



# Creating a performance-oriented e-learning environment: A design science approach

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## ABSTRACT

E-learning is now being used by many organizations as an approach for enhancing the skills of knowledge workers. However, most applications have performed poorly in motivating employee learning, being perceived as less effective due to a lack of alignment of learning with work performance. To help solve this problem, we developed a performance-oriented approach using design science research methods. It uses performance measurement to clarify organizational goals and individual learning needs and links them to e-learning applications. The key concept lies in a Key Performance Indicator model, where organizational mission and vision are translated into a set of targets that drive learning towards a goal of improving work performance. We explored the mechanisms needed to utilize our approach and examined the necessary conceptual framework and implementation details. To demonstrate the effectiveness of the approach, a prototype workplace e-learning system was developed and used to evaluate the effectiveness of our approach.

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## 1. Introduction

Organizations face a permanent changing environment due to new challenges such as globalization, economic pressures, and the changing nature of work. To be successful, employees must learn to cope with such changes. E-learning is being used by many organizations, especially SMEs but most applications are performing poorly and employees are not motivated to learn new methods. Thus significant gaps exist between corporate interests and learner needs when e-learning is provided. Individuals generally do not feel that e-learning is helpful since the knowledge learned does not help improve their work performance. Indeed, e-learning is generally implemented without considering the organizational vision and mission. As a result, most e-learning applications fail to meet user needs and ultimately fail to serve the organization's quest for success in the knowledge economy.

Moreover, e-learning systems tend to focus on technical issues and ignore pedagogical and organizational issues necessary for effective e-learning. Most applications lack a sound pedagogical underpinning and fail to understand the learning behavior in an organizational and social context [14]. The dominance of

technology-oriented approaches makes e-learning practice less goal-oriented, and thus they are perceived as being poor in quality.

A further review of the root cause of the problem reveals that much e-learning research is based on formal courses in educational institutions. Corporations as learning arenas are different from schools, although educational institutions are extending their reach to workplaces by introducing new pedagogical models such as problem-based learning, project learning, and case studies. Workplace learning is built on practical tasks and work situations that meet organizational goals. Learning in the workplace takes place in the context of use and application, and the result often remains implicit and embedded in work practices. Moreover, learning is more collaborative in workplace settings, where sharing individual knowledge with co-workers is an important part of the learning environment.

To solve this problem, pedagogical principles and organizational learning theories should provide the basis for the design and implementation of e-learning applications in work environments; indeed a systematic and rational approach is vital. This underscores the need for structuring learning activities to meet corporate interests, individual needs, work performance, and the social context. The development of e-learning in the workplace should consider the alignment of individual and organizational learning needs, the integration of learning and work, and communication between individuals.

In our study, we provided a performance-oriented approach intended to improve e-learning development in the workplace. We

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used performance measurement to clarify organizational goals and individual learning needs, and linked them to e-learning applications. The key idea lay in a Key Performance Indicator (KPI) model, where the organizational mission and vision were translated into a set of performance targets that drive learning towards the goal of improving work performance. The model therefore helps an employee identify performance measures for his/her position, capabilities needed to be developed to improve performance, knowledge about the capability, and learning resources needed. This conceptualization helps accomplish organizational goals by showing a clear picture of what is important and what is needed to learn it.

To implement the KPI-oriented learning environment, ontology- and intelligent agent-based functionalities were added to the e-learning system. Ontology is a formal representation of a set of concepts and their relationships in a domain; it uses machine languages and semantic annotations to achieve this [8]. We used ontology for an explicit representation of the KPI model, as a foundation for guiding performance-oriented learning. Intelligent agents act autonomously and perform tasks that depend on the context and user preferences. A set of intelligent agents was developed in our study to assist learners perform adaptive learning activities. With the support of these technologies, real-time personalized instructions and recommendations were continuously generated and sent to participants to facilitate and direct their learning processes to improve their work performance. The KPI model can also be used to identify each individual's work context, expertise, and proficiency, as well as to organize knowledge assets, with a view to facilitating knowledge sharing and social networking in a learning community.

