

Chapter 5

A Model for E-Learning and Knowledge Management: The Virtual University at Tecnológico de Monterrey

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Introduction

For the past four decades, the concept of educational technology has been evolving into what it is today. Since the early 1950s, efforts to improve the educational process by using some kind of technology, such as radio, television, or audiovisual media, have been evident. The importance of the components has shifted through the years. In the early 1950s and 1960s, the focus was mainly on the means by which information was sent. During the 1970s, communication theory emphasized the process of sending and receiving information with transmitters and receivers. Later the importance was placed on the learning process. In this sense, educational technology attempts to support and improve the educational process when combining instructional methods that are grounded on a learning theory with new models that are based on information and communication technologies (ICT) (Escamilla, 2003).

In the context of globalization, which is characterized by entwined economies and increasing immigration, a growing need for lifelong education has emerged, especially for people who often were excluded from schools and universities. This new channel allows education to reach people who could not attend traditional campus classrooms. All of these forces stimulate the development of more specific educational models. In the last two decades, many universities have incorporated some kind of distance learning into their teaching-learning process. All these resources seem to benefit the teaching-learning process by reaching a more diverse student body. Hence, new educational models have emerged.

Background

Currently there is an identifiable continuum of educational models stretching from the traditional way of teaching in the classroom to a 100% distance education model,

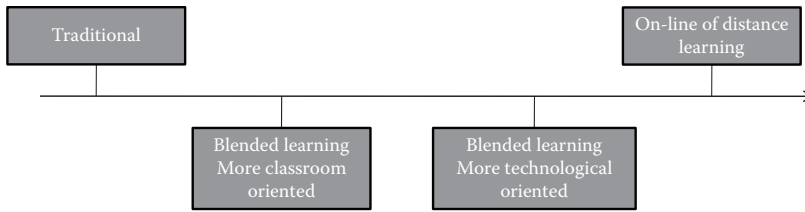


Figure 5.1 Schemes of Educational Models.

through the use of ICTs, as shown in Figure 5.1. First, the traditional way of teaching in a classroom, face to face, is based on a lecture and a chalkboard at the front of the classroom. Distance learning via computer technology today incorporates a learning management system (LMS) or electronic platform. The professor can post syllabi, a calendar, grades, and so forth. The information on the course is static, and requires, as does a traditional class format, a classroom posting. Students can post their homework on electronic platforms, and this is the entire role the platform plays. This simple model is called *Blended Learning* (BL). A further step is a more technology-oriented blended learning in which the professor and his or her students are not in the same classroom; generally, they are geographically distant and use an LMS to post syllabi and a calendar and use all the communication tools of the platforms, but at least two or three times during the semester they attend face-to-face sessions on campus. This model blends the best of both worlds, the virtual and face-to-face. The final online distance education model in which professor and students are far from one another other actually mimics a campus or a classroom. All the course information is posted on the LMS. The students and the professor exchange communications through the LMS platform, since it is the only vehicle that allows them to teach and learn. The professor posts many kinds of learning resources that are available to students at all times. Students and teacher interact frequently on the platform and use other tools to communicate with one another.

Naturally, each model has its own unique character, applied to satisfy specific needs and requirements. Every university creates or modifies the educational model to answer precise student needs in specific social contexts. On the other hand, these models require, in many cases, a clear vision on the part of campus authorities to implement faculty training in the use of the technology, and technical and pedagogical support for these activities. Table 5.1 shows typical faculty and student activities, the type and role of technology employed in the teaching–learning process, and special training requirements to support the LMS for each educational model.

