A Problem-Based Approach to Web-Based Corporate Learning

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Diagram PDF

Abstract

This paper questions the pedagogy behind some existing Web-based Corporate Learning (WBCL), and proposes the adoption of a problem-based learning (PBL) approach to WBCL as pedagogically sound. The proposed WBCL model is based on scaffolding the PBL processes with the aid of a type of concept map. The model was applied in the design and development of an `Effective Communication' course for junior managers of Frima[1], a multinational company based in Shanghai, China. The descriptive account of this process highlights several real-world implications for the major stakeholders of WBCL: WBCL service providers, human resource managers, and knowledge workers.

Introduction

In a fast-changing world where knowledge is always shifting, lifelong learning is no longer a buzzword for corporations, but rather, a basic necessity for their survival in the market place. Web-based corporate learning (WBCL) is seen as helping corporations meet their growing demands for adaptable workers who can readily acquire needed skills; and it meantime supports the continued expansion of knowledge. It is also believed that this Internet-supported learning innovation allows workers to learn anywhere and anytime , promotes active and independent learning, and supports communication between experts and novices. This on-going corporate learning is an important strategy to sustain growth in corporations.

Corporations are already shifting many of their traditional courses online. WBCL leverages on the unique attributes of the Internet, such as hyperlinks, chat lines and online communities. These Internet technologies, however, are often used to administer the kind of teaching and learning activities traditionally mediated by a teacher at a chalkboard, a textbook prior to a lecture, or a worksheet with multiple choice questions. The tools mediating the activities may have changed over the years, but many of the methods employed remain constant. Learners are

often treated as passive recipients of information, while web-based learning resources take on the roles of an information dispenser, an authoritative expert, and a fountainhead of information and knowledge.

It is a fallacy then to assume that the mere presence of sophisticated Internet technologies will enhance corporate learning. In this paper, the authors first explore the opportunities of Internet technologies for corporate learning, and identify problem-based learning (PBL) as an alternative approach in successful WBCL. By constructing a WBCL model that reproduces the technological, social, time and motivational characteristics of real world problems, learners are no longer treated as vessels to be filled with knowledge, but rather, as self-directed learners. Learners are first presented with an authentic problem situation in their working context and linked to many other smaller problems, using a concept map. By working through each sub-problem, mediated by the concept map, learners are guided to the solutions of these problems. A synthesis of the solutions of the smaller problems leads to the solution of the main problem. Therefore, learners are actively seeking out and analysing new knowledge in the context of their work.

This paper also provides a descriptive account of how the WBCL model is applied in the design and development of an `Effective Communication' course for junior managers of a multinational company based in Shanghai, China. The design and development of the course was carried out by the content and multimedia development team of 12Learn, a WBCL service provider based in Shanghai, together with the managers of Frima and the authors. The account highlights the opportunities and limitations of the PBL model for WBCL and suggests important implications for human resource managers, knowledge workers and WBCL solution providers.

Web-Based Corporate Learning (WBCL)

WBCL employs the "use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance" (Rosenberg, 2001, p.28). These learning solutions may be delivered asynchronous or synchronous over the Internet to the learners' computers. There are several push and pull factors towards using Internet technologies in corporate learning. The main push factors include the failure of traditional educational institutions and courses to meet up with the demand for continuous learning in corporations; and the high running costs for these corporations to conduct the courses themselves. The main pull factors of WBCL include its anywhere/anytime accessibility and communication that provide up-to-date information and promote just-in-time learning, and its non-linearity that caters for learners' needs and styles.

Despite the hype of WBCL, doubts have been raised in various reports and articles about the real benefits of WBCL (Peters, 1999; Delio, 2000; Kruse, 2000; Lim, 2001).

Many WBCL courses have attempted to replicate traditional learning and teaching media. For example, from textbooks to online books, or from overhead transparencies to Powerpoint slides. Content knowledge is organised, arranged and presented in a way to maximise learning,

hopefully. Such methods place authoritative information before learners, rather than encourage them to actively seek out knowledge, interpret results and test hypotheses. There are few interactions between participants in these WBCL courses.

