U

Ubiquitous Computing

This refers to a new genre of computing in which the computer completely permeates the life of the user. In ubiquitous computing, computers become a helpful but invisible force, assisting the user in meeting his or her needs without getting in the way. For ubiquitous computing, the computer's system has Seamless Connectivity. The system should support strong User Centered Interface to use without any difficulty by a computer novice.

Ubiquitous Learning

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Synonyms

All-pervading learning; U-learning

Definition

Ubiquitous learning can be defined as an everyday learning environment that is supported by mobile and embedded computers and wireless networks in our everyday life (Ogata et al. 2009). It is aimed to provide learners with content and interaction anytime and anywhere (Hwang et al. 2008). The learning process includes the real-life experience augmented with virtual information and is adapted to the learner and learner's environment. The content objects, activities, and the interaction with the system and with other humans (including instructors and peers) are customized according to learner's current goals of learning, interests and preferences, cognitive characteristics, history and current state of competency in the subject matter in hand, the characteristics and demands of the location, the technology being used as the medium and facilitator for learning, and the context of the situation in which the learning is taking place.

Theoretical Background

Traditional paradigm of classroom learning has been criticized for being too artificial, rigid, and unresponsive to the needs of today's society. It is not only incapable of accommodating those who, for whatever reason, are not able to attend formal classes at a predefined place at a predefined time, but also the learning in such environment is very much out of context. Researchers argue that learning is largely a situated phenomenon and real-life experiences in authentic settings are a primary requirement for successful and effective learning.

Ubiquitous learning provides such settings of omnipresent learning in which virtual and electronic resources are made available through portable devices that help learners navigate the real and surrounding physical world (Peng et al. 2008). Learning happens all around the learners without any conscious effort on the part of the learner. Ubiquitous learning no longer restricts learning process to be inside the classroom or formal learning environments. Rather, the learning involves situating learners in both the real world and the virtual world to extend learners' learning experiences (Shih et al. 2011). Ubiquitous learning therefore provides learners with opportunities to learn in their own environment, in context, using the kind of artifacts they can relate their work and living experiences with.

Such ubiquitous approach to learning requires modeling of a variety of personal and environmental parameters. For example, learning system must know who the learner is, where he or she is right now, what technology is at the disposal of the learner at that

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particular moment, where this learner has been before and what he/she knows, who else is in the vicinity of the learner with whom interaction could take place, what real-life objects are currently available in that learner's surroundings that could be used for learning purpose, and so on. Ubiquitous learning therefore heavily relies on real-time dynamic modeling of the learners, location, technology, and context.

The *learner model* typically contains information about individual learners, such as their past behavior, current state, learning styles, cognitive abilities, and performance (Kinshuk and Graf 2009). It is more like a historical representation and dynamically updated track record of the learner. The performance detection models used in ubiquitous learning have been around for last many decades, whereas the modeling of learning styles and cognitive abilities (such as working memory ability, inductive reasoning ability, and associative learning skills) for ubiquitous learning is rather recent; formalizations for such modeling have been developed in only past few years, even though the learning styles themselves have been in consideration for rather long time.

The *location model* includes learner's current location and previous location history calculated through the data received from the various navigation mechanisms, such as GPS and cellular network base station identity, and the location identification of real-life learning objects through object identification technologies such as Wi-Fi access point identification, QR Code, and active radio frequency identification (Active RFID) module. Ubiquitous learning uses this model to not only identify what real-life learning objects in the learner's surroundings can be used for instruction but also to detect other learners who may be in the vicinity for the purpose of creating ad hoc study groups.

The *technology model* obtains information about the capabilities of the technologies that are available to the learner at certain point in time, such as display capability, audio and video capability, available memory and bandwidth, and characteristics of the operating platform. The learning experience is then customized to align with those capabilities.

The *context model* analyzes the learner's environment in real-time, including the learner's current learning goal, the atmosphere in which the learner currently is, and the recent history of learner's interaction so as to relate next learning experience with it.

Important Scientific Research and Open Questions

Research in ubiquitous learning has been heavily focused on creating technological infrastructure for gathering as much information as possible about the learners and from learners' surroundings. Cognitive psychology literature has been helpful in inferring learners' cognitive capabilities. However, further research is needed to relate that cognitive state to the interaction between the learners and the surroundings and the effect it has on learners' learning experiences. How various cognitive traits, such as working memory capacity, associative learning skills, and inductive reasoning ability, affect the way learners perceive their surrounding environment, relate it to their learning goals, and interact with it in the knowledge construction process?

The ultimate aim of ubiquitous learning research is to find ways to immerse the learner in the environment in such a way that the learning would simply happen, automatically and in such small amounts, that it would not even be noticeable. The environment will need to be so intuitive that every action of the learner and every change in the surrounding would contribute to the learning process. This raises several questions regarding the pedagogical shift needed to facilitate effective and efficient learning, and the technological infrastructure that is needed to make that learning happen. How should the learners be provided with exactly what they need, right at the moment they need it, and how the learning process be made so seamless and natural that no explicit action is needed on the part of the learner to initiate learning. Fundamental research is therefore required to understand the real-life interactions and their impact on learners' cognitive processes, so as to identify the measures for successful learning in such environments and to design the mechanisms for remedial yet unobtrusive instructional interventions.

Cross-References

- ► Adaptive Learning
- ► Context-Awareness
- ► Location-Awareness
- ► Mobile Learning
- ► Seamless Learning
- ► Serial Position Curve

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UCT

► Learning with Monte Carlo Methods

UDP

UDP stands for user datagram protocol. It is a transport layer protocol that enables a computer to establish a one-way connection to send streams of data. UDP does not guarantee data delivery.

U-Learning

► Ubiquitous Learning

Ultimate Explanations of Learning

► Adaptation and Learning

Unaware

► Consciousness and Emotion: Attentive vs. Pre-attentive Elaboration of Face Processing

Un-bundling Attention

► Role of Attention Triangulation in Organizational Learning Processes

Uncertainty

► Confusion's Impact on Learning

Unconditioned Stimulus (US)

This is a stimulus whose presence automatically unleashes a response in the organism. For example, a loud noise generates in us all the response of a jump.

Unconscious Affect

► Unconscious Emotion

Unconscious and Conscious Learning

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Synonyms

Implicit learning; Incidental learning; Tacit knowledge

Definition

Unconscious learning is both used as a process and as an outcome variable. It is a way of learning in which