Blended learning is defined as a combination of face-to-face instruction with some elements of the course delivered by technology (Kerres and De Witt, 2003; Osguthorpe and Graham, 2003). There can be many possible arrangements, from the inclusion of more face-to-face components with little technology delivery (such as LMS for syllabi, or e-mail communication between professor and students) to

Table 5.1 Activities and Roles in Educational Models

<i>Model</i>	<i>Professor Activity</i>	<i>Student Activity</i>	<i>Type and Role of Technology</i>	<i>Special Training/ Special Support</i>
Traditional Synchronous	Design the course Teach every day course in classroom usually by lecture format Grade student activity Communicate face to face Has office time to attend to students' doubts	Go to classroom during the semester Listen to professor and take notes Do homework individually or in teams Study to take exams	Blackboards (traditional or smart) that help in the classroom process PC's and projector for use by professor in presentations PC's for students to take notes or research information in class	Does not require special training
Blended learning classroom oriented Synchronous	Design the course Teaches every day course in classroom and post syllabus and calendar on LMS Communicate face to face and by e-mail with students Evaluates students' activities Post grades on LMS	Go to classroom during the semester Listen to professor and take notes Review the LMS and get information from it Do homework individually or in teams Send homework by LMS Communicate with professor and classmates face to face and by e-mail Study to take exams Review grades on LMS	Classroom is the center of activity LMS just to publish syllabi, calendar, and grades	Little special training to make use of LMS

<p>Blended learning oriented to technological oriented Synchronous and asynchronous</p>	<p>Design the course Post all the course in LMS Communicate by several means (LMS, e-mail, chats) Attend the campus sessions/satellite sessions Evaluates students' activities Post grades on LMS</p>	<p>Review course on LMS Make learning activities individually or in teams Send learning activities by LMS Communicate with professor and classmates by several means (LMS, e-mail, chats) Attend the campus/satellite sessions Take exams in face-to-face sessions Review their notes by LMS</p>	<p>PC, internet, LMS and satellite technology are fundamental to this model Classroom on Campus is necessary Other communication means by internet</p>	<p>Little special training to use of LMS</p>
<p>Online or distance Education Asynchrony</p>	<p>Design the course Post the course on LMS Design learning resources and post them (videos, e-lo, animations, etc.) Communicate by several methods (LMS, e-mail, chats, mobile means) Teaches on LMS Evaluates students' activities Post grades on LMS</p>	<p>Review course on LMS Perform learning activities individually or in teams Send learning activities by LMS Communicate with professor and classmates by several means (LMS, e-mail, chats) Take exams on LMS Review their notes by LMS</p>	<p>PC, internet, LMS are fundamental to this model Other communication means by internet</p>	<p>Requires a training to use LMS as professor and students Need of a support pedagogical team to design, develop the course and resources.</p>

AU: Unclear.

extensive use of technology for face-to-face classes, for example, satellite sessions, and course delivery by LMS with e-learning components. As mentioned earlier, these combinations can be made with several types of technology and used in many different ways, as mentioned above. The main objective of blended learning is to get the best of both methods.

E-learning or distance education usually occurs when professors and students are not in the same place and may be in different time zones. In this sense, communication between them must take place through artificial means, such as printed material sent by mail, telephone, and more recently by ICT. In general, technology allows for both asynchronously and synchronous sessions. To Moore (1996), distance education is planned learning that normally occurs in a place different from the teaching site and, as a result, requires specific techniques of course design, instructional techniques, and methods of communication via electronic and other technology, as well as an infrastructure to support the special organization and administrative arrangements.

AU: Moore and Kearsley 1996 in ref. list.

It is possible to distinguish three types of education models for distance education: independent study, the remote classroom, and the interactive model based on ICT (Escamilla, 2008). Independent study, based on printed material, is the most “classic” type of distance education technique; it uses printed materials and is known as “correspondent study.” Students learn by themselves using the designated material. The material is written as a “guided didactic conversation,” so careful reviewing is required since the student is alone with the material (Holmberg, 1998 in Escamilla, 2008).

The second model, the “remote classroom,” tries to reproduce from a distance the interactions that occur in the classroom. Generally speaking, this model is a traditional professor is in a classroom and the students utilizing the television or the Internet. Another name for this model is “distributed classroom.” It is based on technology that allows for synchronous transmission of material to the student (Bates, 1995; Levenburg, 1998). These models are available only for classes that have such technology. Thus, the instructional design for this model is defined by the available technology and depends more on institutional capacity than on student needs (Heydenrych 2000).

AU: Levenburg and Major 1998 in ref. list.