The Problem-Based Learning (PBL)

PBL is not a new concept. Since its introduction in American medical schools in the early 1970s, other fields such as engineering, law, and business have adopted PBL to prepare or upgrade their professionals. Unlike traditional direct instruction, PBL begins with the presentation of an authentic and meaningful problem at which learning centres. These problems serve as springboards for inquiry, information-gathering, and reflection of theoretical concepts and relationships, industrial standards, norms and practices, and company expectations and culture. PBL offers an alternative instructional approach that motivates learners to engage in authentic problem solving and develop skills required for lifelong independent learning (Hu & Wong, 2000).

What is PBL?

Torp and Sage (1998) define PBL as a curriculum development and instructional system that simultaneously develops problem solving strategies and disciplinary knowledge bases and skills by placing learners in the active role of problem solvers confronted with an ill-structured problem that mirrors real-world problems. The ill-structured problem is messy and complex in nature, with no fixed and "right" solution. Some examples of ill-structured problems in the `Effective Communication' course include:

> You have just been appointed as a junior manager in your sales team. During the first management meeting, new initiatives for boosting sales were formulated. These initiatives involved discarding and refining many of the existing practices. As a manager of a sales team, how are you going to communicate these initiatives to your team?
>
> You overheard two of your IT staff complaining about the lack of clarity of your expectations and instructions. They agreed that you were task-oriented and friendly but commented on your inability to communicate your ideas and instructions effectively. They also said that many of the staff were often at a loss on what to do and how to proceed. What do you think has gone wrong? How do you intend to address the problem?

In the two examples above, the participants of the course are expected to access new information, critically appraise it, and apply it to the problem they are presented with - taking into account the context that they are in and hence convert "raw knowledge into professional

wisdom" (Dixon, 2000, p.41). The five defining characteristics of PBL are:

- The starting point for learning is a problem;
- The problem is one that learners are likely to face in their present or future work environment;
- The subject matter is organised around problems rather than disciplines;
- The learners assume a major responsibility of their own learning; and
- Most learning occurs within the context of small groups rather than lectures (Jonas, Etzel and Barzansky, 1989).

Rationales of PBL

PBL addresses the assumptions about learning. It creates a learning environment that reproduces the technological, social, time, and motivational characteristics of real world situations where what is learnt will be used; and hence, addresses the problem of inert knowledge. Learners are no longer treated as vessels to be filled with knowledge or passive receivers of wisdom. The main rationales for using PBL in corporate learning include:

- Making knowledge or theory more applicable to different real-world problem situations (Norman & Schmidt, 1992); and
- Encouraging independent lifelong learning (Brine & Shannon, 1994).

By presenting authentic problem situations in context, research studies have shown that learners are more likely to learn when, where, and how the knowledge can be applied to other situations (Coles, 1985; Schmidt, Dauphinee, & Patel, 1987; Brine & Shannon, 1994). That is, PBL engages learners in their learning process in ways that are similar to the ways in which knowledge will be recalled and employed in future situations, and assesses learning in ways that demonstrate understanding and not mere acquisition (Gick, 1986).

Research studies have also shown that PBL allows learners to be more engaged in learning because they are hard-wired to respond to dissonance and because they feel they are empowered to have an impact on the outcome of the investigation (deVries, Schmidt, & deGraaff, 1989). This in turn promotes metacognition and self-regulated learning by asking learners to generate their own strategies for problem definition, information gathering, data-analysis, and hypothesis-building and testing, comparing these strategies against and sharing them with other learners' and mentors' strategies (Boud & Feletti, 1991). Therefore, with the responsibility of managing a largely self-directed learning process, learners are better equipped to take on the responsibilities of professionals who are lifelong learners (Brine & Shannon, 1994).

