

# E-Learning and Multimedia Databases

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## INTRODUCTION

E-learning covers the variety of teaching and learning approaches, methodologies and technologies supporting synchronous or asynchronous distance education. While distance education is a concept typically used by conventional institutions of education to mean remote access and delivery of instruction, the concept of e-learning broadens the scope to all instances of learning using Web-mediated learning. The scope includes realizing learning organizations (Garvin, 1993), achieving knowledge management (Beccerra-Fernandez; Gonzalez & Sabherwal, 2004; Aussenhofer, 2002) and implementing organizational training.

Individuals continue to learn throughout their lives, particularly as a function of their work and profession. The manner in which they access information and use it often depends upon the available technology, their previously learned response for information acquisition and how their organization facilitates learning and knowledge transfer (Tapscott, 1998; Zemke, Raines & Filipczak, 2000). Hence, e-learning is not simply a consideration for traditional learning institutions, but for any organization.

As such, e-learning not only faces the traditional challenges of teaching to various learning styles while conveying the spectrum of educational objectives, but also faces the extra challenge of using emerging technologies effectively. The three significant emerging technology areas to e-learning are: networking, mobility and multimedia. These technologies can enable a highly interactive delivery of material and communication between instructors and students. Out of the three, however, multimedia technologies relate directly to pedagogical concerns

in providing material tailored to the content domain, to the individual and to the learning objectives (Vitolo, 1993).

Currently, multimedia and e-learning initiatives focus on the presentation of multimedia. The adequate presentation of multimedia is often more an issue of the network being used and its connectivity parameters. Acceptable multimedia presentation depends upon the format of the multimedia and its ability to be quickly transferred (David, 1997). In these circumstances, the availability and appropriateness of the multimedia is assumed to have already been decided as necessary to the instruction.

Not being addressed currently is the storage of multimedia. Multimedia databases should allow for retrieval of components of the integrated and layered elements of the media data stored. In this way, the media would support learning goals. Its retrieval should be conditional upon a context and a content need. Context involves the learning situation – the educational objectives and the learner, combined. Content need includes the particular material to be acquired. Conditional retrieval of multimedia based upon a pedagogical circumstance implies that not all learners or situations need the same media to be delivered, but that a compendium of stored media should be available. In fact, the media alone cannot solely enable learning. Clark (1983) analyzed the effects of learning from different media and observed that significant changes in learning are a function of the media used for the presentation of the material. Significant attention must be given to the content material available for e-learning systems. The material in a certain media format should be included, because it adds or complements the underlying informational intent of the system.

Further, as educational objectives aspire to higher levels of competency such as analysis, synthesis and evaluation, more depth and variety of detail need to be communicated to the student. However, due to the connectivity issues of e-learning, often layers of representation are not available to the learner. For example, during face-to-face communication, student to teacher, the teacher provides the path to the solution and essentially trains the student when teaching analysis skills. However, with e-learning systems, just the end product—the “solution”—of the analysis is provided. When the underlying reasoning layers of the analysis are not available, the overall quality of the instruction suffers (Vitolo, 2003).

Multimedia databases added to an e-learning initiative would provide conditional retrieval and comprehensive storage of multimedia. However, no database management system (DBMS) exists solely for multimedia storage and access (Elmasri & Navathe, 2000). Several current DBMS do provide a data type appropriate for multimedia objects. However, the range of capabilities available for manipulating the stored object is severely limited. A pure multimedia database management system (MDDBMS) is not commercially available, now.

## BACKGROUND

Learning, education and teaching are inextricably intertwined, highly complex processes. Each process has been researched as a social phenomenon, cognitive transformation, generational bias and personality expression. While the work on these topics is vast, several aspects are generally accepted as foundation concepts:

- People interact with environments on an individualized basis. Learners have learning styles; teachers have teaching styles; individuals have personality styles.
- Educational efforts seek to find a correspondence between these various styles so that learning can progress effectively.
- Educational efforts can be described via taxonomies—progressions of objectives. The realization of these objectives does not necessarily require any specific learning or teaching

modality. The communication of the content of the objective may be better suited to one modality (visual, auditory or tactile) than another.

- Learning can continue throughout an individual's life.
- Technology can facilitate educational efforts by providing various formatted and comprehensive content for interactive and self-regulated learning. Multimedia technology provides an excellent opportunity for packaging content into a variety of modalities.

With respect to styles, Coates (2002) provides a condensation of the various style-based perspectives of learning. While much of these style-based analyses of behavior stem from the initial work of Carl Jung (1923), the facets of the styles are continually being researched. Learning is mediated by a variety of factors—some (such as modality of instruction) that can be manipulated successfully within an educational effort, some (such as generational cohort biases) that are out of the control of instructional design.

With respect to educational structures, educational researchers have developed taxonomies to explain educational objectives. (See Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths & Wittrock, (2001) and Bloom (1984, 1956) for classic coverage of these taxonomies.) Essentially, educational efforts advance instruction in levels of difficulty and performance so that the breadth and depth of the knowledge of a field can be communicated.

As a foundation concept to using multimedia for e-learning, the media requires appropriate processing for adequate capture, production and distribution. For example, video may be shot using either an analog or digital camera. Before the source video can be edited using computer software, it must be instantly accessible from a hard disk and not the original videotape. The source video is imported into the computer by a process called video capture. Captured video is huge; 10 seconds of raw, uncompressed NTSC video (the standard for television video) use as much as 300 megabytes (MB) of storage space.

For video to be played in a Web browser or distributed on CD-ROM, the file size must be reduced significantly. This file size reduction, or com-

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