The Constructivist Learning Environment Scorecard: A Tool to Characterize Online Learning

Barbara J. Helland
The Krell Institute

Over the past five years, the number of individuals engaging in online learning as well as the number of online course offering has grown exponentially. At the same time, outcome research on online learning design is sparse. This paper describes the development of a constructivist learning environment scorecard and explores its usefulness in characterizing and comparing online learning courses and subsequently learning outcomes.

Keywords: Adult Learning, Constructivism, Online Learning

Society has shifted from the industrial age and its use of machines for production to the information age with its rapidly increasing volume of accessible information (Toffler, 1990). By the year 2000, the number of online, indexable documents available via the Internet surpassed the 100 billion mark with 3.2 million new pages and more that 700,000 images added every 24 hours. Also in 2000, approximately 55,000 new users per day logged on to Internet; triple the number of users in 1997 (UCLA Internet Report: Surveying the Digital Future, 2000).

In the midst of this information explosion, the 1999 CEO Forum Report on Education and Technology reported that sixty percent of the jobs available at the beginning of the 21st century will require skills currently held by only twenty percent of the workforce. Correspondingly, in 1999, the "Industry Report" in *Training Magazine* estimated that corporations would spend $62.5 billion on training, a 24 percent increase in five years.

Problem Statement

More and more corporations and educational institutions are offering distance education or e-learning courses. As corporations rush to offer courses online, human resource development practitioners may have to reexamine their assumptions on course design. Distance learning courses should be designed not only to meet business needs but also to reflect the characteristics and needs of their learners— the adult (Rosenberg, 2001). Most online learners are full-time workers who want to improve their skills by participating in continuing education opportunities that fit into their busy schedules (Green, 2000). Furthermore, they are older and have dependents at home (Huang, 2002). These individuals realize that to survive in today's environment, they must be able to construct their own knowledge by evaluating and applying new information. Thus, human resource development practitioners should also revisit learning theories such as constructivism, with its focus on the learner constructing knowledge.

Like corporations and universities, I have become interested in how to use computers to deliver instruction to geographically dispersed learners. In the ten years that I have been conducting face-to-face workshops for middle and high school teachers, the workshops have transformed from a teacher-led, lecture-based courses to student-centered, constructivist learning environments. To successfully translate these workshops to an online learning environment, I need to identify the critical attributes of the constructivist classroom and what tools or constructs are available to recreate those attributes if the learners only meet online. Much of the current research on the outcomes of online research has been anecdotal reports, surveys or self-reports on small samples (Rudestam & Schoenholtz-Read, 2002). In my review of the literature, I found several models that defined constructivist learning environments or rubrics that measures specific components found in distance learning such as collaboration or interaction. I did not, however, find an instrument that could help me classify a course as a constructivist learning environment. Thus, the purpose of this pilot is to propose an analytical tool, the constructivist learning environment (CLE) scorecard, and explore its usefulness in to characterize online training.

Theoretical Framework

Characteristics of Adult learners
As noted above, adult learners comprise the largest segment of learners in online courses. According to Malcolm Knowles, adult learners are self-directed; bring life experiences, which serve as resources for learning,

into the learning situation; take a problem-centered approach to learning; are ready to learn when they experience the need to learn something because of a work-related or life-related problem or task; and are motivated to learn by internal and external factors (Merriam and Caffarella, 1999, Noe, 1997). Furthermore, because of demands on their time, they appreciate flexibility in their learning environments and respect for their situation in life.

John Dewey postulates that genuine education or learning comes from experiences (Merriam & Caffarella, 1999). However, an experience doesn't educate if it doesn't lead to broader and deeper experiences. To understand how experiences lead to learning, Kolb (Jarvis, 1992) defined the four-stages that individuals go through in response to an experience: experience a new event, observe and reflect on what happened, make generalizations about experiences, and use new ideas and concepts in actual practice. Jarvis (1992) expanded Kolb's cycle by identifying nine responses that can occur from an experience: presumption, non-consideration, rejection, preconscious learning, skills learning, memorization, contemplation, reflective skills learning and experimental learning. Recognizing that we do not always learn from our experiences, Jarvis classifies the first three responses as non-learning. The second set of three responses defines non-reflective learning. As Jarvis notes, people involved in non-reflective learning are trying to fit into their environment and don't question the underlying culture. In reflective learning, as evidenced in the final three possible responses to an experience, people "stand back, make decisions and evaluate their learning. (p. 76) Jarvis' reflective learning is similar to Argyris' (1993) notion of double loop learning. In double loop learning, errors are corrected by changing the governing values or underlying master programs that led to the error. Correspondingly, reflective learning requires the learner to stand back and evaluate their governing principles before the action of learning takes place. Learning begins when the equilibrium between the individual and their environment is disrupted and they are forced to reflect on their past and future actions.