Many of these studies drew upon modern theories of adult learning that dated back to 1946 when Malcolm Knowles was an educational director for the Young Men's Christian Association.

His initial observations and later research led to a landmark book in 1970 titled *The Modern Practice of Adult Education: Andragogy versus Pedagogy*. Knowles's (1970) theories of adult learning are complex, but his conclusions are just as valid in today's context as they were more than 30 years ago. His conclusions that support the rationale for the PBL approach in corporate training include:

- Adults need to know why they're learning something; they must believe it will have a personal benefit;
- Adults have lifetime experiences that should be tapped and built upon;
- Adults learn best from hands-on, problem-solving approaches to learning; and
- Adults will expect to apply new knowledge and skills immediately, which will aid retention.

A PBL Model for WBCL

Given the opportunities for making knowledge more applicable to the real-world context and for encouraging independent lifelong learning, the authors suggest that the adoption of a PBL model for WBCL will address many of the problems of existing WBCL courses. Moreover, Internet technologies offer PBL opportunities such as learner control, anywhere/anytime learning, just-in-time learning, and virtual reality through multimedia presentations and simulations. Therefore, by harnessing on the strength of PBL and vice versa, a PBL model for WBCL offers a pedagogically sound alternative to existing models of WBCL.

Incorporating Concept Maps into PBL

It must be noted, however, that one of the greatest concerns of the PBL approach is the inherent difficulties with PBL as a mode of learning (Albanese & Mitchell, 1993). Perkins (1991) points out three broad ways in which the problem-based mode of learning makes strong demands on learners:

- Cognitive complexity is high as problems are authentic; and learners are expected to test concepts against reality;
- Task management is increased as learners are expected to exhibit learning independence; and
- Failure to "buy into" the PBL approach, as learners are incapable of adopting such a vastly different paradigm of learning.

The demands on learners in a PBL environment point to the need for scaffolding. Scaffolding is

the support that enables learners to achieve a goal or action that may not be possible without that support. It is also the support that helps the learner learn how to achieve the goal or action, without the support, in the future (Guzdial, 1994). In the PBL environment, the scaffolding acts as a schema or knowledge-based representation that contains the typical problem goal, constraints, and solutions procedures useful for that type of problem (Gick, 1986).

Visual representations of the scaffolding can be provided by concept maps that organise the problems and bits of knowledge in networks that are inter-connected and inter-related. Knowledge bits are pieces of instruction that can be viewed on the web as a text block, diagram, animation, movie or other object. These bits are related to each other and they may be viewed together, but they may also be viewed singly. Research studies have shown that concept maps have been used successfully in classrooms to encourage learners to organise their knowledge about a content domain and to be explicit about the nature of relationships between ideas (Spoehr, 1994). Concept mapping also forces learners to identify, verify and classify important concepts, describe the relationship between concepts and assess its meaning, analyse the nature of the relationship, and form the link or connection within or across content domains (Jonassen, 1996).

As compared to the concept maps used in these studies that are learner-generated, the concept maps generated in this paper are to be generated by the web development team. The use of concept maps in a PBL environment facilitates the learning process by constructing a representation of the focal problem, linking the problem into sub-problems, and connecting these problems to appropriate bits of knowledge. Therefore, the incorporation of concept maps into PBL ensures that by placing the control of the learning process at the fingertips of learners, they are not abandoned and left to deal with the complexities of a real-world context on their own.

Concept maps can be easily incorporated into a web-based environment to support PBL. When learners access a topic or module, he/she is presented with a concept map that includes the main problem, its sub-problems and their respective knowledge bits. There may be different levels of sub-problems, depending on the complexity of the main problem. The hyperlink feature of the Internet allows for learner control as learners work through the problems in a non-linear way, according to their prior knowledge and learning style.

