Integrating Web-Based Technologies and Knowledge Management Concepts in a Novel Online Model for Modern Education

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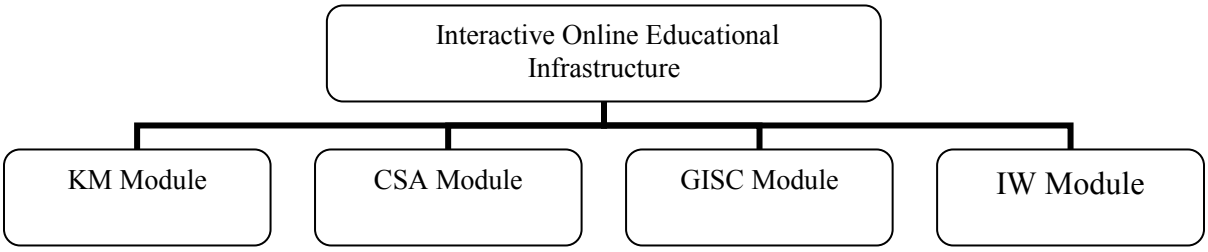
Introduction

New web-based technology breakthroughs and accelerated availability of wide-bandwidth tools and resources for preparing multimedia educational materials present a unique opportunity to boost academic rigor and quality of modern education, increase student interest and participation, and explore avenues for optimizing distant-learning delivery models.

This research focuses on modeling of an interactive online educational infrastructure (OEI) by introducing four major modules forming this OEI:

a) knowledge management (KM) module,
b) client/server applications (CSA) module,
c) group information sharing and collaboration (GISC) module, and
d) an interactive workflow (IW) module.

The architectures, processes and procedures in support of each of these modules reflect different features of the online interactive enterprise and are used for assessment of the OEI outcomes. Proposed model has been tested during the five-year period of offering online the graduate E-Commerce and then E-Business program at National University.



Proposed KM module is comprised of eight types of knowledge associated with OEI, such as tacit, explicit, descriptive, procedural, reasoning, linguistic, presentation, and assimilative types, and of six KM lifecycle components, such as relevant knowledge creation, capturing, refining, storing, managing, and disseminating.

The CSA module is mapped into the three major blocks:

- inquiry applications (via the data/information repositories),
- transaction-oriented services and applications (via access gateways and other web-based processors), and
- consultative sessions (available through Internet, pagers, wireless phones, and web-enabled call centers).

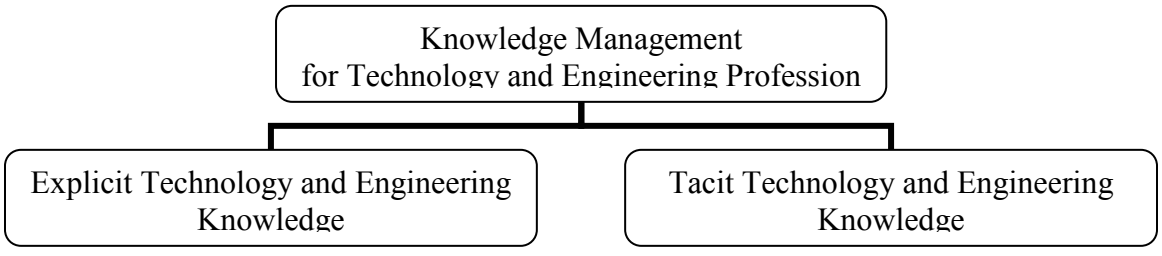
These applications merely focus on supporting and automating different OEI processes and would provide limited contributions to the KM enterprises. The GISC module formalizes an Internet-enabled support for all types of interactions between an online instructor and each student as well as between students themselves through utilization of readily available on the market GSS (Group Support Systems) software, such as information sharing, discussion groups, web collaboration, application sharing, and electronic brainstorming.

Knowledge Management Module of an Interactive Online Educational Infrastructure

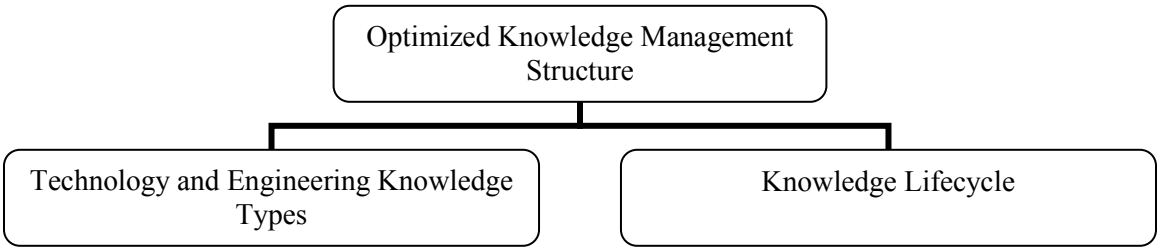
Evolution of any profession has always been affected by the progress in science, applicable tools, standards, methodologies, and new discoveries. At the same time, technology and engineering fundamentals have been, are and always will be essential in supporting any progress in those and closely related fields.