Constructivism

As indicated by the title of the tool, the scorecard is based on the constructivist theory of learning. Constructivism is consistent with adult learning theory because it focuses on the learner making meaning from experiences (Herring, 1997). Bruner (1990) defines "making meaning" as experiencing phenomena, interpreting the experiences based on our current knowledge schema, reasoning about them and reflecting on the experiences. Thus, constructivists believe that knowledge must be constructed from our experiences (Jonassen, Peck & Wilson, 1999).

Social constructivists, as evidenced in the work of Lev Vygotsky, believe individuals make meaning by engaging in dialogues and activities about shared problems or tasks. Vygotsky defined the zone of proximal development to describe how collaboration leads to learning.   Smith (1998) used three concentric circles to illustrate Vygotsky's zone of proximal development. The inner circle represents an individual's current knowledge and skills based on life experiences. The area in the second circle is the zone of proximal development. This zone is characterized by what the individual could learn with the help of a more experienced individual. The outer circle is the information or concepts that the individual won't understand no matter how much assistance is provided. Thus, learning or knowledge is a social interaction where the learners are introduced to the culture by more knowledgeable individuals or other learners and making meaning is both an individual activity and a socially interactive exchange (Herring, 1997, Merriam & Caffarella, 1999).   The implication that social constructivism has for a learning environment is that it should support dialogues and shared problem solving between learners and it should provide a mechanism for more knowledgeable individuals to help the learners move into their zone of proximal development.

Learning Principles

Huang (2002) proposed six instructional principles based on the constructivist approach to online learning for adults. The following sections present a more detailed discussion of Huang's instructional principles.

Interactive learning. In an online environment, opportunities must exist to support interactions between the learner and the teacher, between learners and between the learner and the content. Cavallo (2001) explains that content in constructivist learning environment emerges from interactions between teacher and students and between students. This is preferable to instructional designers specifying content because it allows the content to be based in and grow out of the existing culture or real world of the learner.

In a web-based problem presentation/simulation space, the learner creates his/her own path through the interconnected chunks of information. Unfortunately, one side effect of interactive learning within online systems may be information overload.   Instead of engaging with the learning material, learners become disoriented and focus on navigational and browsing issues. Information resources in a constructivist learning environment (CLE) must be organized in a meaningful way so that the learners don't lose sight of their learning objectives (Nunes and Fowell, 1991, Hudson, 2002).   Navigational tools are needed to keep the learners focused on the information.

Collaborative learning. Collaborative learning is contrasted with cooperative learning. In cooperative learning, learning is characterized by learners sharing the workload and coming to consensus.   Collaborative learning requires the learners to search and evaluate the evidence for different viewpoints. In the CLE, learners are presented

with opportunities to work together to develop, compare, evaluate and understand different viewpoints on an issue. (Bednar, Cunningham, Duffy & Perry., 1992). Specifically, activities must be "designed to include issues of individual differences, diversity in groups and structural inequalities that arise in globalized economy" (Hudson, 2002, p. 60).

Facilitating learning. To support collaborative and interactive learning, teachers must create a safe, but not necessarily comfortable, environment that supports critical dialogues and experimentation by the disoriented learners. Learning begins when the individual's equilibrium within their environment is disrupted (Jarvis, 1992). Students need to feel free to offer written advice or constructive criticism even when they don't know how it will be received on the other end because they can't see the reaction. In order to create a safe online learning environment, Hudson (2002) advocates the use of guidelines or covenants to promote critical dialogues where the learners are free to give voice to the thoughts in their head.

In addition to creating a safe environment, another instructional method that can be used to facilitate learning is the creation of cognitive apprenticeships within the learning environment. Employing the technique of cognitive apprenticeship, teachers first serve as experts and model problem solving within the content domain. As the learners gain skills and knowledge, the teachers evolve into coaches that guide learning. For instance, the teachers help learners into their zone of proximal development by involving the learners in tasks that stretch them to go beyond their level of expertise and providing the appropriate level of social guidance and support (Wilson & Cole, 1992). Teachers can force learners to recognize the inconsistencies in their naïve model and challenge them to create better models (Perkins, 1992). Lastly, cognitive tools, such as online tutorials, should be developed to help the learners or cognitive apprentices acquire skills that they may lack to complete the projects in the CLE.