By working through the networks of sub-problems and their knowledge bits, the learners have then to integrate knowledge from the extensive network of knowledge bits to solve the focus problem. That is, the whole learning process of the PBL model of WBCL is driven by main problems, and supported by concept maps that network the problems and their knowledge bits. And hence, learners are more likely to engage in their learning process and also become more self-directed in their learning. A concept map of the PBL model for WBCL is presented in Figure 1.

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A Case Study of Using the PBL Model for WBCL

To illustrate how the model can be adopted in a web-based course, this section provides a descriptive and interpretive account of the planning and development of a web-based course on `Effective Communication'. The general objective of the course is to equip junior managers of Frima, a Shanghai-based multinational manufacturing company, with effective communication skills. Effective communication at the managerial position means that the communicator's message must lead to the response he/she desires from his/her audience. 12learn, a business-to-business (B2B) e-learning consultant based in Shanghai that offers a host of customised learning solutions, was asked to develop such a course.

In consultation with the first author, 12learn decided to adopt the PBL model for WBCL in its design of the course. The first author and 12learn had been constructing and fine-tuning the model over the past three months, and felt that they were ready to bring it from theory to practice. More importantly, the course objective was appropriate for the adoption of the PBL model because of the necessity of transferability of communication skills across situations. By presenting an authentic problem situation in the working context of the junior managers, they would be more likely to learn when, where, and how the communication skills could be applied to other situations.

Identifying and Presenting the Problem

Since the problem is one of the defining characteristics of PBL, a considerable amount of time and effort is devoted to choosing a focal problem for the course. The team consists of the human resource manager and two middle-level managers from Frima, the content expert and two multimedia developers from 12learn, and the authors. Each member of the team has a crucial role in the design and development process. The managers from Frima help in identifying the focal problem, based on their own experiences in the company as managers. This ensures relevance and complexity of the focal problem so that it deals with situations learners are most likely to face in the future.

The content expert validates the process by ensuring that the problem has enough integrative value and coverage to allow learners to discover and integrate all components of effective communication: communicator strategy, audience strategy, message strategy, channel choice strategy, and cultural context strategy. The multimedia developers then consider the modes of presenting the problem: text-based case study (with or without graphics), simulation game, and role play. The authors acted as consultants and facilitators throughout the design and development processes.

Based on the general objective of equipping learners with effective communication skills, the

team decided on the following focal problem to be presented as a role play, with the intention of allowing learners to recognise the salient visual, auditory, and non-verbal cues:

> You overheard two of your IT staff complaining about the lack of clarity of your expectations and instructions. They agreed that you were task-oriented and friendly but commented on your inability to communicate your ideas and instructions effectively. They also said that many of the staff were often at a loss on what to do and how to proceed. What do you think has gone wrong? How do you intend to address the problem?

Pre-structuring the Problem

The focal problem was then broken up into sub-problems or guiding questions. The team decided that a high degree of pre-structuring or scaffolding was needed due to two factors. The first factor was that the learners might have difficulty making the transition to PBL and scaffolding was needed to allow them to become more comfortable and more familiar with PBL. A second factor was the lack of resources, including learners' access to library resources and relevant experts, and learners' time to work through the problem. The guiding questions were all linked up to the focal problem. Some of the related questions were also interlinked. The questions included the following:

- What is the message strategy that I should employ?
- How can I organise a strategic message?
- What must I emphasise in the message? (This question is linked to the next one)
- What are my objectives as a communicator? (This question is linked to the previous question and the next one)
- Who are my audience?

Linked to each guiding question or sub-problem, the content expert provided a web of knowledge bits. In this paper, knowledge bits are defined as small packages of information, ideas or examples that are embedded or linked to the problems or other knowledge bits. The concept map provided a platform for these bits to be linked to one another, as well as to the problems. The multimedia developers then explored different multimedia elements to represent and organise the problems and bits. The managers of Frima provided company specific information and examples to ensure a more authentic learning experience.

