another among themselves), instructors, and administrators are demonstrated. The learning theories and the assumptions underpinning the system design framework are discussed in terms of each of the system components: case library with real-world cases, question prompts, peer review, expert modelling, and self-reflection mechanisms. In conclusion, initial findings about the support system are shared, and issues regarding reusability, adaptivity, and generativity of the system are addressed focusing on developing novice learners' problem solving skills in various domains and contexts. The article proposes a cognitive model for contextualizing learning scenarios to support real-world problem solving, which has implications for designing e-learning.

Hannafin, M., Hill, J., and MacCarthy, J. (2000). Designing Resource-Based Learning and Performance Support Systems. *In D. A. Wiley (Ed.). The Instructional Use of Learning Objects*: Online Version. Retrieved November 5, 2007 from: http://www.reusability.org/read/chapters/hannafin.doc

Abstract: Two promising developments have emerged: 1) Electronic Performance Support Systems (EPSS) design technology; and 2) resource-based approaches to media production and access. Using knowledge object technology, multimedia resources can be tagged and re-used to support a wide range of education and training (as well as workplace) needs. EPSS technology has likewise emerged to address a range of both performance and learning demands. The link between these developments, however, is relatively new. The purposes of this chapter are to frame the learning-performance issues associated with EPSS use, to introduce EPSS design and implementation issues, to describe the relevance of resource-based approaches to EPSS design, and to present an EPSS project involving the application of knowledge object/resource-based approaches.

Hannafin, M., and et al. (2001). Scaffolding Performance in EPSSs: Bridging Theory and Practice. ED-MEDIA 2001 World Conference on Educational Multimedia, *Hypermedia & Telecommunications*. Proceedings (13th, Tampere, Finland, June 25-30, 2001). Retrieved on November 11, 2007 from ERIC database: http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/000001b/80/1a/2b/ab.pdf

Abstract: Electronic performance support systems (EPSS) help users accomplish tasks, using computational technologies. Scaffolding is the process through which efforts are supported while engaging a learning or performance task. A number of different types of scaffolds are possible, including conceptual, metacognitive, procedural, and strategic. Each of these types of scaffolding is defined in this paper, and a case study involving the application of different scaffolding approaches is presented.

Maughan, G. (2005, Winter). Electronic Performance Support Systems and Technological Literacy. *Journal of Technology Studies*, 31 (1), 49-56, 8p. Retrieved on October 29, 2007 from Academic Search Premier database.

Abstract: Electronic performance support systems (EPSS) can provide alternative learning opportunities to supplement traditional classroom or training strategies. Today's students may benefit from educational settings and strategies that they will use in the future. In using EPSS to nurture the development of technological literacy, workers and students can achieve higher level cognition skills while they perform tasks. Although there are unique challenges to the development and use of EPSS, efforts to overcome these challenges are becoming more widespread.

Retalis, S., Georgiakakis, P., and Dimitriadis, Y. (2006, June). Eliciting design patterns for e-learning systems. *Computer Science Education*, Jun2006, 16 (2), 105-118, 14p.

Abstract: Design pattern creation, especially in the e-learning domain, is a highly complex process that has not been sufficiently studied and formalized. In this paper, we propose a systematic pattern development cycle, whose most important aspects focus on reverse engineering of existing systems in order to elicit features that are cross-validated through the use of appropriate, authentic scenarios. However, an iterative pattern process is proposed that takes advantage of multiple data sources, thus emphasizing a holistic view of the teaching – learning processes. The proposed schema of pattern mining has been extensively validated for Asynchronous Network Supported Collaborative Learning (ANSCL) systems, as well as for other types of tools in a variety of scenarios, with promising results.