Authentic learning. Merriam and Caffarella (1999) identify the attributes that must be present if a learning activity is to be considered authentic. These include solving real-life problems with ill-structured complex goals, evaluating the relevance of information, involving student's beliefs and values, and participating in collaborative activities. Consistent with adult learning theory, learning must relate to real life needs and the learner's experiences are a valuable resource for the instructor to draw upon. In the CLE proposed by Jonassen, et al. content, through related cases and information resources, is introduced in the context of the real-world as defined in the problem presentation/simulation or problem manipulation space.

Learner-centered learning. Both adult learning and constructivist theories identify new roles for the learner. In the constructivist classroom, learners must be involved in designing their own learning environments, defining content, setting objectives and evaluating their progress toward meeting their objectives. Students learn as they dialogue with each other, by actively participating in learning activities and through observation.

The difficulty in moving from a teacher-centric to learner-centric environment is one of task management. Learners can become overwhelmed when asked to accept responsibility for their learning. The teacher or course designer walks a fine line in defining structure to help the students overcome their feelings of frustration while allowing them to take control of their learning. As noted in earlier sections, the teachers or the navigational elements in an online course can serve as guides to help the students when they become lost. (Duffy & Jonassen, 1992; Rudestam & Schoenholtz-Read, 2002; Hudson, 2002.)

High quality learning. Jonassen et al's. (1998) term for high quality learning is constructive learning. When engaged in high quality or constructive learning, learners "articulate what they know or have learned and reflect on its meaning and importance in larger social and intellectual contexts." (p 218) Jarvis' (1992) reflective learning and Argyris' (1993) double loop learning are also examples of high quality learning. Within the CLE, high-order thinking skills are called upon to determine the validity and quality of information and for viewing information from multiple perspectives. As noted above, the learning activities must force the learner to question their governing values and reflect on their past and future actions.

Methodology

Constructivist Learning Environment Scorecard

Wilson (1996) defines a constructivist learning environment (CLE) as "a place where learners work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities" (p.5). Jonassen, et al. (1999) defined a CLE as technology-based environments where students "can do something meaningful and useful." For the purposes of my study, a constructivist learning environment (CLE) is defined as a safe place for students to work together and learn from their experiences, and each other, by exploring, experimenting, dialoguing, and reflecting. Combining my definition of a constructivist learning environment with Huang's instructional principles, I initially used the rubric construct as the foundation for the my instrument. However, as I applied the rubric to an online course that I had

previously taken, I found that the rubric was difficult to use because it was too narrowly focused. Thus, I redesigned my instrument (see Table 1) using the scorecard metaphor because I wanted it to represent a balanced approach for course design based on constructivist learning attributes.

Table 1. *Constructivist Learning Environment Scorecard*

Evaluation Criteria:
Little or no evidence: 0-1; Limited evidence: 2-4; Some Evidence: 5-7; Compelling evidence: 8-10

Points	Category	Characteristics
	Interactive Learning (10 points maximum)	Course design supports interactions between students; between student and teacher and between student and content. Navigational tools designed to keep learners engaged with the content.
	Collaborative Learning (10 points maximum)	Course design supports teamwork to understand and act on materials, work on projects and engage in dialogues to understand and evaluate each others perspective.
	Facilitating Learning (10 points maximum)	Course design and/or teacher create a safe environment for dialogues and experimentation. Teachers/simulations serve as role models, facilitators and guides.
	Authentic Learning (10 points maximum)	Course design requires students to draw upon their experiences as well as content. Course materials and projects are presented in context of the real world of the learner.
	Learner Centered Learning (10 points maximum)	Students are integral in defining content, setting course learning objectives and identifying projects that they want to work on.
	High quality Learning (10 points maximum)	Course design encourages students to evaluate and reflect on their learning and determine the validity of information.