The third model is based on ICT and uses the Internet exclusively. Materials and communication take place on an LMS. This model is known as online or e-learning. In this model, all the participants are taught in the same context. The communication can be both ways, asynchronous or synchronous. To be successful, this model requires more specific course design and close, guided communication. It can be a constructivist learning environment. These three models are summarized in Figure 5.2

The Education Model at Tecnológico de Monterrey

In this section, we introduce Tecnológico de Monterrey, presenting an overview of the education model on which a description of the institution’s e-learning system,

		Space	
		Face to face	Distance
Time	Synchronous	Traditional classroom	Remote classroom (Satellite, TV)
	Asynchronous	No model	Independent study (postal) Online (interactive model based on ICT)

Figure 5.2 Diverse educational models by time or space flexibility.

called the Virtual University, is given in the section titled “The E-Learning Model: The Virtual University.”

Tecnológico de Monterrey

Tecnológico de Monterrey was founded in 1943 by Eugenio Garza Sada and a group of businessmen who established EISAC, a nonprofit association to support the institution’s operations. Tecnológico de Monterrey is a private institution, independent of and not related to any political party or religious group that operates as an educational institution under the statute of a Free University, granted by a presidential decree. Its mission statement declares that its goal is to prepare people with integrity, ethical standards, and a humanistic outlook, who are internationally competitive in their professional field and, who, at the same time, are good citizens committed to the economic, political, social, and cultural development of their community. Nowadays, Tecnológico de Monterrey is a multicampus university system with 33 campuses throughout the country, as shown in Figure 5.3.

The operation of its campuses is supported by nonprofit, civil associations that are constituted by a group of distinguished leaders who are committed to quality in higher education. Each year, the trustees of these various governance associations meet to establish the goals that guide the decisions needed for achieving the institutional mission, which stresses the development of local communities around the country. In order to raise funds to increase the scholarship program and the investment in infrastructure, Tecnológico de Monterrey organizes national lotteries every year. The institution has achieved recognition for both high academic standards



Figure 5.3 Tecnológico de Monterrey.

and for the culture of entrepreneurship, hard work, efficiency, and responsibility it seeks to instill in its students. These values have motivated alumni from different regions of Mexico to promote the establishment of campuses in their home cities. The institution has accepted the responsibility of responding to the important economic and social challenges of the country's development. Alumni have become directors of successful companies in Mexico and other countries, and an increasing number of graduates are in important positions in government and public service. Thus, Tecnológico de Monterrey is working to become a highly recognized university around the world, for the leadership exercised by alumni in the private, public, and social sectors, and for the research and technology development it carries out to promote a knowledge-based economy by generating incubator and business models, improving public administration and public policies, and creating innovative systems for the sustainable development of local communities.

The Education Model

The education model of Tecnológico de Monterrey focuses on the students and their learning, for which students are held responsible. The professor plays the role of facilitator and guides the students in analyzing problems and discovering relevant knowledge in order to apply it in problem solving of practical situations. To achieve these objectives, the education model emphasizes collaborative work

and didactic techniques such as problem-based learning, project-oriented learning, and the case-solving method. In this way, knowledge is applied to solve real-life problems; it makes studying meaningful and becomes the object of critical reflection and social commitment. The education model also includes processes that are enhanced by the use of information technologies and telecommunications. Both face-to-face students and online students use computers to do homework assignment, fulfill their learning objectives, and interact with their classmates and professors. The use of computers favors active student participation on the courses, encourages them to assume responsibility in their learning process, and leads to the formation of authentic learning communities. Every semester, symposia and seminars are organized in various academic disciplines to give students the opportunity to learn about the latest trends. These activities, which are a very important part of academic life, help students develop their teamwork and leadership skills. Students take part in the university's social projects, as well as those administered by different organizations within civil society, government agencies, and charitable institutions. The experience obtained this way allows them to become aware of the social reality of other groups, understand the needs of their environment, and apply the knowledge they have acquired by contributing to the country's social and economic development. Through the school's programs, students acquire knowledge and skills to

- Promote the international competitiveness of companies
- Develop business models to compete in a global economy
- Develop business incubator models and networks to contribute to the creation of enterprises
- Collaborate in professionalizing public administration through analyzing and proposing public policies for México's development
- Design innovative models and systems for education, social, economic, and political improvement

The academic programs also encourage students to appreciate a humanistic culture in its diverse manifestations, as well as the historical and cultural identity of the country and its regions. The programs also include reflections on the ethical aspects involved in dilemmas that arise in professional life, as well as activities aimed at developing civic capabilities. Other elements of the education model that reinforce the entrepreneurial culture and encourage technology transfer include business incubators, business accelerators, and technology parks for the creation and attraction of competitive businesses to accelerate regional growth. Through the development and creation of business incubators, high-tech company, and park models for landing companies, new businesses can be set up and jobs generated.*

* See <http://ruv.itesm.mx>.