Seak-Zoon, R., Sungwook, H., and Byeong-Min, Y., (2001, November). Strategies for Building Integrated EPSS. Annual Proceedings of Selected Research and Development [and] Practice Papers. Presented at the *National Convention of the Association for Educational Communications and Technology* (24th, Atlanta, GA, November 8-12, 2001). Volumes 1-2. Retrieved on November 11, 2007 from ERIC database: http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/87/f3.pdf

Abstract: Because the complex link and node structure awaiting users can lead them into becoming lost in hyperspace and cause them cognitive overload, navigating the hypertext system is often not an easy task, especially for novices. They may have difficulty perceiving a structure of an entire system, locating specific information, or using a navigational aid. This phenomenon can be expected to occur even more in the highly structured electronic performance support system (EPSS). Content providers and designers of Web-based integrated EPSS should know how to design interfaces and information structures based on content and purpose. This study analyzed four interface design methods (simple selection menu style, menu with global navigation, menu with global and local navigation, and pull-down menu) and four information structures (linear structure, grid, hierarchy, and network) in terms of the complexity, flexibility, navigation, domain knowledge, and cognitive load. Based on this analysis, guidelines for building the integrated Web-based EPSS effectively are provided.

Singer, S., and Edmondson, A. (2006, November). *When Learning and Performance are at Odds: Confronting the Tension.* Harvard University. Retrieved on November 4, 2007, from: http://hbswk.hbs.edu/item/5571.html

Abstract: This chapter explores complexities of the relationship between learning and performance. We start with the general proposition that learning promotes performance, and then describe several challenges for researchers and managers who wish to study or promote learning in support of performance improvement. We also review psychological and interpersonal risks of learning behavior, suggest conditions under which exploratory learning and experimentation is most critical, and describe conditions and leader behaviors conducive to supporting this kind of learning in organizations. We illustrate our ideas with examples from field studies across numerous industry contexts, and conclude with a discussion of implications of this complex relationship for performance management.

Smith, R. (2007). *Professional Development Framework for e-Learning: A guide for Advisors and Practitioners*. London, United Kindom: Learning and Skills Network. Retrieved on December 20, 2007 from ERIC database.

Abstract: In January 2006 the Learning and Skills Development Agency (LSDA) launched its draft publication, "A Professional Development Framework for e-Learning" (ePD) for consultation with the post-16 education and training sector. In March 2006 the Learning and Skills Council funded the Learning and Skills

Network (LSN) to run a pilot to implement the concepts and functional roles described within the framework, which was completed by April 2007. This publication shares the experiences of staff and their good practice as they used the framework as part of their continuing professional development in e-learning, eCPD. This publication is designed to give advisers and practitioners ideas and guidance on using eCPD to develop their e-learning skills and pedagogy through CPD either at the organizational or individual level. The guide introduces the national context in which the framework has been developed and outlines the different ways topics within the framework could provide enhancement for different types of user. It then explains the six-step process that underpins all competence development, before illustrating pathways through the framework with examples drawn from the ePD pilot projects.

Review of the Literature

The purpose of this inquiry is to understand why Constructivist pedagogy should be applied to the design of an effective corporate EPSS website. In order to reach this goal, this inquiry draws from selected literature published from 2000-2007 that examines the following areas: 1) on-the-job (also known as corporate) training, including the role of EPSS systems, 2) principles of a Constructivist Learning Theory, and 3) the types of EPSS support structures and potential alignment to Constructivist pedagogy, within an EPSS framework.

Corporate training and the role of EPSS

The adoption and improvement of information technology has shifted workforce training (also known as corporate training) from classroom settings to decentralized mechanisms over the last decade (Cagiltay, 2001; p. 433). One of the training mechanisms least documented is Electronic Performance Support Systems, a term first coined by Gery (1989) in the early 1980's. Even with little or no documentation, some form of EPSS is operational today within most large corporate intranets under the guise of online help, tutorials, demos, or simulations (Hannafin, 2001).