This version of the CLE scorecard allows the rater to assign up to ten points based on the level of evidence that the course design exhibited the constructivist/adult learning characteristics for each of the six categories. I established the following point distribution: Little or no evidence – 0-1 point; Limited evidence – 2-4 points; Some evidence – 5-7 points; Compelling evidence – 8-10 points. The end points, compelling evidence and little or no evidence, are representative of each end of the spectrum in each category. For example, in the case of the interactive and collaborative learning components, working in collaboration is at one end of the continuum while working in isolation is at the other. Similarly, the movement is from student-centric to teacher-centric in facilitating and learner centered learning; from project-based or discovery learning to memorization in authentic learning; and from Jarvis' reflective to non-reflective learning in the case of high quality learning. The differentiation between the middle two subdivisions is based on the degree to which the elements listed under the Characteristics column are proposed and implemented in the course design.

The *score* generated from the scorecard is actually an identifier that conveys information about individual components. The proposed identifier is defined in the following manner: HHIICCAA.FFLL where HH = High quality score; II = Interactive score; CC = Collaborative score; AA = Authentic score; FF = Facilitating score; LL = Learner-centered score. The facilitating and learner-centered score were placed to the right of the period because they represent roles within the learning environment rather than a type of learning.

Pilot Study

To pilot my scorecard, I applied it to a qualitative study of an online graduate sociology course offered in at a large Midwestern university. As described in the course syllabus, the sociology course "addresses the theoretical and applied topics in the sociology of technology." The instructor designed online course using WebCT and materials from a similar undergraduate sociology course. The course content was available on web pages, in texts and articles an E-Reserve at the university and on a CD mailed to each student registered for the class. As described in the course instructions, the instructor developed self tests to help the students understand the basic concepts. In the initial design, the instructor included two common online constructs, the chat room, a synchronous component that requires the participants to be online at the same time, and threaded discussion group, an asynchronous component that is available to participants any time. The purpose of the chat room was to further clarify the materials and readings and the threaded discussion group was included to let the students share their

opinions about issues covered in the materials. For the purposes of my study, I observed the class participation in the chat sessions and reviewed the transcripts of both the chat sessions and threaded discussion groups.

I asked for volunteers from the sociology students to share their experiences in the course with me via questionnaires that I developed. I solicited their experiences via e-mail three times during the semester and once after the course was over. The first questionnaire was actually two instruments. The first instrument was Felder and Soloman's (2002) Index of Learning Styles instrument. I chose this instrument to help characterize the students in the study. Although it has not been validated, I chose it because it was available to the public via the web. The second instrument was designed to collect background information on the students participating in the study. The questionnaire was divided into two sections. The first section collected demographic information and assessed the students' readiness for online learning. The second part was designed to determine the students' familiarity with technology.

The second questionnaire was designed to touch base with the students after the first month of class to see how much time they were spending on the class and how comfortable they were the technological constructs. I also used the questionnaire to draw them into the design of the course by soliciting their suggestions for redesigning the discussions groups to encourage more participation. The third questionnaire was given at the end of the class and was designed to determine the presence or lack of the creation of a community of learners. Finally a month after the class finished, I send the CLE scorecard out to the participants to determine their reaction to the design of the course.

Results

Of the sixteen people who signed up for the class, five responded to all four surveys. The participants involved in study were between the ages of 25 – 47 living in geographically dispersed regions in the U.S. All but one was working on a Masters of Agriculture degree. None of the respondents were fulltime students and they represented a variety of professions. Based on a review of the time periods when items were posted to the threaded discussion groups, the majority of students in my study logged onto the system during non-working hours. The characteristics of the students in my study were similar with those described by Huang (2002) and Green (2000).

To determine the CLE scorecard category ratings for the course, I reviewed design of the course as described in the course syllabus and instructions and the student responses to the questionnaires as well as their participation in chat and discussions groups.

CLE Scorecard Ratings

Interactive learning. Although the students interacted with each in the chat rooms, the threaded discussions were really designed to support these interactions. According to the participation diagram that I developed for the first unit's threaded discussion group, the students responded to the instructor, not to each other. Shortly thereafter, the instructor modified the threaded discussion grading so that the students were required to respond to one of the other student's posting. This modification resulted in some interaction between students as evidenced in subsequent units' participation diagrams. The chat rooms served as the opportunity for the students to interact with the instructor. As evidenced in the transcripts of the chat sessions, the instructor posed questions that led to lively discussions of the material. Based on these observations, there was compelling evidence that the course was designed to support interactive learning and it received nine points on the scorecard.