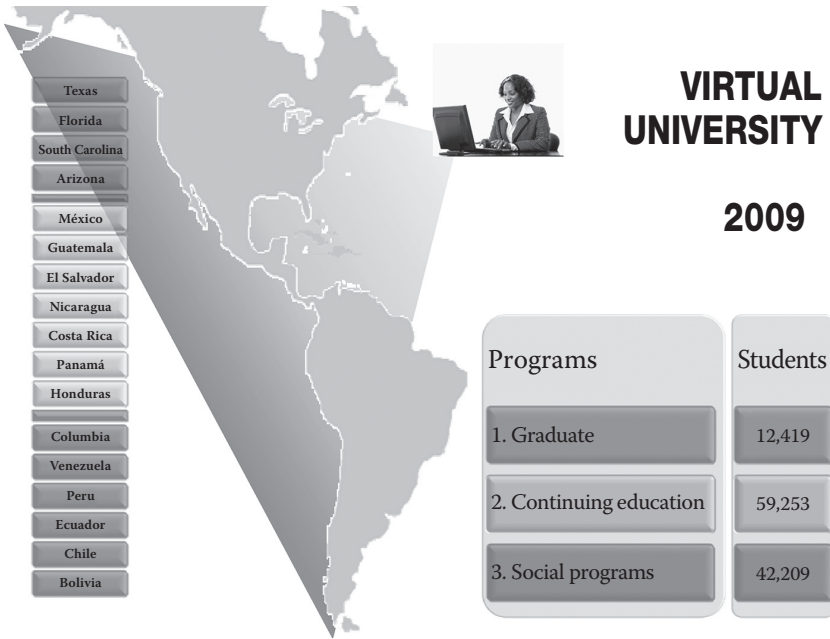


Figure 5.4 Tecnológico de Monterrey's Virtual University.

The E-Learning Model: The Virtual University

The e-learning model at Tecnológico de Monterrey is based on its Virtual University (VU), which has been in operation since 1989. It has become a leading worldwide institution in distance education by offering a variety of online programs. The Virtual University's coverage extends to various Latin American countries and the United States, as shown in Figure 5.4.

The Virtual University offers graduate degree programs, continuing education programs for companies as well as government and nongovernmental organizations; programs for elementary and secondary school teachers, and programs for the development of marginalized communities. In order to do so, it uses learning networks and advanced information and communication technologies.

The E-Learning Education Model

The Virtual University's student-centered education model shifts the emphasis from the teacher to the student as the heart of the learning process. The model enables students to explore and replace the traditional professor's lecture with efficient teaching–learning strategies. The components of the model include the following.

Students

In a student-centered model, students play a more active role and must assume responsibility for their own learning. The advantage student's gain by adopting an active role is the development of new skills, and an increase in their retention capacity. In distance education, the role of the professor is to organize and facilitate the learning process. Professors provide knowledge and design the course contents. Students interact with the professor and their peers, generating new content via research and interaction with classmates.

Self-Directed Learning

Academic activities are carried out by each student, at his or her own personal pace. Self-directed learning promotes an independent kind of learning and allows a student to develop abilities, attitudes, and values that can help them perform better in a global society.

Some of these self-study activities include the following:

- a. Reviewing articles and reading material
- b. Reviewing links and databases
- c. Reviewing contents of the Web page
- d. Taking exams
- e. Analyzing and reviewing cases, situations, and problems
- f. Completing homework assignments

Collaborative Learning

Collaborative learning is a socialization experience that is oriented toward getting students to play an active role in their learning via interaction with the professor and their fellow students, often located in different geographic regions. Collaborative activities include

- a. Problem solving
- b. Case solving
- c. Collaborative activities
- d. Exchange of ideas and opinions
- e. Carrying out projects
- f. Discussion, analysis, and debates

Faculty

Courses are designed by outstanding faculty members who are specialists in the institution's various content areas and are supported by a group of educational technology specialists who enhance materials using various technologies.