E-learning

E-Learning is the use of networked technologies for the creation, delivery, and facilitation of learning, "anytime and anywhere"(Abdon, Ninomiya, and Raab, 2007; p. 2). Stephenson's (2003) review of key findings of e-learning reports and practices reveals that the availability of e-learning continues to increase as corporations move towards

maximizing training dollars and company time. Stephenson (2003) concludes corporate e-learning events that are most useful for learners include:

- Content that is supported in-house,
- Learning experiences that are personalized,
- The option to successfully withdrawal or exit as determined by learner,
- A flexible pace and duration, and
- Consideration of "participants' unexpected pressures on time and resources" (p. 5)

Motivation and Content

Collis (2001) notes corporate training relevance is usually easy to establish since all employees face real workplace problems and issues. Waight & Stewart (2005) comment that the likelihood of knowledge transfer increases when e-learning content mimics the elements found in the work environment. Involving multiple individuals from the business helps identify workplace problems, training solutions, the target audience, and tie individual performance to business strategy (Waight & Stewart, 2005).

Livingstone (2001) summarizes findings that report most workplace training focuses on keeping employees current on new general career knowledge (71%), learning new job tasks (63%), improving problem solving or communication skills (63%), computer skill training (61%), health and safety training (55%), and training on new technologies (52%) (p. 11).

Social Context for Learning

Dakers (2005) states that learning is shaped by the environment and the social meaning associated during the learning experience. While learning can be either a solo or social activity, the very act of learning is always determined by social and cultural factors, including family, economics, and peers (Dakers, 2005). Olesen (2000) comments that while many learners may participate in the same learning event, that learning event may have an entirely different meaning for each individual, therefore rendering some learning aspects as "unforeseeable and not easily controlled" (p. 27). Fardanesh (2006) confirms this by citing that "Groups don't learn, individuals learn. Learners may be part of a group while learning, learners may learn from one another, and the social context of a learning environment may provide support for its members; nevertheless the change in cognitive structure and the acquisition of knowledge and skill is an individual event" (p. 8).

Constructivist Pedagogy

What is Constructivism?

Constructivism is one many methodologies for describing how individuals learn. Fenwick (2001) defines Constructivism as the dominant approach for understanding adult experiential learning where an individual's learning is said to originate from a learner's cognitive reflection of his or her concrete experiences (p. 7). "Constructivists believe that learning is an active process of constructing, rather than acquiring, knowledge and that the goal of instruction is to support that construction rather than trying to transmit knowledge" (Aytekin, Dehmet, Fahme, & Hatice, 2005; p. 3). Brandon (2004) restates

this by noting that "a substantial part of constructivist practice has to do with helping people learn how to learn, including how to test, verify, and validate new knowledge and skills and so to increase their own autonomy" (p. 2).

The philosophy of Constructivism can be traced back to the late 1930's to John Dewey, a professor long considered a prominent figure in the field of education (Dewey, 1938). His position on experiential learning as interpreted by Dickinson (2006) "did not mean that every random learning activity that could be devised constituted a valid experience. He [Dewey] listed conditions for projects. First, they must induce student interest, which, he noted, was more than temporary excitement. Projects must be worthwhile, more than just a fun activity, and they should lead into unknown areas. Finally, they must involve enough time so that the thinking process has time to unfold" (Dickinson, 2006; p. 23; Dewey, 1938). The attributes that define constructivist views of learning today are summarized by Fox (2001) as:

1) The learner actively engages in the learning process.
2) Knowledge is constructed through experience and reflection.
3) Knowledge is created by the learner. It *is not* discovered.
4) Knowledge is personalized and unique to the individual.
5) Knowledge is socially constructed.
6) Learning is a way of "making sense of the world."
7) Learning requires meaningful, open-ended problems that are contextually situated and require the learner to find a solution in order to be effective (p. 24).

Constructivist Instructional Design Model(s)

Constructivist instructional design models seek to "help people develop transferable skills during initial learning events and to remind and help learners in unfamiliar situations to adapt and apply concepts with which they are already familiar" (Fenwick, 2001; p. 38). Towards this end, Aytekin et al. (2005) presents a four stage Constructivist instructional design model with the following stages:

1) Input Stage – Learners' needs are assessed and learning strategy is developed according to the learners' needs. Supporting materials are then developed based on this information to support the learning goals.

2) Process Stage – Learners' undergo a pre-assessment to determine learner readiness, skill level, and effectiveness of material. Based on initial results or feedback, materials may be revised, restructured, or reformatted to better suite the learner.