Once the concept map had been finalised, the team started working on the storyboard to prepare and format the materials towards the instructional objectives, given the web-authoring program (Dreamweaver), multimedia tools and concept map. The storyboard was a visual

representation of the series of webpages that contained the focal problem, guiding questions or knowledge bits. The storyboard helped the team to organise the instructional design efforts, ensure the coherence of materials presented, and track what must be done in every step of the planned learning experience. With the completion of the storyboard, the multimedia development team took over the process.

Issues for Implementations of PBL in WBCL

Although the application of the PBL model in the web-based `Effective Communication' course is still at its development phase, the team has identified several essential issues that might undermine the success rate of implementing PBL in WBCL with respect to the following.

- Target audience (Learners);
- Human Resource Managers; and
- Course Instructors

Target Audience

The PBL approach requires a profound change in learner's attitude and the way they learn. Most learners are only familiar with traditional direct instruction that requires them to listen, transcribe, absorb, and repeat. They may be incapable of learning in a vastly different paradigm of instruction where they are expected to assume increasing responsibility for their learning. When faced with such changes, learners may feel frustrated in not getting information or solutions to problems directly from the instructor, and having to think harder. To make extra effort to search for the solutions themselves may exacerbate their frustration.

A related issue is how the learners perceive the nature of knowledge. Many learners went through their formal education in schools where solving well-structured textbook problems was a regular activity. For this type of problem, there is always a single correct answer, and the teacher might even insist that the problem be solved in certain ways. One of the consequences is the perception that there is always a single correct solution to any problem, and such perception might be deeply entrenched in working adults. However, real life problems may be ill-defined or ill-structured, may have different solutions, and may require stakeholders to negotiate, taking into account the contextual factors (Kitchener & King, 1981; Kitchener, 1983; Voss, 1988). Thus, when faced with ill-structured problems in PBL, the learners may be perturbed by the uncertainty of several possible solutions.

Human Resource Manager

While PBL is an approach that focuses on the effectiveness of transfer of learning such that

learners can readily apply their knowledge to real-life context (Voss, 1988), this model is affected by the efficiency of instruction. It is much easier and faster to adopt the didactic chalk-and-talk method to cover the syllabus of the course than it is to prompt, to guide, to encourage active participation of learners and to facilitate their discussions. In addition, the traditional model focuses on pre-set instructional objectives and a congruent set of objective assessment questions. The outcome of instruction is manifested through the scores obtained in the end-of-course assessment. PBL, on the other hand, emphasizes the process of problem solving. Assessment of ill-structured problem solving often relies on a set or rubric for the holistic judgement of the process engaged in by the learners and their justification of optimal solutions. It is far more difficult to establish the reliability and validity of the assessment method - unlike the simpler number crunching of objective tests.

These issues are critical to the adoption of PBL model in WBCL, both for the human resource manager and the course instructor. For the human resource management, Return on Investment (ROI) is a main concern. Conducting a training course can be considered as a kind of investment in human resource development; and the return is often measured on the basis of training outcome. If a course can be completed within a shorter period of time, and with concrete assessment scores to represent training outcomes, it is more convenient and easier to justify the cost effectiveness of the training. In comparison, PBL falls short in this aspect as it takes a longer time to implement, and its benefits are often manifested in real world applications, which are not easily measurable.

Course Instructors

The role of WBCL course instructor is different with different models of instruction. In the traditional didactic model, the instructor would assume the role of a subject matter expert, contributing to the content knowledge and perhaps the instructional strategies. Once the web-based course is developed, the learners are expected to interact with the instructional materials and may clarify any doubts with the instructor via various modes of online communication.

In the PBL model, the instructor similarly assumes the role of a subject matter expert during the course design phase. However, equal emphasis is given to the implementation phase during which dynamic interactions among learners, instructional materials and the instructor form the critical mechanism for learning to occur. The instructor acts like a juggler, handling various roles at different times. The instructor may have to guide the learners when they are lost; prompt them when they miss the point; motivate them to search for information; perform demonstration or modelling when they have no clue on how to proceed; mediate a discussion among them; resolve conflicts among them; or even inject a controversial point to provoke thinking. Such daunting tasks can be the greatest obstacle that prevents instructors from adopting a PBL model.

