Constructivist Learning Systems: A New Paradigm

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Abstract
The educational enterprise is in the midst of a philosophical shift from a behaviorist to a constructivist paradigm. If constructivism is to be taken seriously as a new educational paradigm in the information age, learning technology R&D must pay more attention to learners instead of teachers.

1. New Times Give New Challenges
Advances in information technology are creating a new infrastructure for business, scientific research, social interaction, and education. Future workforce is required to effectively use information technology to remain competitive, employ creativity and critical thinking to solve problems, possess the ability to communicate and collaborate with others, and have the capacity to readily acquire new knowledge and skills. Given this trend, we must emphasize the learning environment that enable individuals to understand the changing world, create new knowledge and shape their own destinies. We must respond to new challenges by promoting learning in all aspects of life, through all institutions of society, in effect, creating environments in which living is learning.

Building an education enterprise suited to the new times requires developing new education strategies, designing new teaching and learning modes, and creating learning environments that enhance learners\' proficiency in understanding, thinking, reasoning, and problem solving. The real promise of technology in education lies in its potential to enhance the learning experience for learners. Better learning will not come from finding better ways for teachers to instruct classes but from giving learners better environments to construct knowledge.

The increasing understanding of knowledge, learning process, and learning environments enables us to have a better perspective of how learning technology should be used to create "authentic" learning environment that correspond to the real world. During the past decade, constructivism has become an important intellectual movement in education as well as in many other fields. The challenge is how to cast this new learning theory and vigorous information technology advances as an opportunity for creative and innovative learning paradigm that takes the whole learning environment into account.

2. Constructivism
Constructivism is a philosophical view about knowledge, understanding and learning. Constructivism holds that learning is a process of building up structures of experience. By contrast with the traditional view of education as a process involving the transmission of knowledge from teachers to students, a constructivist view believes that learning occurs through a process in which learners play active roles in constructing the set of conceptual structures that constitute their own knowledge base.

Constructivism focuses on the learner\'s control of learning processes. Learners are viewed as active constructors of knowledge. They develop understanding through observation, reflection, experimentation, and interactions with the surrounding environment that continually confirm, challenge, or extend ongoing theories or beliefs. In summary, constructivism holds several general assumptions and beliefs about learning [1]:

- Knowledge is constructed, not transmitted.
- Knowledge construction is embedded in learner\'s interests and personally meaningful activities.
- Learners take active roles in developing their learning environment.
- Social interaction is an essential factor in the construction of knowledge.

3. Constructivist Learning Environment
Constructivism provides both theoretical foundation and practical opportunity to move towards building constructivist learning environments. A constructivist learning environment (CLE) is a technology-rich, open place where a learner can use a variety of tools and information resources in his pursuit of learning goals and problem-solving activities. Wherein the learner can draw upon information resources and tools to actively construct knowledge, generate a diverse array of ideas, develop
multiple modes of representation, engage in social interaction, and solve authentic problems.

**Figure 1 Elements of constructivist learning environment**

Four major elements are bound together by their roles in the establishment of a CLE (Figure 1):

- **Public knowledge system**: It consists of all kinds of knowledge management systems that facilitate the creation, capture, storage, manipulation, and dissemination of public knowledge.

- **Distributed instructional system**: It offers educational programs, produces instructional materials, and is entitled to give out legally recognized certificates.

- **Learning community**: It is a group of individuals who are interested in a common topic or area and engage in knowledge-related transactions as well as transformations within it.

- **Constructivist learning system**: Constructivist learning system is a tool with which learners combine the most appropriate learning information and tools for a certain kind of learning situation. This system emphasizes the active and purposeful role of learners in configuring learning environments to resonate with their own needs, echoing the notions of learning with technology through mindful engagement [2].

4. **Constructivist Learning System**

The fundamental principle of the constructivist theory is that learning is a constructive activity that the learners themselves have to carry out. The insights gained from constructivist perspective can be instrumental in forming our views about the nature of learning system and the purpose of learning technology.

A constructivist learning system (CLS) is a technology-based knowledge-construction tool with which a learner develops his CLE and constructs his knowledge base. Since CLEs are constructed from the perspective of learners, sensitive to their learning needs, styles, paces, local cultures, interests, and aspirations, learning system developers provide learners with only scaffoldings that contain tools, strategies, and guides, which enable learners to interact with construction tools in ways that best enable them to build the learning systems at different levels of knowledge structure and technological sophistication.

As shown in Figure 2, in general, a CLS contains six components [1, 2]:

- **Information bank**: It serves as a source of explicit information about topics through which a learner can access databases of information, including textbooks, dictionaries, encyclopedias, journals, digital library, music, films, and other electronic documents.

- **Notebook**: It is a highly organized set of note-taking tools for a learner to construct his own artifacts in the form of presentations, written documents, reports, models, pictures, etc.

- **Learning tool kit**: It provides a learner with access to the tools to understand and solve a problem. Learning tools include visualization tools, modeling tools, simulation tools, remote instrumentation, remote engineering tools, remote workstations, etc.

- **Microworld**: It presents scientific and social phenomena and makes them accessible to scrutiny and manipulation. It may contain virtual realities, scientific simulations and emulations, virtual laboratories, virtual museums, online field trips, online special events, and other miniature scientific and social world.

- **Conferencing Room**: It provides conversation and collaboration tools, using a variety of computer-mediated communication methods, to facilitate communication among communities of learners and with teachers and experts.

- **Task manager**: It provides a learner with self-service and self-administrative mechanism that enables the learner to plan his study, create learning maps, manage and track learning process, update records, register for courses and event, and schedule activities.

**Figure 2 The components of a constructivist learning system**

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