3) Output Stage – The learning is deployed. Learners' may be facilitated through the instructional materials. Evaluations may also be part of the learning environment and are applied at this stage.

4) Feedback Stage – Feedback and evaluations are reviewed and a used to determine whether the instructional design resulted in the desired learning or improved job performance. If changes are required, the instructional design developed at the Input Stage is revisited and adjusted (Aytekin et al., 2005).

A report by Fardanesh (2006) further expands the Constructivist instructional design model with ten possible teaching and learning approaches. These include participatory events, anchored instruction, cognitive apprenticeship, generative learning, computer supported learning environments, discovery learning, interpretive learning,

mind tools, problem-based learning, and project-based learning (p. 12). Tsoi, Goh, and Chia (2005) conclude EPSS developers must first identify the concept attributes that are essential for crafting the learner experience and mastery of the content and that enable desired learning styles (p. 4). Explanations of the teaching and learning approaches identified by Fardanesh (2006) are:

1) Participatory Events – A group-based collaboration project designed to teach a specific concept(s).
2) Anchored Instruction – The learner solves a problem based in a real-world situation.
3) Cognitive Apprenticeship – The thinking process used by experts is mimicked by the learner.
4) Generative Learning – Learning activities that are structure to require deep levels of mental processing.
5) Computer Supported Learning Environments – Learner learns knowledge through participating in knowledge communities.
6) Discovery Learning – Learner develops problem-solving skills by through personal inquiry and discovery (trial-and-error method).
7) Interpretive Learning – Group-based inquiry where the learner encounters group issues and constructs an interpretation.
8) Mind Tools – Software tools that enable a learner to process information differently (e.g. databases, multimedia resources, spreadsheets, etc.).

9) Problem-based Learning – A learner participates in solving a given problem drawing from previous knowledge, either in a group or individually.
10) Project-based Learning – Group-based participation on project-based activities (pp. 9-11).

Electronic Performance Support Systems

What is an EPSS?

Cagiltay (2001) cites both Gery (1989) and Brown (1996) who collectively define "an EPSS as a self-contained, online system which is designed to integrate a knowledge base, expert advice, learning experiences, and guidance with the goal of providing individuals with the ability to perform at a higher level in the workplace and requires minimal support and intervention by others" (p. 434). The primary purpose of an EPSS is to support learners while they are doing their actual job (Cagiltay, 2001, p. 433).

"Facilitating the learner's demand for information, when and in what form the learner prefers, is an important function of EPSS…. EPSS engages the learner by providing highly relevant information while tasks are performed." (Maughan, 2001; p. 53). "The task for developers of EPSS is to envision multiple access points within the process during which task support is offered – some at very basic levels, continuing in hierarchical fashion to very advanced levels of entry skills, knowledge and ability. In many cases this is not merely an investigation into a linear continuum of difficulty, but often requires the integration of related attributes and concepts fundamental to achieve success (Maughan, 2001; p. 54).

Advantages of EPSS.

In the larger context of the competitive business world, it is believed that the "continuous learning can bring competitive advantage in a changing world" (Brandon, 2004; p. 3). In an EPSS performance survey given to 79 EPSS coordinators, Chang (2004) reports twelve perceived EPSS benefits that ranked highest among EPSS professionals:

- Decreases information overload and paper documentation,
- Reduces training time,
- Increases productivity,
- Improves job performance,
- Enhances employee empowerment,
- Decreases training costs,
- Improves individual competence,
- Improves customer satisfaction,
- Decreases support costs (e.g. Service Desk),
- Positively changes employee's work,
- Enhances knowledge transfer and learning retention, and
- Institutionalizes best practices (p. 357).

Chang (2004) also indicates an EPSS implementation can reduce over-the shoulder coaching by nearly 80% and training time by 50%.

Limitations of EPSS.