Tutoring

The model requires direct monitoring of learning by personal tutors. The tutor is a professor who is a specialist in the field and can facilitate learning and support students during the entire educational process.

Tutoring is provided by both the professor and the tutor, through the following media: interactive forums on the technological platform, e-mail, instant messages, telephone and, on special occasions, by radiochat (voice broadcasting).

Meaningful Learning

Classes promote meaningful learning as students apply their knowledge, skills, and attitudes in a real-world context. Knowledge is applied to solving real-life problems, which makes studying meaningful and becomes the object of critical reflection and social commitment. Everything learned has an impact on students' development and as individuals and in the workplace.

Course

The course content is provided online in a manner that facilitates learning over the Internet. The courses encourage research and information queries using digital libraries and other databases. Course design offers flexibility in time and space, so students can work at their own speed.

Teaching Techniques

The education model centers on the use of advanced teaching techniques that help students to learn collaboratively through problem solving and case analysis, as well as project design.

Information Technologies

The model requires the use of a technological platform and diverse information technologies to provide students with a space for interaction, querying, and learning. The VU's educational model promotes meaningful learning using technologies in a learning environment. As a result, students develop new and useful skills and knowledge for their personal and professional life. This is achieved by

- Teamwork
- Technology utilization
- Cases, problems, and solution generation
- Information search and analyses

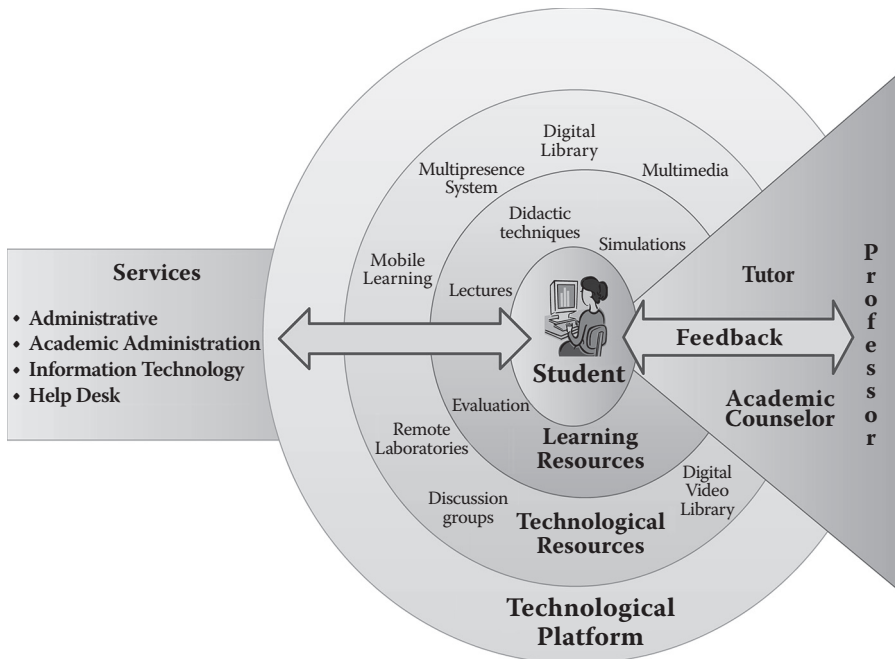


Figure 5.5 Elements of the e-learning course delivery process.

Blackboard

Blackboard, used in many universities, is a flexible, proprietary LMS platform. It contains basic functions to create the documents for the administration of a course. It is based on Web technologies and has the following characteristics:

- It offers the possibility of applying Web-based systems that help design a course creatively and that use electronic resources to support learning.
- It is governed by international standards (IMS) for content development.
- It allows for synchronic and nonsynchronic communication.
- It is easy to use and does not require extensive training.

Figure 5.5 summarizes the main elements of the e-learning model developed at the Virtual University over the years.