Collaborative learning. In the chat session after the first discussion group assignment, the instructor indicated that the participation in the discussion groups was not meeting his expectations. This observation was based on the students' posting patterns. According to the course syllabus, the threaded discussions had been included in the course design to create a team-like environment where the students could share their ideas and perspectives. The description of the threaded discussions in the course instructions was the only indication that I had that the instructor expected some collaborative learning. I felt that this represented limited evidence in support of collaborative learning and only awarded two points in this area.

Facilitating learning. On the second questionnaire, one student commented that the environment in the threaded discussions did not support free expression of ideas. This student felt bullied by others in the course, primarily because of the student's profession. Reviewing the chat sessions and discussion groups provided evidence to support this student's observation. The student offered a different perspective, but some of the other students chose to "bully" rather than to understand. In addition, another student observed that "a lot of times people are afraid of sharing their opinions or ideas, especially if there are classmates dominating the chat session." The course syllabus or instructions did not offer any guidelines for appropriate behavior in either the chat sessions or threaded discussion groups. I felt that there was little evidence that the course was designed to create a safe environment that promoted dialogue.

The instructor, on there other hand, tried to serve as a facilitator and guide. He created structure for the course so that the students knew when the discussion groups and chat sessions were scheduled. There were separate threaded discussion groups for each unit and a beginning and end for each discussion. He guided the threaded discussions by posting thought-provoking questions that were designed to encourage collaboration and reflection on the part of the students. He continually requested feedback from the students on the design of the course. However, there was little chance for the students to take leadership roles in setting or resetting course objectives or goals, sharing their experiences or providing supplementary materials.

Within the learning environment of the course, the instructor served as a guide to the learner. He did not set or ask the students to establish guidelines to create a safe environment. Because these two actions tended to counteract each other, I averaged the scores for each part and only found some evidence that the instructor was acting as a constructivist learner-centered facilitator and awarded six points for facilitating learning.

Authentic learning. The CD that the students received contained a simulation that required the students to become change agents and develop a strategy to insure the adoption of a new technology in a hypothetical village. This game was similar to the "SimCity" type of computer games without the fancy graphics. The students had to apply the skills and knowledge they gained in other course units in order to develop their strategy.

There was some evidence that the course materials were presented in the context of the real world, but, as evidenced in the assignments, the real world was limited to the immediate area around the university. Students from other states experienced some difficulty relating to the material. For these reasons, I only awarded five points for authentic learning.

Learner-centered learning. The instructor asked for input and feedback from the students during several of the chat sessions. Their suggestions were used to restructure the threaded discussion groups. According to the participation diagrams of the threaded discussion groups, the most involved conversations were still in response to the instructors questions. Even though two points were awarded for taking leadership in the chat sessions, I found little indication in the transcripts that the students assumed this role. Because I found very little evidence that students designed their own learning, I awarded it one point in the learning center learning category.

High quality learning. Based on my observations, the rapidity of the online chat sessions did not allow for reflection. The threaded discussion groups were included in the course design so that the students would evaluate and reflect upon their learning. For the most part the student responses to the instructor's questions demonstrated some reflection and thought. However, in relation to either the instructor's or student's posts, there was little evidence that the students reached the level where they questioned their own governing principles. As evidenced in the transcripts, none of the students changed their position on the technology studied in the course. Based on these observations, I found that there was some evidence that the instructor had designed the course to promote high quality learning and awarded it five points.

As an additional assessment of the usability of my CLE scorecard, I asked the participants who responded to the third questionnaire to fill out my CLE scorecard and compared their responses to mine (see Table 2). Our scoring pattern was similar expect in the case of authentic learning. Since all of the respondents were working on their Masters of Agriculture, they felt the course as designed was authentic and addressed the issues that they face in real life. As expected, the student who felt bullied gave the course the lowest score for facilitating learning. Finally, because they all felt the course met their expectations, they considered that they had experienced high quality learning.