In research conducted by Kirschner, Sweller, and Clark (2006), the results repeatedly suggest that within an EPSS environment, beginners to intermediate learners

require more "direct, strong instructional guidance rather than constructivist-based minimal guidance", which may not be included in the design of an EPSS site. Kirschner, Sweller, and Clark (2006) state:

> Even for students with considerable prior knowledge, strong guidance while learning is most often found to be equally effective as unguided approaches. Not only is unguided instruction normally less effective; there is also evidence that it may have negative results when students acquire misconceptions or incomplete or disorganized knowledge (pp. 83-84).

EPSS Framework Dimensions

Meaningful learning environments are dependant on the presence of numerous systemic and interdependent factors. EPSS designers who understand these systemic factors will produce "meaningful….learning environments" (Khan, 2000; p. 2).

Pedagogical structure.

When selecting content for the EPSS, Nunes (2001) remarks that the learning materials should contain activities that "are situated in real world contexts, are authentic, and provide multiple perspectives on the subject matter" (p. 87). Dong and Agogino (2001) assert that "pedagogical structure is necessary for education and learning to happen. Deciding which resources to use, and what information to extract….altering, rearranging or recomposing information, are among the numerous information processing tasks associated with constructing mental models" (p. 315). Additionally, library sciences and the resulting information architecture play an important role. Kirkley and Kirkley (2005) "believe that….constructivist and situated theories offer the best approach to

learning environment design and for integrating….new technologies into education and training" (p. 43).

Contextual design methodology.

Altun and Büyükduman (2007) believe that using a constructivist approach requires the EPSS designer to create a product that is "more facilitative in nature than prescriptive", which should result in an EPSS website where the learner determines the direction of content and instruction (p. 31). Dong and Agogino (2001) suggest that collecting and developing an EPSS should demonstrate a deep understanding of the users' work context. Information about tasks associated with job functions can be collected by employing the following data collections strategies:

1. Review of case studies and user scenarios,
2. Benchmarking using existing and similar EPSS prototypes,
3. On-site observations in the work setting, and
4. User personas and task modeling (p. 316).

Waight and Stewart (2005) present a similar perspective, and note that "needs assessment, work and task analysis help to identify case studies and scenarios most relevant to the targeted performance problem. Using case studies and scenarios that are relevant to learners' experiences can heighten the learners' motivations to engage in the learning process and can also trigger transfer of knowledge and skills to the workplace" (p. 1118). Chyung, Stepich, and Cox (2006) view the focus on learners translating "their knowledge, skills, and abilities (means) into valued organizational outcomes" as key in developing a system that is competency based (p. 311).

Retalis, Georgiakakis, and Yannis (2006) list six points for exploring EPSS complexity and design ideas:

- Tap experienced experts (instructional designers and system designers) for advice.
- Observe user performing tasks (also noted above by Dong and Agogino),
- Analyze the functionality of other EPSS systems in depth (also noted above by Dong and Agogino).
- Review literature about pedagogical strategies.
- Analyze the EPSS systems user log files.
- Study of other disciplines with published works (e.g. Human Computer Interaction or HCI).

Bianco and Collis (2004) further note that since online learning materials differ considerably in design and in the conditions in which the learning is used, "tools need to be adaptable….[and the EPSS designer] needs to understand this complexity in order to develop suitable tools" (p. 511). Piloting content with real participants and their supervisors is suggested and collecting evaluations of the experience "will strengthen the further development of a portfolio of tools and strategies and guidelines for how to use them in different situations" says Bianco and Collis (2004; p. 511).

Technological factors.

Waight and Stewart (2005) believe that technological factors play an important role in an organization's ability to deploy an EPSS. Preliminary questions to assess the organization's technical readiness include:

- What is the supported web access bandwidth?
- What are the information access limitations?

- Are there specific media types that aren't supported by the network?
- Is there a support staff available for troubleshooting and system maintenance? (Waight & Stewart, 2005 ; p. 1121).

Khan (2000) expands the previous list by defining technological readiness in these terms:

- Infrastructure – The policies, guidelines and standards, operating systems, security measures, and Internet services and Internet connections.
- Hardware – The hardware and equipment enabling the e-learning development and deployment (e.g. computer, networking devices, scanner, etc.).
- Software – The software used for e-learning development and deployment (e.g. word processing, e-mail, spreadsheet, browsers, presentation tools) (p. 6).