Implications of PBL Model for Major Stakeholders of WBCL

Implications for Learners/Knowledge Workers

The WBCL model aims to motivate learners to be active problem solvers engaged in the learning process. The learners construct their own meanings in different contexts and hence, will be more adaptable to changes in their working environment. The main motivating factor is the focus on real life problems with which the learners can identify and therefore possess ownership of solutions. For the model to work successfully, however, it requires learners to be active participants in the process. Given the complexity of ill-structured problems, the problem-solving task can be daunting (Wood, 1983). Learners should engage themselves as active problem solvers, chiefly responsible for the solutions to the problems. If the learners still cling on to the mindset of passive learning, that is, waiting for the instructor to pass on information - instead of constructing their own knowledge, they may become easily frustrated and surrender to the problems.

Implications for Human Resource Manager

The WBCL model based on PBL will only work if HR managers play a pivotal role in developing a corporate culture for problem solving. The HR manager should be aware of the pedagogical principles underlying the PBL model and therefore the rationale for the delivery of such WBCL courses. They should also realise the differences between the PBL model and traditional didactic instruction in terms of learning activities, time - frame required, and assessment methods. If not, incongruent expectations about the conduct of the courses may occur and this learning model may fail. However, to have a well-customised course, there must be collaboration with the service providers and openness on the part of the HR managers to share company policies and case studies. The main attraction for HR managers is that the WBCL model ensures that the problems are authentic and specific to the corporation, and hence, prepare employees better for real-world, work-based problems.

Implications for WBCL Service Providers

To design with a PBL model is extremely challenging. The instructional designer has to select or design appropriate problems that authentically reflect the complexity of real life problems (Jonassen, 1997), to decide on appropriate scaffolding to support learners, to engage learners in active participation, to monitor learning progress, to probe for higher order thinking, to facilitate collaborative learning, to monitor and adjust level of task difficulty, and to withdraw the scaffolding gradually.

Conclusion

The WBCL model constructed in this paper, based on the PBL approach with concept maps to

scaffold the learning process, provides a pedagogically sound approach to WBCL. By applying the model in the design and development of a course, the paper has described how the opportunities of Internet technologies can be harnessed to help learners apply knowledge and skills acquired in the course to real life problems. Although the course is still in the process of development and no evaluation has been done on the course (implementation is at the end of 2001), the authors have highlighted various implications of the model for the major stakeholders of WBCL.

References

Albanese, M. & Mitchell, S. (1993). Problem-based learning: A review of the literature, its outcomes and implementation issues. *Academic Medicine*, 68(1), pp. 52-81.

Boud, D. (1985). Problem-based learning in perspective. In D., Boud (Ed.), *Problem-Based Learning in Education for the Professions*. Sydney, Higher Education Research Society of Australasia, pp.13-18.

Boud, D. & Feletti, G. (1991). *The Challenges of Problem Based Learning*. New York, St.Martin's Press.

Brine, J., & Shannon, S. (1994). Consolidating professional skills and developing the confidence of graduating architects. In S.E., Chen, R.M., Cowdroy, A. Kingsland, & M.J., Ostwald (Eds.), *Reflections of Problem Based Learning*. Sydney, Wild & Wooley.

Coles, C. (1985). Differences between conventional and problem-based curricula in their students' approaches to studying. *Medical Education*, 19, pp.308-309.

Delio, M. (2000). Report: Online training `boring'. *Wired*, 30 August. [Online]

Available from: http://www.wired.com/news/business/0,1367,38504-2,00.html

DeVries, M., Schmidt, H. & deGraaff, E. (1989). Dutch comparisons: Cognitive and motivational effects of problem-based learning on medical students. In H., Schmidt (Ed.), New Directions for Medical Education, pp.231-238.