Table 2. *Comparison of CLE Scorecard Response.*

	HHIICCAA.FFLL
Student 1:	10100810.1007
Student 2:	10100010.1000
Student 3:	8100810.0908
Student 4:	8060608.0708
Student 5:	7070709.0707
My Score:	5090205.0601

Discussion

The pilot study in this paper was primarily undertaken to test the design and development of the CLE scorecard. As noted above, the advantage of using an identifier rather than a *score* is that the identifier maintains the information from each individual component in the scorecard. Thus, this instrument could also be used to compare elements in

many courses or to establish a baseline if the goal is to modify an existing course.   In the pilot study, I examined the course syllabus and instructions as well as the transcripts from chat sessions and threaded discussion groups to establish the final, mixed rating for each component in the scorecard. In order to identify what course elements were successful, prior to the start of the course, I should have generated an identifier based on the evidence found the class syllabus and course instructions.   Once the course was over, I should have generated a second identifier based on the evidence gathered from the transcripts of the chat sessions and threaded discussion and the student questionnaires. The comparison of the two characterizations would more accurately identify the learning areas that needed refinement or more study. Even though I didn't generate a pre- and post-identifier for the class in my pilot study, I felt that the CLE scorecard was useful in that it identified possible connections between the categories. For instance, the lack of course elements that encouraged the students to work collaboratively may have contributed to learners relying on the instructor to guide their learning.

In pilot study, I also used the identifier, as seen in Table 2, to compare my characterization of the course with the students' reaction to the course.   However, the students' level of expertise and understanding of the categories in the scorecard was limited because the information in the CLE scorecard was the only description that I gave the students for each category. The disparity in our ratings is probably attributable to inter-rater reliability.   Further pilot studies are needed to refine the definitions for each category so that consistent identifiers are generated by different raters using the scorecard. To gather this information, I intend to modify the CLE scorecard and include an area for the rater to document the evidence or lack of evidence for each component.

As I used the CLE scorecard with the sociology course, I began to question my initial assumption that all of the categories carried equal weights.   Based on my literature review, I believed each component contributed equally in creating a constructivist learning environment.   However, even as I created the algorithm to generate the identifier, I separated facilitating learning and learner centered learning from the other learning categories.   I felt that these two categories represented the roles of the student and the instructor/course designer within the constructivist learning environment.   Upon reflection, the pilot study raised several questions such as: does a constructivist learning environment exist if one of the elements, for example, authentic learning, is missing? Can learners can still "make meaning?" Correspondingly, does a constructivist learning environment exist if only one element is present, for example high quality learning? The answers to these questions may depend on the purpose of the training. Perhaps every course does not need to have a rating of ten for each component. For instance, all components may be necessary, but if skill development is the goal of the course, then authentic learning may be the most relevant learning attribute.   Overall, I'm encouraged with the CLE scorecard, but realize that more testing is needed to address the issues raised in this study.

Applications to HRD

I designed the CLE scorecard, in part, to provide a tool that would help course designers develop courses and training based on learning theories. Successful employees in today's global, information-age corporations rely more on cerebral skills than on manual skills, are able to work collaboratively in teams, and are asked to solve ill-posed problems. The constructivist learning theory with its focus on shared problem solving and making meaning by reasoning and reflection on experiences more closely mirrors the training needs of the 21st century workplace than more traditional learning theories. Thus, the CLE scorecard, based on the characteristics of adult learners and the constructivist learning theory, has several applications to human resource development. Strategically integrated HRD practitioners (Gilley & Maycunich, 1998) can use the CLE scorecard to provide a discussion framework when managers approach them with a training need. However, based on my limited pilot study, I believe that a more important use of the scorecard is in conjunction with assessments of learning and transfer to the job to identify instructional elements that are successful or that need further modification. The CLE scorecard can provide HRD practitioners with an action research-based method for making training decisions and modifications.

References

Argyris, C. (1993). *Knowledge for action: A guide to overcoming barriers to organizational change.* San Francisco, CA: Jossey-Bass, Inc.

Bednar, A.K., Cunningham, D., Duffy, T.M., & Perry, J.D. (1992). Theory into practice: How do we link? In T. M. Duffy & D. H. Jonassen (Eds.), *Constructivisim and the technology of instruction: A conversation* (pp. 17-34), Hillsdale, NJ: Lawrence Erlbaum Associates.

Bruner, J. S. (1990). *Acts of meaning*. Cambridge, MA: Harvard University Press.

Cavallo, D. (2000). Emergent design and learning environments: Building on indigenous knowledge. *IBM Systems Journal, 38*(384), 768-781. [On-line] Available,
   URL http://web.media.mit.edu/~cavallo/cavallo_emergent.design.pdf

CEO Forum on Education and Technology, School Technology and Readiness Report. (1999). *Professional development: A link to better learning.* [On-line], Available: http://www.ceoforum.org/reports.cfm..