Moreno iterates "that the main advantage of high-tech learning environments lies in [its] potential to afford a variety of effective instructional methods.…[including:] Focusing on (a) what learning methods a particular technology affords and (b) how these methods are sensitive to the way that humans process information will enable researchers to discover instructional technologies that lead to deeper learning" (Moreno, 2006; p. 67). However, Juniu (2006) cautions that "simply using technology tools does not ensure a quality education; how educators use technology is more important than whether they use it. The question is when and how to use educational technology." Various technologies may be used to promote learning, according to Constructivist theory (p. 69).

Information design.

Dong and Agogino (2001) note that "research has shown that curriculum with highly structured treatments seem to help students with low ability but hinder those with high abilities... The implication for the information architecture then is to balance

prescriptive navigation while allowing users ability to explore" (p. 315). Dong and Agogino (2001) assert that the exact same navigation should assist multiple learners fulfill their individual learning needs.

It is not uncommon for resources used for EPSS to be adapted and modified by EPSS designers to meet the specific training and learning needs (Hannafin, 2001; p. 5). According to Seak-Zoon, Sungwook, and Byeong-Min (2001), an EPSS may use one or a combination of four basic structures to organize the information:

1) Linear -- The organization of information in a sequence using either a chronological or logical order. Linear structures are particularly useful "for guided tours, job aids, tutorials, and demonstration[s]" (p. 545).
2) Grid – The organization of information by one vertical category or concept and a different horizontal category. Presentation of content in grid format may be difficult to understand if the user is not familiar enough with the content to understand the interrelationships of the concepts.
3) Hierarchy – The organization of material with a parent / child arrangement. Hierarchical arrangements are commonly used on websites and many users are familiar with this type of organization.
4) Network – The organization of material by association. Information arranged in a network format may be confusing if users are not able to understand or predict the outcome. This format is useful for simulation or gaming-type content.

Online support.

Khan (2000) notes the importance of providing "both technological and human-based support" for EPSS sites. Online support tools enable a learner to solve problems themselves, using an "all-purpose technical troubleshooting" tool or connect with an expert for "online instructional counseling" (p. 7). A guide for advisors and practitioners published by Learning and Skills Network (2007) presents several case studies that also confirm the value in online support in the form of coaching, mentoring, community, and peer support forum (pp. 18- 21).

Development Considerations

Multiple areas of practice.

As noted by Calgiltay (2001), numerous areas of practice are involved in the development of EPSS structures, including human performance technology, instructional systems development information engineering, business process reengineering, technical writing, interface design, and computer-based training (p. 436). Kirkley and Kirkley (2005) note that the cross-discipline nature of EPSS development can pose some problems in EPSS site uniformity when multiple developers are involved. They highlight a few of the key reasons:

- Each EPSS developer will have specific goals related to their area of expertise and job function.
- Vocabularies among developers will usually differ.
- Each developer will have unique development processes and outcome expectations. Kirkley and Kirkley (2005) note the criticality of discussing these different development processes and settling on just one.

- No one may be tracking the overall design/development process and decisions because an EPSS site can be a "very complex and situated environment with many iterative layers, processes and tools" (p. 50).

Another problematic aspect of system design, noted by Kim and Hannafin (2004), is that "good design is situation-specific and contextually determined" and "good learning systems design – appropriate, important, useful – is not absolute, but a function of the shared" practices and values of a given learning situation (p. 9).

EPSS components.

Ge and Er (2005) note that the EPSS components and "shell can be reused, adapted, and generated to any specific content domain, with the primary goal being to develop learners' problem solving expertise" (p. 140). Bianco and Collis (2004) assert that an EPSS structure will likely use a combination of the following components:

- Tools – Word processor, spreadsheet, database, templates, or forms
- Information Base – Online documents, reference materials, information databases, case history data.
- Advisory System – Expert advice, coaching, community, or contextual online help.
- Learning – Multimedia web-based training, tutorials, simulations, or scenarios (p. 506).