The E-Learning Programs

The e-learning programs offered by the Virtual University follow the education model described in the section titled “The Education Model at Tecnológico De Monterrey” and in the subsection titled “The E-Learning Education Model.” There

Table 5.2 Types of e-Learning Programs Offered by the Virtual University

• Undergraduate courses
• Graduate programs
• Continuing education programs
• Social development programs

are four types of programs, as shown in Table 5.2. The Virtual University does not award undergraduate degrees. However, undergraduate courses are given online. The VU's graduate degree programs focus on the areas of business, engineering, information technologies, public management, the humanities, and education. The continuing education programs are offered to companies and the government for professional training and skill development in employees. The social programs are offered by Tecnológico de Monterrey and the Virtual University in alliance with federal, state, and municipal governments in rural areas for basic training and the development of skills by their residents.

The following statistics pertain to 2009: 17,330 undergraduate students were taking online courses; 12,419 students were enrolled in graduate programs; 59,253 employees took continuing education programs; and 42,209 people benefited from courses in social program courses.

The e-learning graduate programs offered through the Virtual University are displayed in Table 5.3. These programs are in the areas of business, information technologies, engineering, public management, and the humanities.

The e-learning graduate programs in education offered through the Virtual University are shown in Table 5.4. There are three master programs, with various specializations, and a research PhD program in educational innovation.

A Knowledge Management Model for E-Learning

This section outlines the main components of a knowledge management (KM) model that is under development to support the e-learning model at Tecnológico de Monterrey's Virtual University. This model is at the core of a research project at Tecnológico de Monterrey (Cantu and Heredia, 2009).

Knowledge management investigates the processes of knowledge creation, storage, distribution, and use (Liebowitz, 1999). There are various approaches and methodologies to KM (Liebowitz and Beckman, 1998). This KM methodology includes the following steps: identify, collect, select, store, share, apply, create, and sell knowledge within an organization with the intention of developing a corporate memory to store and distribute information and knowledge relevant for business operations. The KM model proposed in this chapter agrees with the e-learning

Table 5.3 e-Learning Graduate Programs

AU: Should this, and similar entries in this table, be "Master's"?

• Master in Business Administration
• Master in Marketing
• Master in e-Commerce
• Master in Innovation and Business Development
Information Technologies
• Master in Administration of Information Technologies
Business
Engineering
• Master in Science with specialization in Quality Systems and Productivity
Public Management
• Master in Public Administration
Humanities
• Master in Humanistic Studies

Table 5.4 e-Learning Graduate Programs in Education

Master of Education
• Teaching and Learning Processes
• Cognitive Development
• High School Teaching
• Science Teaching
Master of Education: Administration of Educational Institutions
• Basic Education
• Higher Education
Master in Educational Technology
• Innovative Media for Learning
• Corporate Training
PhD in Educational Innovation