Our study aimed at improving organizational performance through the design and implementation of an IT artifact for e-learning in the workplace. Two research questions were examined: (1) how should an e-learning system be designed to align learning with work performance in the workplace? and (2) to what extent is such an e-learning system effective for learning in the workplace?

## 2. Literature review

### 2.1. E-learning

E-learning focuses on the use of computer and network technologies to create and deliver a rich learning environment that includes a broad array of instruction, information resources and solutions, with a goal of enhancing individual and organizational performance. Here we use the term *e-learning* to encompass Computer-Based Learning, Computer-Based Training, Technology-Enhanced Learning, Technology-Mediated Learning, Web-Based Education, or Virtual Learning Environment. E-learning has attracted considerable interest by providing a variety of benefits to learners, education institutions, and organizations by: removing barriers of time and space in the development of knowledge and skill; providing just-in-time learning, convenient access, and flexible learning processes; enabling real-time content updating while avoiding information overload; reducing travel, off-site training costs and time away-from-the-job; and facilitating the interconnectivity of people for knowledge transfer [11].

Many schools have been using course management software (e.g., Blackboard, WebCT, and Moodle) to complement traditional classroom-based instruction. Many empirical studies have been conducted to demonstrate how IT supports learning by improving students' learning outcomes, enhancing information literacy of students, and increasing effectiveness of education management. Despite the variation in research findings, there has been a consensus that substantial gains in student attainment are achievable if the use of IT in schools is planned, structured, and integrated effectively.

To improve existing e-learning applications, smart learning environments must, however, to provide personal services to help a learner use, manage, and interact with the learning system. A number of studies have investigated the use of intelligent tutoring techniques, such as personalized learning interfaces and adaptive learning. These efforts have generally emphasized technology development but had little concern for effective instruction or pedagogy to enhance learning performance.

### 2.2. Workplace learning

This field – also known as Training and Development, Human Resource Development, Corporate Training, and Work and Learning – can be defined as the means, processes, and activities in the workplace by which employees learn basic skills, high technology, and management practice that can be immediately applied to their jobs, duties, and roles in the firm. Indeed, to compete and keep up with changes, organizations require effective ways to update their workforce's skills and knowledge.

The rapid development of ICTs has made it necessary for organizations to provide new ways of developing workforce competence and enhancing human resource management [6]. However, most e-learning applications have been developed primarily for school learning programs, and ignore the special features that are needed in work situations. Generally the complexities of interaction between e-learning and organizations have been underestimated. To leverage the potential of e-learning for sustaining effective change, a sound business and people-centered strategy is essential.

## 3. Design science research methodology

The objective of our study was to design, implement, and evaluate a KPI-oriented e-learning system that could address the special problems of existing workplace situations. A design science research methodology was adopted to investigate this design-based problem. Design research creates, builds, and evaluates innovative artifacts to help solve identified problems [5]. The goal of design researchers then moves beyond offering explanations of phenomena to designing interventions for solving problems [10]. Design science research is increasingly recognized as a companion to behavioral research in business [4] and education fields [1].

Design-based research is a systemic but flexible methodology aimed at improving practices through iterative analysis, design, development, and implementation in real-world settings. It has been welcomed in education, especially in technology-enhanced learning environments [1]. Learning scientists move beyond simply observing to becoming involved in using developing technological tools and curriculum models to improve courseware and generate evidence-based facts about learning. Such research becomes important in situations where complex and ambitious educational reform policies are ill specified and where the implementation process is uncertain.

Design-based research requires identification of a relevant organizational problem, development and presentation of an artifact, its evaluation to assess its utility, articulation of the value added to the knowledge base, and explaining its implications. It requires not a single, but a series of methodological approaches such as surveys, case studies, interviews, evaluations, and comparative analyses.

Since it is infeasible to develop a learning system applicable to all business organizations, we used a case study approach in our research to investigate the mechanism of developing the artifact from both an understanding-oriented and an action-oriented perspective. The development was conducted in a real-world setting, with close collaboration with the stakeholders.

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