Conclusions

The target audience for this literature review is corporate web authors. The assumption underlying this inquiry is that imparting a deeper understanding of EPSS website construction to web authors has the potential to mutually benefit web developers and the enterprise through improved EPSS practice, and consistency in the resulting instruction design.

The Review of Literature focused on Constructivism as the selected type of instructional design for an EPSS website. Brandon (2004) notes that "*constructivism is not a specific approach to design — it's a way of thinking about design*" (p. 4). The attributes that define constructivist views of learning today are summarized by Fox (2001) as:

1) The learner actively engages in the learning process.
2) Knowledge is constructed through experience and reflection.
3) Knowledge is created by the learner. It *is not* discovered.
4) Knowledge is personalized and unique to the individual.
5) Knowledge is socially constructed.
6) Learning is a way of "making sense of the world."
7) Learning requires meaningful, open-ended problems that are contextually situated and require the learner to find a solution in order to be effective (p. 24).

The task of creating, producing, and/or publishing EPSS websites usually falls within the web authoring domain, unless the job responsibilities are shared with an internal training department. Job responsibilities of the target audience for this review can

range from managing web information currency, content accuracy, to all aspects of the design, development, functionality, and implementation of web-based systems (Salary.com, n.d.). As a group, the exact preparation among web authors to do their job is unknown. It can be assumed that they have a mixed background along required technical dimensions of information design, technical writing, web and application programming languages (i.e., php, JavaScript, html, xml, Java, C#, C++), and/or graphical user interface (GUI) design. The same variation can be expected along educational dimensions, including human performance technology, instructional design, or learning theory.

Cagiltay (2001) comments that EPPS design and development is a "complex and multidisciplinary process" (p. 436). Hannafin (2001) further notes that "while the foundations for EPSS design are found across disciplines, they are organized and refined in none" (p. 4). Corporate web authors tasked with development of EPSS sites may not be familiar with EPSS fundamentals or have instructional design backgrounds to guide development. For these individuals, the question becomes: How can an understanding of Constructivist pedagogy be utilized to create an effective corporate EPSS website?

There are a number of ways that the information presented in the Review of the Literature generally supports the value of the application of Constructivist pedagogy to the design of an effective corporate EPSS website. Top results expressed in Chang's (2004) survey included:

1) A reduction in information overload,
2) A reduction in training time and cost,

3) Improvements in job performance through employee empowerment and competence, and
4) The opportunity to institutionalize the best practices for a specific job function (p. 357).

Achieving these types of results suggest that a learner's ability to remember and construct useful meaning from interaction, dialogue, and problem-solving has been well supported by "instruction, demonstration and practice, as well as [presenting the learner with] challenging problems and investigations" (Fox, 2001; pp. 33-34). Brandon (2004) reiterates that the primary reason for selecting a constructivist model "is not to precisely transfer knowledge from the instructor to a group of learners, but to facilitate the individual learner's ability to build on and extend existing knowledge within a given domain" (p. 1).

Kirschner, Sweller, and Clark (2006) provide a caution, stating that some novice to intermediate users may require strong instructional support, otherwise the result is ineffective instruction or "misconceptions or incomplete or disorganized knowledge" (pp. 83-84). Hannafin (2001) suggests this might be overcome by using EPSS information assistants that enable users to become more capable over time. This suggestion is later supported by Chang's (2004) research which found that using job-oriented or problem-solving advisory systems contribute most to "maximizing the benefits of EPSS use in business organizations" (p. 362).

Web developers should be generally aware of common cross-discipline pitfalls notes Kirkley and Kirkley (2005), which include competing goals among EPSS developers that are rooted in each individual's area of expertise, the use of different

vocabularies, the use of different development processes, and the lack of tracking in the development and design process.

Brandon (2004) reiterates that a large part of practicing constructivism is devoted to "helping people learn how to learn, including how to test, verify, and validate new knowledge and skills and so to increase their own autonomy" (p. 2). Bianco and Collis (2004) note that EPSS developers might consider using a combination of EPSS components, including tools, an information base, advisory system, or multimedia to achieve this goal.

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