Developing a Technology Based Learning Model

Dumitru RADOIU, Calin ENACHESCU
Petru Maior University of Tirgu Mures

Abstract- Education at Petru Maior University (PMU) has been rapidly transformed by the campus-wide use of interactive learning and Advanced Learning Facility (ALF). The paper addresses the issue of Web-based learning model as a solution to residential education challenges while facing a quick enrolment growth and wide varying degrees of prior IT knowledge and skills.
While the common approach is to develop a learning model based on what the newest technology can offer, ours was to only use the technology that best suits the actual development stage of our learning model.
The web-based learning model we use is a natural extension of PMU residential educational experience and tradition and forms the foundation for future developments of residential and distance education at the Institute. The model uses common course tools, traditional human presence and humanized web-based environment.
This paper provides an overview to the evolution of the model, a description of the techniques, technologies and design strategies involved in developing the synchronous and asynchronous components of a course, and an overview of implementation issues.

Index terms- web-based learning model, Advanced Learning Facility (ALF), design strategies, Web-based education components, and Web-based education process optimization and validation.

Background

Over the last decade technology has had a profound effect on teaching and learning. Most of the effort was focused on what technology can do for education in order to replace the exemplary role of the teacher and diminish the need of the human presence. The effort to improve education was mostly technology driven than problem to be solved driven. The issue is not what technology can do, but rather what we have to do when using technology to make learning successful.

As technologists, we are always tempted to look for a technological solution. Even more we often read statements like: “E-learning is replacing total instructor-lead… It gives a much better return on investments.” [4]

- Yet the question is not what technology can do, but:
- What do we need to do to make learning successful?
- Are there technologies that can help us do it?
- What learning model is our learning process based on?
- If we change it is the model consistent with our institution and faculty (staff) knowledge, tools, skills and experience?

It looks like simply integrating technology into the learning process is not going to bring the best results, if any positive.

Technology based learning requires some fundamental re-thinking about what learning really means, and what is the faculty’s role in making it happen

A successful learning experience has also to take into account several given elements:

- students’ prior IT knowledge and skills
- their previous learning habits and experience
- level of faculty (staff) IT knowledge and training
- staff previous teaching experience and tradition
- available technology
- available IT enabled facilities (auditorium, labs, ALFs)
- the stage of IT infrastructure implementation
- time (for courses and labs)
- staff teaching load
- available founds
- available (technical, pedagogical, teaching, training) support

Due to the structure, content, legislation and evolution of the Romanian education system students enrolling at Petru Maior University have varying degrees of prior IT knowledge and skills. The students represent an extremely

diverse group in age, programming background and majors (e.g. some math and science, some art and literature). For most of them the best prior exposure to computing has been a word processor or a spreadsheet; for a few programming languages and for most of them next to nothing.

The same is also valid for staff. Few have benefited of mobility in technologically advanced educational institutions. Even fewer have systematic training organized and financed by the university administration.

Traditional education cycle is still enforced by the Ministry of Education and is based usually on two-hour lectures and a two-hour laboratory per week. Due to several reasons (e.g. lack of founds, unattractiveness of the position) TAs (teaching assistants) are almost inexistent.

The instructor usually lectures to approximately 100+ students at a time and a TA (teaching assistant) conducts the laboratory sessions for 25+ students at a time.

Re-stating the objectives

Availability of IT infrastructure exerted a certain pressure to use it into the learning process no matter what, if only to meet the technological expectations of the students.. The “glue” was also there, in the body of several advanced e-learning tools like WebCT and Top Class.

Yet Web based learning randomly inserted into classical education was a real danger (low efficiency, high failure risk) without prior adequate training of staff, audit of students’ skills, constant support. Simply using e-learning tools would mean almost sure failure for web-based learning and tools provide a lot of functionality as well as a lot of constraints.

In moving from classical learning towards web-based learning we started by re-stating the institution objectives:

- Base the learning process on a model/theory
- Make the most out of staff classical approach on learning

- Smooth transition from classical approach to technology enabled learning
- Training the whole staff to use ALF
- Overcome students IT diversity by auditing, training and tutoring them to use on-campus learning environment
- Receiving national recognition for Web-based undergraduate study

The first objective is to base the whole process on a suitable and accepted learning model (theory). The primary purpose and value of a theory [1] is that it helps describe and explain a phenomenon. A theory is like a map; in fact a map is a theory. It shows the general shape of something in a simplified form; it shows the relationships among the constituent parts of a phenomenon; and very important, it shows what areas are not known.