Thus, it seems reasonable to suggest that a mission of a novel online model for modern education should focus on optimized knowledge management to maintain and balance two major types of technology and engineering knowledge:

- **tacit** knowledge (technology and engineering expertise; design; know-how; engineering ethics, engineering values, and cultural aspects of technology and engineering profession; skills and collaborative teaming) and
- **explicit** knowledge (technology and engineering fundamentals, major contributions to the particular field of engineering profession, technology and engineering standards, patents, established practices and successful engineering developments).

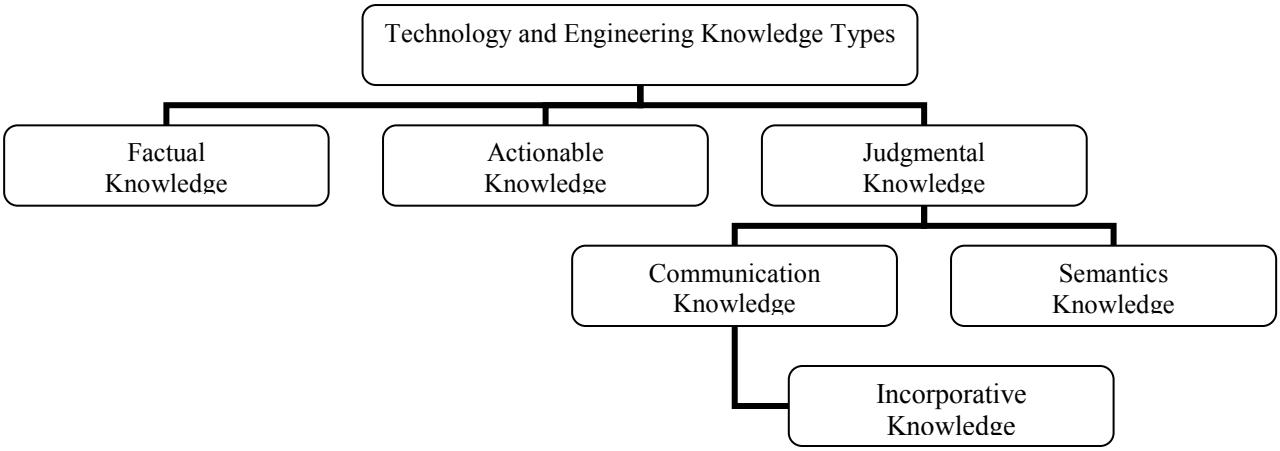


Optimized knowledge management structure includes two major blocks: Technology and Engineering Knowledge Types block and Knowledge Lifecycle block.



In turn, Technology and Engineering Knowledge Types block might include:

- **factual** knowledge (concerned with an accumulated wealth of past, present, future, or expected topics associated with *what* in engineering),
- **actionable** knowledge (concerned with processes and procedures essential in each engineering field for knowing *how*),
- **judgmental** knowledge (concerned with knowing *why* in assessing complex engineering developments),
- **communication** knowledge (concerned with means of communication with project teams, administration, standard-developing organizations, competition, government agencies, vendors, suppliers, research entities, manufacturing departments, and non-engineering supporting services),
- **semantics** knowledge (concerned with interpreting contextual meaning of communication related to a new knowledge), and
- **incorporative** knowledge (concerned with maintaining the engineering knowledge base current by improving on existing knowledge and thus optimally maintaining balance between the legacy and newly developed elements on knowledge in each particular engineering field).



One of the important specifications for the Actionable Knowledge subset would be associated with selected Interactive Tutorials.

Examples for the particular field of Electrical and Electronic Engineering would include such Interactive Tutorials as "Advanced Instrument Control with LabVIEW", "Fast Fourier Transform", "Simulation Interface Toolkit", "Machine Vision and Scientific Image Processing", "Eliminating Accuracy Errors with Self-Calibration", etc. These particular interactive tutorials (offered by National Instruments[1] and other providers) would be linked (through the required licensing agreements) with the database of the proposed interactive online model.

For the proposed Factual Knowledge subset, linkage to the well established web repositories might substantially increase effectiveness of the proposed model. One of the options might be the GlobalSpec[2] web site with such categories as "Sensors, Transducers and Detectors", "Laboratory Equipment and Scientific Instruments", "Networking and Communication Equipment", "Industrial Maintenance", etc.

In the wide variety of technology, communications, information systems, and engineering professions, keeping students and professionals current in their field(s) of expertise becomes an issue of competitiveness and employability. That is why a cycling approach in maintaining a good knowledge management system is so important: knowledge must be periodically updated to reflect changes in the relevant engineering and technology fields.

