THEORY OF CONSTRAINTS APPLIED TO E-LEARNING

Myron Hatcher, Craig School of Business, California State University, 5245 N. Backer Avenue M/S PB7, Fresno CA 93740, 559-250-1729, myronh@csufresno.edu and Matthew Yen, Information Technology

ABSTRACT

Similar to a production system, effective delivery of E-Learning must overcome external constraints as well as internal constraints. Removing constraints require consistent planning and conflict resolutions. Theory of Constraints (TOC) is a systematic approach to identify and exploit system constraints for improved performance. By verbalizing intuition with tools, such as: the cloud, the branch and the target tree, TOC has successfully been applied in education of all levels for behavioral modifications and content analysis. These tools have also improved the performance for numerous organizations in manufacturing industry and service industry. These are viable tools to effectuate e-learning delivery.

INTRODUCTION

When designing e-learning courses, our focus is often on technologies and deliveries. *The way we look at the problem is the problem* (1). The modus operandi of e-learning is far more complex than traditional classroom lectures or labs. It provides flexibility and allows asynchronous learning. It melts down geographical boundaries and may reach far and beyond. Internet resources are abundant. Overall e-learning has great value and enormous benefits. Simple, it overcomes the time and space barriers common to most group activities.

On the other hand, there are associated disadvantages and problems which need to be addressed. Even though individual student may find tremendous freedom with e-learning, it may impersonal due to restricted interaction. The paradigm shift demands us to approach e-learning with a different attitude and behaviors. It may also require a different set of outcome expectations.

E-learning is more than the application of internet and technologies. It is a whole new way of education. Unless we take a holistic point of view, e-learning is just another tool and not a paradigm shift. *Besides technologies, we must address behavior, habit, attitude and ethic issues.* Unfortunately technology itself offers little helps in this area. First behavioral issues: instructors and students have to adapt a new way of communication and interacting where their backgrounds are important in the success of this interaction. It requires disciplines and time-management. Second, the attitude and ethic issues: instructors and students are literally 'free' from traditional auditing practice. The false sense of freedom may lead to degraded education and non-essential learning.

Theory of Constraints (TOC) was developed to improve manufacturing productivity and management effectiveness in a 'loosely coupled' network environment. The concepts and tools developed may well be applied in a 'loosely coupled' e-learning environment. Three TOC thinking tools: the cloud, the branch and the target tree, have been applied in numerous classes and schools worldwide. This paper

examines the applications of these tools for both behavior issues and content analysis in the e-learning environment.

Effective learning requires disciplined thinking. Educators realize that critical thinking is such an important life skill and require students take courses in this area. However, most required courses fails to teach students as independent thinkers. Why? Because thinking process are such an abstract activity that most teachers do not know how to instruct students to think, let alone 'critical thinking' and effective learning. Goldratt developed three specific thinking and communication tools for such needs: namely: ***the Cloud, the Ambitious Target Tree, and the Branch***.

APPLYING TOC TO E LEARNING

Fredenall classifies constraints into three types {2}. They are:

1. Physical or logistical constraints – these are resources within system which have capacity that is equal to or less than the demand placed upon it.

2. Policy constraints – these are decrees or rules from management staff that sets limits on the system performance in that they do not lead directly to achieving the goals and objectives of the system.
3. Paradigm constraints – these are entrenched habits or assumptions of people in the system that things must be done this way because they have always been done this way. Paradigm constraints often lead to policy constraints which may lead to physical constraints.

BRANCH TOOL APPLIED MIS COURSE

The MIS, Management Information System course, is among the first major classes a business student takes. It normally is taken as a first semester junior. This course is in contract to a programming class where many people self-teach themselves. Programming classes are ideally suited for e-learning partially because of the student population. Instructor may plan the MIS class by using the cause-effect process, the branch – also known as transition tree, to plan the class. Instructor can also tie the grading scheme, A, B, C, D and F, in the branch to reflect stages of learning, expectations, obstacles and actions they may take to achieve intermediate objectives (IO s) as shown in the following diagram. Professors may expand this branch in a separate diagram if students are having difficulties with a particular intermediate objective.

Figure 1. The Branch for an Information Systems Audit Project in a MIS course.

Sept. 18, 2003	Information Audit completed	
	Synthesis	
Actions: Learn to define competitive advantage and determine what strategy makes the system work	Know how to determine competitive advantage and related strategies	Obstacles: What is competitive advantage and how does a strategy effect it?
	Synthesis	
Actions: Study the system in depth and determine the data that is essential for the system to function	Know how to define critical data	Obstacles: What is the critical data and its attributes for this system?
	Synthesis	
Actions: Review the definition of Information and apply Input, Process, Output analysis to system and determine information.	Know how to define information used by the system	Obstacles: What is information anyway, let alone in this system?
	Synthesis	
Actions: Study IS infrastructure and how to define it.	Know how to define hardware and software components of the system	Obstacles: There is so much hardware, software, and firmware, what is critical?
	Synthesis	
Actions: Study the theory of critical Success factors and via interviews and synthesis apply to this system.	Know how to define critical success factors of the system	Obstacles: What is a critical success factors and what are they for this system?
	Synthesis	
Actions: Study the modern definition of product and decision processes.	Know how to define product and decision process	Obstacles: Today, the term product has a new meaning, what is it, and what decision processes are.
	Synthesis	
Actions: Study methods of interviewing and questionnaire design.	Know how to create a sample questionnaire for interviews and set up interviews	Obstacles: How to gather information?
	Synthesis	
Actions: Study the definition of an information audit and the process.	Do not know how to do an Information Audit	Obstacles: What is an information audit?

DISCUSSION AND CONCULSION

To deliver E-learning requires a complex web of people, equipment, methods, materials and measures. Changing technologies, emerging disciplines, information explosion, complex policies and legal issues, etc. may further complicate its delivery. Technology can only improve 'local' performance. Behavioral changes, habit and attitude adjustments are pre-requisites for successful e-Learning. TOC offers critical thinking and visual communication tools for students as well as instructors.

REFERENCES

{1} Covey, S. R., *The Seven Habits of Highly Effective People*, Simon and Schuster, NY.1989

{2} Fredendall, L. D. and Hill, E.. *Basics of Supply Chain Management*, the St. Lucie Press/APICS Series on Constraints Management, 2001.