Towards a 21st Century Learning Model

We started from the observation that the driving force in effective learning is the learning model. Only some of the PMU learning model fundamental ideas presented bellow are research based; most of them are the result of years of practice. The implementation of the Web based learning model is a natural extension of PMU on-campus residential learning environment and – at this stage - is looked at as complementary to the traditional approach.

An emerging approach to twenty-first-century learning calls for instruction to become more learner-centered [6] (Table 1)

20th Century Learning (Instructor-Centered)	**21st Century Learning (Student-Centered)**
Lecture	Facilitation
Individual learning	Team learning
Student as listener	Student as collaborator
Instructor as source	Instructor as guide
Stable content	Dynamic content
Homogeneity	Diversity
Evaluation and testing	Performance

Table 1

In the new environment the student could be less of a listener and more of a collaborator in the learning experience.

- We added to this some experience derived principles:
- Make it simple so almost everybody can use it
- Keep the balance (e.g. between old and new, synchronous and asynchronous, lecture and hands-on)
- Maximize interaction (especially student to student interaction)
- Use all instructional events (In the classic reference on instructional design, Gagne, et al [3] identify nine events (Table 2) that need to be included in each learning experience.
- Asses suitability of the model for different types of content

Gain attention: appeal to the learner's interest
State objectives: tell the learner the kind of performance that indicates learning **Stimulate recall of prerequisite learning:** new learning is the combining of past ideas **Provide the stimuli material:** content that needs to be learned **Provide the learning guidance:** learner needs to discover, not to be told **Elicit performance:** have learners show that they know how to do it **Provide feedback:** correctness and degree of correctness of the learners performance **Asses performance:** immediate indication that the desired learning has occurred
Enhance retention and transfer: set a meaningful context for the content just learned

Table 2

The Learning Model

The basic idea in our learning model is to use technology to make instructional learning (group learning) as effective as tutoring (one to one learning). Therefore first basic concepts we use are:

- **Tutor** (one to one learning experience), the one who provides knowledge and support on the spot and assesses performance immediately
- **Instructor** (one to many), the one who provides the knowledge and organizes the environment (not the people).
- **Student**

As learning can be viewed as the combination of information and interaction, other basic concepts are:

- **Content**: lectures, books, on-line tests, on-line tutorials, PP presentations, Web-based course.
- **Content tools:** WebCT
- **Interaction,** substantiated as conversation between instructor/tutor and student, student and student, and student and content.
- **Interaction tools:**
- **Presence** (of others) a critical affective dimension that is requisite to effective learning; presence is at low level in text-based communication channel and at high level in face to face interaction channel.

  A new concept has been coined in the idea of measuring medium's "affective channel capacity" (Picard, 1997). Affective channel capacity is defined as how much affective or emotional information a channel lets through as compared to the total amount of information is passed. In videoconferencing - for instance - it may or may not be synonymous with bandwidth. Pointing a camera at a wall uses the bandwidth, but does not transmit any affective information.
- **Advanced Learning Facility** (ALF) Small well equipped classrooms/labs (instead of large auditoriums/lecture halls). Basic equipment means: LAN, Internet/Intranet access, video projector, large screen.

  ALF allow students and instructor/tutor to interact with each other

and with the content. Content presented by instructor is available and accessible by all students at all time: during lecture, during hands-on, labs and for off campus use via Internet.

- **Mini-lecture,** lecture for a small group of students (e.g. 25) using ALF advantages.
  Mini-lecture and ALF exploits intensively student to student interaction and facilitates the learners to become active creators of their own knowledge rather than passive receptacles of delivered content.

We started from the 4 possible web-based learning scenarios [6] and the Kolb Learning Cycle [7]

Scenario	**Time of Event for All Students**	**Location of Event for All Students**
1	Same time	Same place
2	Same time	Different place
3	Different time	Same place
4	Different time	Different place

Table 3

Scenario 1 depicts a typical face-to-face learning environment, which will continue to be appropriate or even necessary for some content and some student population.