Duffy, T. M., & Jonassen, D. H. (1992). Constructivism: New Implications for Instructional Technology. In T. M. Duffy & D. H. Jonassen (Eds.), *Constructivisim and the Technology of Instruction: A Conversation* (pp. 1-16), Hillsdale, NJ: Lawrence Erlbaum Associates.

Dunlap, J. C., & Grabinger, S. (1996) Rich environments for active learning in the higher education classroom. In B. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 65-82). Englewood Cliffs, NJ: Educational Technology Publications, Inc.

Felder, R., & Soloman, B. (2002). *Index of Learning Styles*, [Online], Available: http://www.ncsu.edu/felder-public/ILSpage.html, accessed August, 2002.

Gilley, J., & Macycunich. (1998). *Strategically integrated HRD*. Reading, MA: Addison-Wesley.

Horton, W. (2000). *Designing web-based training: How to teach anyone anything anywhere anytime*. New York, NY: John Wiley & Sons, Inc.

Hudson, B. (2002). Critical Dialogue Online: Personas, Covenants, and Candlepower. In K.E. Rudestam & J. Schoenholtz-Read (Eds.) *Handbook of online learning: Innovations in higher education and corporate training*. (pp. 53-90). Thousand Oaks, CA: Sage Publications, Inc.

Hudson, B. (2002). The jungle syndrome: Some perils and pleasures of learning without walls. In K.E. Rudestam & J. Schoenholtz-Read (Eds.) *Handbook of online learning: Innovations in higher education and corporate training*. (pp. 185-216). Thousand Oaks, CA: Sage Publications, Inc.

Herring, M. C. (1997). *Design and training for implementation of constructivist-based distance learning environments*. Doctoral dissertation, Iowa State University.

Huang, Hsiu-Mei. (2002). Toward Constructivism for adult learners in online learning environments. *British Journal of Educational Technology 33*(1), 27-37.

Industry Report: 1999. (1999, October). *Training Magazine, 46*.

Jarvis, P. (1992). *Paradoxes of learning*. San Francisco, CA: Jossey-Bass, Inc.

Jonassen, D. H., Peck, K. L., & Wilson, B. G. (1999). *Learning with technology: A constructivist perspective*. Upper Saddle River, NJ: Prentice Hall, Inc.

Merriam, S. B. & Caffarella, R. S. (1999) Learning in Adulthood: A Comprehensive Guide Second Edition. (pp.223- 230, 271-287). San Francisco, CA: Jossey-Bass Inc.

Noe, R.A. (1999). *Employee training and development*. New York: McGraw-Hill.

Nunes, J. M. B., & Fowell, S. P. (1996 August) Hypermedia as an experiential learning tool: A theoretical model. *Information Research, 2*(1). [On-line] Available, URL: http://informationr.net/ir/2-1/paper12.html.

Perkins, D. N. (1992). Technology meets constructivism: Do they make a marriage? In T. M. Duffy and D. H. Jonassen (Eds.), *Constructivisim and the technology of instruction: A conversation* (pp. 45-56), Hillsdale, NJ: Lawrence Erlbaum Associates.

Stevens-Long, J. & Crowell, C. (2002). The design and delivery of interactive online graduate education. In K.E. Rudestam & J. Schoenholtz-Read (Eds.) *Handbook of online learning: Innovations in higher education and corporate training*. (pp. 151-170). Thousand Oaks, CA: Sage Publications, Inc.

Rosenberg, M. J. (2001). *E-Learning- Strategies for delivering knowledge in a digital age*. New York, NY: McGraw-Hill

Rudestam, K. E., & Schoenholtz-Read, J (2002). Overview: The Coming Age of Adult Online Education. In K.E. Rudestam & J. Schoenholtz-Read (Eds.) *Handbook of online learning: Innovations in higher education and corporate training*. (pp. 3-28). Thousand Oaks, CA: Sage Publications, Inc.

Smith, F. (1998). *The book of learning and forgetting*. New York, NY: Teachers College Press.

The UCLA Internet Report. (2000). *Surveying digital future*. UCLA Center for Communication Policy [Online]

Toeffler, A. (1990) *Powershift*. New York NY: Bantam Books.

Wilson, B., & Cole, P. (1992). A critical review of elaboration theory. *Educational Technology Research and Development 40* (3), 63-79. [On-line] Available, URL: http://carbon.cudenver.edu/~bwilson/elab.html .

Wilson, B. G. (1996). *Constructivist learning environments: Case studies in instructional design*. Englewood Cliffs, NJ: Educational Technology Publications, Inc.