Learning Laboratories: Designing a Reflective Learning Environment

Daniel H. Kim
System Dynamics Group
MIT Sloan School of Management
E40-294, Cambridge, MA 02139/ USA

Abstract

The use of interactive gaming environments to teach systems principles has recently been gaining in popularity. One of the most promising applications of system dynamics model-based games is "learning laboratories," workshops that blend system dynamics principles and repeated simulation game trials with ongoing conceptualization and feedback sessions to help managers gain a deeper understanding of the system within which they operate. This paper will first describe the design of such a learning laboratory, its implementation, and its use as a vehicle for learning to think more systemically. This will be followed by a discussion on how the learning lab helps unearth deep-rooted assumptions and encourages people to challenge them in a "double-loop learning" mode. Finally, the paper concludes with a brief discussion on possible future steps towards developing systems thinking skills in an organization.

Introduction

Toffler [1970] wrote about the increasing pace of change in *Future Shock* and how people would be paralyzed by the immediacy of its arrival. Ackoff [1981,4] also highlighted the potent nature of change which Donald Schön first articulated: as "the rate of change increases, the complexity of the problems that face us also increases." In other words, as the problems grow in complexity, it takes longer to solve them and the proposed solutions have shorter lives. In fact, solutions are often stillborn because the problems change so rapidly that solutions, when found, are often no longer relevant. One of the consequences of such rapid change is that managers are forced to make decisions with equal rapidity or be left behind. However, the complexity of the problems makes it imperative that managers take more time to reflect on their decisions. How, then, can a manager speed up and slow down at the same time? How can one manage in a world where experience is no longer the best—or even adequate—teacher since change makes yesterdays' lessons obsolete?[1] At a more macro level, how can organizations remain viable given this paradoxical dilemma? Although in real life this simultaneous need for both the compression and expansion of time can not be fulfilled, in what Schön[1983] refers to as virtual worlds, it is a possibility. The learning laboratory is one implementation of such a virtual world.

A learning lab (LL) can be viewed as a manager's equivalent to a sports team's practice session or a pilot's flight simulator. It is a place where a manager can not only accelerate time by simulating a model (or virtual world) of a real life system over long time periods but also slow down the flow of time at each decision point. The LL is a managerial "practice field" where one can test out new strategies and policies, reflect on the outcomes, and discuss pertinent issues with others in the group.

[1]It is not at all clear that traditional training methods, such as the case study, are good at transferring learning from one situation (experience) to another. In fact, Kardes [1987] points out that lessons learned from a case are problem-specific and indivduals have great difficulty applying prior knowledge to new situations.

The Claims Learning Lab (CLL) was developed by two system dynamicists and three claims people in an insurance company, all of whom were interested in exploring how system dynamics could help them better understand the insurance industry. Over a period of eighteen months two system dynamicists worked with the claims people to develop a simple model of the insurance claims function.[2] The model was converted into a game in which managers run a claims office where they must make three decisions—hiring, desired productivity, and desired settlement size—on a monthly basis for a period of fifty months.

Claims Learning Laboratory Design

The initial purpose of the CLL was to simply share the systemic insights gained by the CLL development team with the other claims managers in their organization. In designing the CLL, the goal was to create an environment in which managers could step out of day to day demands to reflect on their decision-making, develop a common language, learn new tools for thinking systemically, discuss operational objectives and strategies in an open forum, test operating assumptions, experiment with new ideas about managing a claims office, and of course, have fun. To help promote such an environment, participation was purely on a voluntary basis[3]. After the success of the first lab and the growing momentum of interest with each subsequent one, the purpose of the CLL evolved towards a broader goal of developing systemic thinking skills throughout the entire organization. The following is a detailed description of the design and implementation of a typical three-day learning lab.

I. The First Crucial Hour—Buy-In

Explaining to participants the context of the CLL—history of its development, original intent or purpose—is critical for establishing a common understanding between workshop leaders (WL) and participants that the CLL is not meant to provide "the answers," but to serve as a useful vehicle for illuminating and communicating issues of importance. The WL are positioned as *enablers*, not authority figures, and the participants are encouraged from the outset not to hesitate to challenge the assumptions of the model with which they will be working. Participants are also encouraged to share any reservations or concerns they may have about the CLL with the rest of the group. These techniques emphasize the experimental aspect of the CLL and encourage participants to challenge their operating assumptions.

II. Current Reality—Where Are We?

It is important to draw participants into the process as soon as possible. This can be done by trying to construct a group picture of current problems and issues which they all face in their jobs. Early small group interactions in formulating the picture are key. They set the expectations about the level of activity required of the group. The idea is to get participants to explore specific issues that are relevant and highly

[2]For a full description of the development process see Senge[1989]; for an analysis of some of the game plays, see Moississ[1989].