Dixon, A. (2000). Problem-based learning: Old wine in new bottles? In O.S., Tan, Little, P., S.Y., Hee, & Conway, J. (Eds.), Problem-Based Learning: Educational Innovation Across Disciplines. Singapore, Temasek Centre for Problem-Based Learning.

Gick, M.L. (1986). Problem-solving strategies. Educational Psychologist, 21(1&2), pp. 99-120.

Gotschall, M. (2000). E-learning strategies: For executive education and corporate training.

Fortune (Education), 15 May. [Online]

Available from: http://www.fortune.com/fortune/sections/onlinelearn/onlinelearn.htm

Guzdial, M. (1994). Software-realised scaffolding to facilitate programming for Science learning. Interactive Learning Environments, 4(1), pp.1-44.

Hu, C., & Wong, P. (2000). Preservice teachers use of IT to present Scenarios for problem-based learning. In O.S., Tan, Little, P., S.Y., Hee, & Conway, J. (Eds.), Problem-Based Learning: Educational Innovation Across Disciplines. Singapore, Temasek Centre for Problem-Based Learning.

Jonas, H., Etzel, S., & Barzansky, B. (1989). Undergraduate medical education. Journal of American Medical Association, 262(8), pp.1011-1019.

Jonassen, D.H. (1996). Computers in the Classroom: Mindtools for Critical Thinking. Englewood Cliffs, NJ: Pentice Hall Inc.

Jonassen, D.H. (1997). Instructional design models for well-structured and ill-structured problem-solving learning outcomes. Educational Technology: Research and Development, 45(1), pp. 65-94.

Kitchener, K.S. (1983). Cognition, metacognition, and epistemic cognition: A three-level model of cognitive processing. Human Development, 26, pp. 222-232.

Kitchener, K.S. & King, P.M. (1981). Reflective judgment: Concepts of justification and their relationship to age and education. Journal of Applied Developmental Psychology, 2, 89-116.

Knowles, M. (1980). The Modern Practice of Adult Education: Andragogy versus Pedagogy. Chicago, Follett.

Kruse, K. (2000). Information is not instruction! Learning Circuits, Feburary.

Lim, C.P. (2001). What is NOT e-learning? *TechKnowLogia (International Journal of Technologies for the Advancement of Knowledge and Learning)*, May/June.

Norman, G.R., & Schmidt, H.G. (1992). The psychological basis of problem-based learning: A review of the evidence. *Academic Medicine*, 67(9), pp. 557-565.

Perkins, D.N. (1991). What constructivism demands of the learner. Educational Technology, Sep, pp.19-21.

Peters, Otto. (1999). Teaching and Learning in Distance Education: Analysis and Interpretations from an International Perspective. London: Kogan Page Limited.

Rosenberg, M.J. (2001). E-Learning: Strategies for Delivering Knowledge in the Digital Age. New York, McGraw-Hill.

Schmidt, H., Dauphinee, W., & Patel, V. (1987). Comparing the effects of problem-based and conventional curricula in an international sample. Journal of Medical Education, 62 (April), pp.305-315.

Spoehr, K.T. (1994). Enhancing the acquisition of conceptual structures through hypermedia. In K., McGilly (Ed.), Classroom Lessons: Integrating Cognitive Theory and Classroom Practice. Cambridge, MA: MIT Press.

Torp, L.L. & Sage, S. (1998). Problems as Possibilities: Problem-Based Learning for K-12 Education. Illinois, ASCD book.

Voss, J.F. (1988). Learning and transfer in subject-matter learning: A problem solving model. *International Journal of Educational Research*, 11, pp. 607-622.

Wood, P.K. (1983). Inquiring systems and problem structures: Implications for cognitive development. *Human Development*, 26, pp. 249-265.

1 The name of the company has been changed to ensure anonymity.