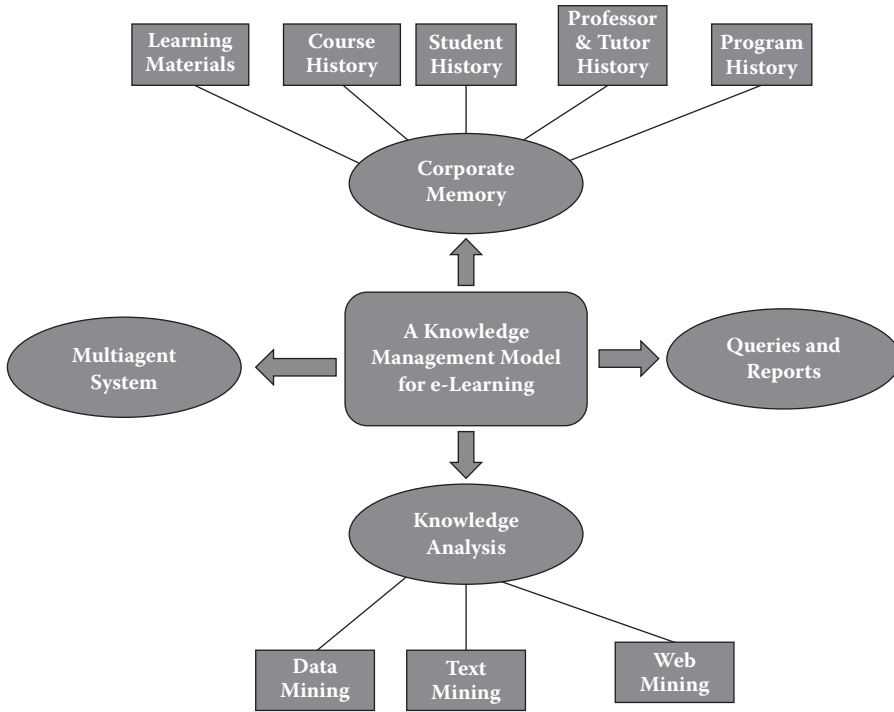


Figure 5.6 Elements of the Knowledge Management Model for e-learning.

model displayed in Figure 5.3 and provides operational support by means of the elements displayed in Figure 5.6.

An E-Learning Corporate Memory

The e-learning corporate memory is a set of entities defined by their attributes, whereby each of the entities is represented by a repository that stores information such as learning materials, courses, students, professors, and tutors. The entities and their repositories are as follows:

Learning materials: This repository stores learning materials for every course offered online each term. The materials are kept online for student consultation during the term. These materials include presentations, videos, case studies, and others.

Courses: This repository stores information about the courses offered each term, including the course syllabi. It also stores interactions and discussions that take place among professors, tutors, and students through discussion forums.

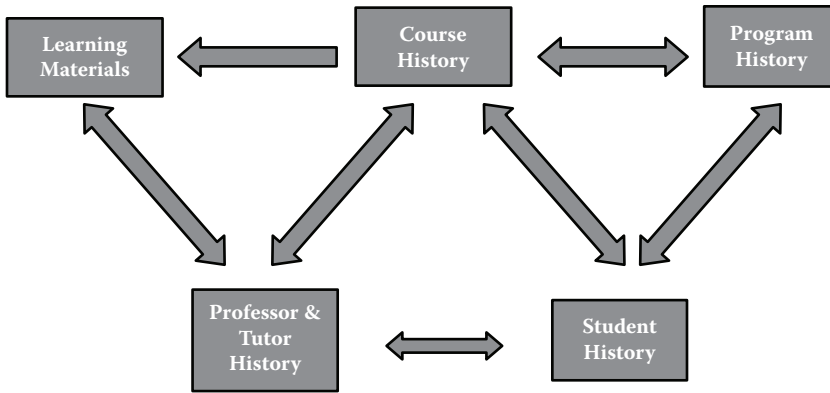


Figure 5.7 Interactions among entities of the e-learning corporate memory.

Students: This repository stores information about students enrolled in every course each term for each program, including scores, homework assignments, projects, and student interactions.

Professors and tutors: This repository stores information about professors and tutors who support each course each term for a given program.

Programs: This repository stores information about the e-learning programs offered at the graduate level or for the continuing education and social programs.

The Blackboard platform provides the means and facilities for storing information from each of these repositories. Interactions among these repositories are shown in Figure 5.7.

Other Elements of the KM Model

The remaining elements of the KM model for e-learning are as follows.

Knowledge Analysis

Knowledge analysis is about the use of either data, text, or Web mining techniques to extract knowledge and useful information from each of the components of the e-learning corporate memory to assist program directors and academic administrators and other decision makers in the design and updating of online academic programs (Cantu et al., 2006). For instance, we can infer the likelihood of student success based on transcript record, SAT scores, university of precedence, and the program of enrollment. We have done student profiling for scholarship allocation as well as text and Web mining for international student exchange and course revalidation (Rios and Cantu, 2006). We can also extend the capabilities of Blackboard's Safe Assign to detect plagiarism in student projects and assignments.

Multiagent System

The use of multiagent system (MAS) technology to automate and provide “intelligence” to the e-Learning model is another ongoing project that builds upon previous experiences with the MAS technology in knowledge distribution (Aguirre et al., 2001) or managing research assets (Cantu and Ceballos, 2010). E-learning is modeled as an electronic institution in which software agents monitor and execute the transactions that take place around online learning processes (Ceballos and Cantu, 2009). Agents also monitor external events on internet Web pages and, through Web services, update the corporate memory repositories and perform data consistency operations (Ceballos and Cantu, 2007).