To this extent, a technology and engineering knowledge management lifecycle is suggested to include the following phases:

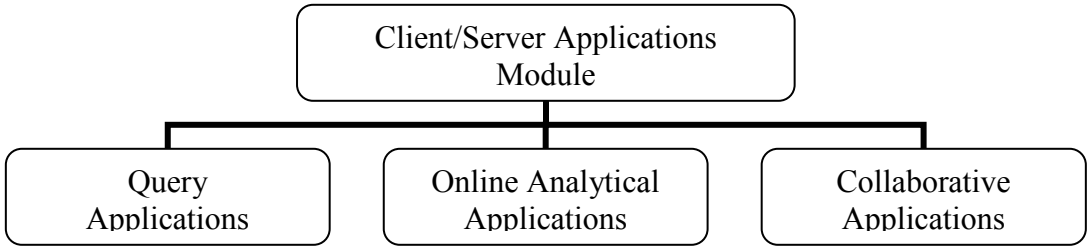
- relevant knowledge **generation** (new developments, new designs, new conceptual, logical, hardware and software introductions and implementations),
- knowledge **assessment** (new and generated knowledge should be properly assessed and identified as valuable, relevant and be expressed in a reasonable format),
- knowledge **stratification** (new knowledge must be analyzed to distribute it between the tacit and explicit domains),
- knowledge **accommodation** (concerned with logistics of storing new knowledge in formats, locations and groupings for convenient access), and
- knowledge **currency update** (continued evaluation and verification of accuracy and relevancy of engineering knowledge).

Client/Server Applications Module

The Client/Server Applications module can be broken into the three major blocks:

- **query** applications (via data/information repositories),
- **online analytical processing** and transaction-oriented applications (via access gateways and other Web-based processors), and
- **collaborative** applications (available through Internet, pagers, wireless broadband services, and Web-enabled call centers).

It should be noted that inclusion of the collaborative applications block stems from the necessity to provide enough support for meaningful and expedient exchange of information and ideas globally, effectively and efficiently.



Group Information Sharing Module

The GIS module's objectives include utilization of readily available on the market Group Support Systems groupware, such as information sharing, Web collaboration, application sharing, and electronic brainstorming.

With a background of currently available wireless technologies, special emphasis could be made on utilization of wireless Internet-based broadband access opportunities offered by different telecommunication carriers. For example, in USA the telecom companies such as Verizon, Sprint, T-Mobile, Singular, and AT&T start offering the broadband Internet access services that are reasonably priced, seamless, available anytime, anywhere (within continental USA), with high speeds of 300-500 Kbps (thousands of bits of information per second), reliable and appropriately secured with an authentication and data protection support.

Interactive Workflow Module

Since the proposed online interactive infrastructure represents yet another example of a system model, then a concept of *modeling* should be inherent throughout its design and development stages. Thus, modeling might represent several conceptual perspectives; in case of the proposed online educational infrastructure, those perspectives might include three online educational engines: data oriented, process oriented, and time-dependent (emphasizing the dynamic nature of the data and information flow).

For example, for an online delivery of a course in Information Systems Methodologies, the Data Oriented perspective might concentrate on the following aspects:

- business data,
- logical database design,
- data taking into account construction tools to be used, and
- data taking into account construction design.

On the other hand, a Process Oriented perspective could be broken down conveniently into three distinct aspects:

- activity performed in business area,
- user perceivable task, and

- construction design stage.

Finally, the time-dependent perspective (sometime called as behavioral oriented perspective) could be broken into four aspects, such as:

- event occurring in a business area,
- information system event,
- triggering condition, and
- initiation of transaction.

The first of these would address the MIS business analysis stage, the second and third would be related to the MIS system design stage, and the last would be associated with the construction design stage.

Test and Validation Considerations

This research is based on an analysis and experience gained as a result of the five-year online interactive offerings of a graduate level program in Electronic Commerce/Electronic Business dealing with both business and engineering/technology issues. The latter ones included the topics in web development and design, database conceptual and logical design, telecommunications engineering, and information technology competencies.

Relevance of this experience to the proposed Online Interactive Model stems from the fact that in both instances – online transactional processes defining Electronic Business and Online Educational Infrastructure – dynamics, global nature of collaboration and competitiveness dominate and define the measure of success or even survival.

The following are samples of the projects that have been developed by the student project teams based on the model proposed.

SDPortal.com

The purpose of this project was to develop, design, and launch SDPortal.com as a strategically profitable job-search website. By implementing the latest software technology, user-friendly design, and effective programming, it was intended to achieve ease-of-use, presentation-layer efficiency, platform independency, fast access time, and self-regulating client access.

Internet-Based Knowledge Management for Enhancement of Business Processes (Assessment Modeling for General Service Administration, Federal Technology Service).

Project utilizes Internet-based applications combined with knowledge management standards in streamlining contracting, marketing and sales processes to better position GSA/FTS in addressing the challenges of increased competition, growing volumes of data, and an aging workforce.

Business Process Reengineering: Applied Microcircuits Corporation

Information Technology-based enterprise-wide solution that allows the AMC Corporation to effectively manage current and future growth in the competitive telecommunications marketplace through implementation of innovative BPR methodologies.

For several cycles of online offerings, validation assessment included: a) proposed program specific outcomes, b) proposed measurable objectives, c) proposed benchmarks for determining program success, d)evaluation methodologies, e)supporting databases, and f) decisions based on the results of assessment and their targeted implementation for the proposed Novel Online Model.

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