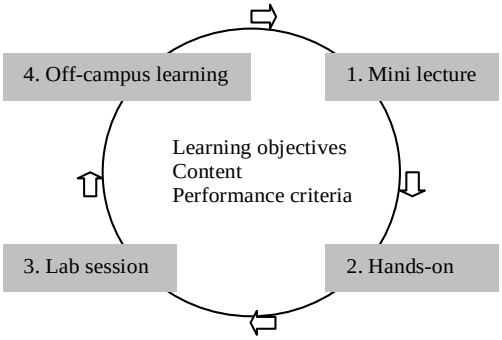
Scenario 2 describes a synchronous technology – enabled learning environment (e.g. video/audio/computer conferencing, ODL). Learning activities and interaction take place at the same time. Students participate in multimedia learning experiences and active collaboration in which they share with instructor and fellow students common software applications.

Scenario 3 describes a computer science lab type environment. Web-based multimedia content, virtual labs, tutorials are used

Scenario 4 describes a learning activity taking place at different times and different locations. Communication with others in the learning group may be accomplished with asynchronous technologies (e.g. e-mail, bulletin boards)

Fig. 1 Kolb Learning Cycle

The literature [5] recommends we incorporate all styles in our teaching in a planned way. This accommodates various natural learning styles and helps students learn to learn in various ways.
The figure bellow (Figure 2) shows the cycle starting with a mini lecture (1) and hands-on session (2), followed by (3) and (4). This sequence is not compulsory; the activities and events are left to the instructor who evaluates their suitability to the content.



1. Mini lecture

Instructor as source
Group learning
Synchronous learning experience
Presence: High
ACC (Affective Channel Capacity): High
Content: Dynamic
Student: Listener
Scenario: 1 and/or 2
Requirements: ALF, video/audio/computer conferencing tools, content tools

Description:
A diversity of learning resources are made available to the student to ensure that the content is both up to date and relevant to the students' situation [6]. Students are given Concrete Experience related to the concepts being introduced. Students think about the experience (Reflective Observation) and interact with instructor. The Instructor can then introduce the underlying concepts or theories (Abstract Conceptualization).

2. Hands-on session

Instructor: guide
Team learning
Synchronous learning experience
Presence: High
ACC (Affective Channel Capacity): High
Content: Dynamic
Student: collaborator
Scenario: 1 and/or 2
Requirements: ALF, content tools, virtual labs

Description:
Students experience the newfound knowledge on real examples (Active Experimentation). Guidance provided by the instructor will smooth out the large diversity of students prior IT skills and knowledge. This stage serves as a template for the asynchronous learning experiences in later stages.

3. Lab session

Instructor (TA): guide
Team learning
Synchronous and asynchronous learning experience
Presence: High
ACC (Affective Channel Capacity): High
Content: Dynamic
Student: collaborator
Scenario: 3
Requirements: CS lab

Description:
As learners gain more experience and confidence in this type of learning environment the instructor can increasingly take a distance and use intensively student-student interaction to enhance transfer an retention
Instructor activity focuses on assessing performance and evaluation.

4. Off-campus learning

Instructor:
Individual learning
Asynchronous learning experience
Presence: Low
ACC (Affective Channel Capacity): Low

Content: Static
Student: collaborator
Scenario: 4
Requirements: on-line access from home, library, etc.

Description:
This completes the cycle and prepares the student for the next cycle.
Streaming technology can bring presence element to a higher level for the on-line (asynchronous) learning modules

On average, about 70% of a student's time would be spent on self-paced engagement of learning materials and about 30% in synchronous learning sessions with the instructor. These percentages are of course flexible and the optimal allocation of time to synchronous and asynchronous components is an open issue being a function of several variables including the nature of the course content, the age of the students, development costs, and staff training. There're many possible allocations of time to asynchronous vs. synchronous learning.

Preliminary Findings and Future Work

The learning process efficiency appears to depend on the accuracy of the audit of the ability of the students to use the technology on which the learning process is based.
There's no consensus so far on the audit procedure nor is the audit consistent from one department to another.
On the other hand not all professors have adopted the model.

Advances in networks, tools and techniques will allow ever greater functionality in the design and delivery of content, improving both synchronous and asynchronous learning experiences significantly enhancing online learning.
Therefore revising and optimizing the model periodically is a must.

References

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