Queries and Reports

Finally, queries and report facilities are available at user convenience to obtain information about the various components of the e-learning programs. Data cubes and other visualization techniques are employed to answer queries and obtain views of repository data.

Conclusions

We have presented a description of Tecnológico de Monterrey’s Virtual University, its e-learning model for distance education, its online programs, and we have given statistics about student enrolment and social impact. Operations at the Virtual University started in 1989 with satellite transmission and have evolved over the last 20 years with the development of the Internet and with an outreach through the Americas with various kinds of programs that include graduate academic degrees, continuing education, and social programs. The graduate academic degrees are in the areas of business, information technologies, engineering, public management, and the humanities. An ongoing research project for constructing a KM system to administer the operations of the e-learning programs has been outlined, and it will continue under development in the next few years.

Acknowledgment

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References

- Aguirre, J. L., Brena, R., and Cantu, F. J. (2001). Multiagent-based knowledge networks. *Expert Systems with Applications an International Journal*, No. 20, pp. 65–75, Elsevier.
- Bates, A. W. (1995). *Technology, Open Learning and Distance Education*. New York: Routledge Publishers.
- Cantu, F. J. and Heredia, Y. (2009). A Knowledge Management Approach for On-Line Education. Technical Report, Center for Intelligent Systems, Tecnológico de Monterrey, Mexico.
- Cantú, F. J., and Ceballos, H. G. (2010). A multiagent knowledge and information network approach for managing research assets. *Expert Systems with Applications and International Journal*, doi:10.1016/j.eswa.2010.01.
- Cantú, F., Garza, L., Robles A., and Morales-Menendez R. (2006). Learning and using Bayesian networks for diagnosis and user profiling. *Proceedings of the Twelfth Americas Conference on Information Systems—AMCIS*. pp. 1402–1409. Acapulco, México.
- Ceballos, H. and Cantu, F. J. (2009). Towards a causal framework for intelligent agents development. *Proceedings of the Special Session of the Eight International Conference on Artificial Intelligence (MICAI 2009)*. pp. 67–72. IEEE: Los Alamitos, CA.
- Escamilla, J. (2003). Selección y uso de tecnología educativa. México, D. F. Trillas.
- Escamilla, J. (2008). Hacia un aprendizaje flexible sin fronteras y limitaciones tradicionales in Tecnología educativa en un modelo de educación a distancia centrado en la persona Lozano A. y Burgos, V. Eds., México, D. F., LIMUSA.
- Heydenrych, J. (2000). A comparison of the remote classroom (rc) approach and the guided independent study (gis) approach for the university of South Africa. *Progressio*, 22 (1).
- AU: Initials? Kerres, M. and De Witt. (2003). A didactical framework for the design of blended learning arrangements. *Journal of Education Media*. 28 (2–3): 101–113.
- Levenburg, N. and Major, H. (1998). Distance Learning: Implications for Higher Education in the 21st Century. *The Technology Source*.
- AU: Cited as Levenburg 1998 in text. Martín, M. (2002). El Modelo Educativo del Tecnológico de Monterrey. ITESM: Monterrey, Mexico.
- AU: Not cited in text. Moore, M. and Kearsley, G. (1996). *Distance Education: A Systems View*. Belmont, CA: Wadsworth Publishing Company.
- Osguthorpe, R. T. and Graham, C. R. (2003). Blended learning environments: Definitions and directions. *The Quarterly Review of Distance Education* 4(3): 227–233.
- AU: Moore 1996 in text. Rios, M. T. and Cantú, F. J. (2006). Knowledge discovery in academic registrar data bases using source mining: data and text. *Proceedings of the Twelfth Americas Conference on Information Systems—AMCIS*, pp. 1392–1401. Acapulco, México.
- Liebowitz, J. (1999). *Knowledge Management Handbook*. CRC Press, Boca Raton, FL.
- Liebowitz, J. and Beckman, T. (1998). *Knowledge Organizations*. Saint Lucie Press Washington, DC.