[3]Although the program was developed with claims managers in mind, non-claims people were also allowed to attend whenever space permitted. As it turned out, several General Managers and V.P.'s, as well as marketing, underwriting, and administration people participated.

visible to them (and which are also in the model). To facilitate this discussion, causal loop diagram (CLD) representations of the issues and how they play out over time are presented and discussed. Working in small groups, the participants are then asked to brainstorm and come up with a list of operational objectives, strategies required to achieve them, and obstacles that need to be overcome in order to reach to reach their goal. The overall purpose of this exercise is to get everyone to think in terms of specific issues to which they can personally relate.

III. Introducing the Tools—CLDs

The introduction of CLDs are coupled with a "storytelling" sequence—talking out loud as one traces around a loop. This entails more than just repeating the "bare bones" variable names of the CLDs (e.g. increase in A leads to increase in B which forces a decrease in C, etc.). Participants must learn to be able to engage their audience by telling a convincing story, using the CLDs to bring discipline into the way they talk about a problem or issue. The WL begin with very simple, basic examples of balancing (or negative) and reinforcing (or positive) loops (e.g. savings & interest), then use a small portion of the CLDs in the game model to connect the tool to the issues at hand, and work through specific examples from the model with which the participants can identify. The underlying purpose is to get people to immediately begin to connect each structure to corresponding patterns of behavior over time.

IV. Using the Tools—Conceptualizing

In small groups, the participants are asked to focus on a particular issue, e.g. one of the decision variables in the computer game, and 1) determine the key factors that affect that variable, 2) sketch patterns of behavior, 3) provide structural explanation (using CLDs), and 4) identify intervention points. One person in each group is responsible for presenting the work to the entire group. This process is then repeated, addressing a different issue. The issues examined in this section usually derive directly from the decision variables in the game. By having the group conceptualize these variables, the participants can replicate part of the model-building process, and thus find it very easy to accept the pre-developed model. Each presenter "tells a story" from the CLD and illustrates with a real world example, if possible. This process helps participants develop the ability to articulate looped structures to other people. The overall objective in this section is to have the group cover all the major issues contained in the model and have a chance to challenge and test the inter-relations that different people within the group may propose.

V. Introducing the Game Model

The WL begin by showing a simplified CLD that contains all the major variables, tracing through the major loops and explaining the dynamic consequences of a particular action or incident. They then sketch a corresponding pattern of behavior and connect it back to the structure. This is followed by a hands-on introduction to the game[4] and the computer[5], in order to help novices become familiar with the mechanics

[4]This is a special application developed by Ernst Diehl. A commercial version of the software, Microworlds™ Creator, can be obtained through Microworlds, Inc., Cambridge, MA.

[5]The computer of choice is the Macintosh™ due to its high resolution screen and ease-of-use interface.

of using the computer. It also gives everyone a chance to become familiar with the game screen, reports, and operating features.

VI. Planned Scenarios—Holding the Reins

In this section, it is most beneficial if people work in groups of two at each computer. The teams are instructed to pursue a single-minded strategy where they are accountable for meeting one particular goal (e.g. hiring freeze). The exogenous input of a unit step in incoming new features (claims) is known to the participants and remains the same for the various policy alternatives they are asked to pursue. Each group is responsible for doing the following: 1) Plan a strategy and commit to it on paper, 2) predict the consequences of executing the strategy by sketching in behavior over time of some key variables, 3) play the game, and 4) debrief game results and explain to the rest of the group, who pose as the Board of Directors.

These planned scenarios allow the group to slowly get their feet wet by trying a very focused strategy through which they can get a feel for the dynamics of the model. Optimally, the debriefing structure encourages more reflection in every phase of the process—strategizing, managing within the game, and debriefing the outcomes. A more important underlying purpose is to begin addressing particular organizational issues through appropriate choices of planned scenarios. Assignnment of team groupings by WL (as opposed to self-selection) is an available option if the WL want to use this opportunity for team building among specific individuals or for sharing of cross-functional perspectives.

VII. Free Plays—Cutting the Reins

In this section, as opposed to the previous dry-runs, the participants have no *a priori* knowledge of how the inputs (new incoming features) are going to change. Again, each team strategizes, presents their strategy for managing in this uncertain environment and explains how they plan to achieve their goals to the rest of the group. The debriefing is carried out as before with the non-presenters asking the questions.

General Comments

It cannot be emphasized enough how critical the first hour of the LL is in setting the tone of the workshop. Participants must be made to feel free to express their true sentiments about the workshop—to air any doubts that they may have at the moment or at any time during the lab.

Developing the participants' skills in connecting CLDs with their corresponding patterns of behavior requires upfront attention. In some of the CLLs in which making such connections was not emphasized from the start, it was extremely difficult to get the participants to adopt the practice later. When the connections were made early on, however, there were fewer problems in their continued usage throughout the workshop.

If we look at one model of learning where an *action-->result-->reflection-->learning-->action*, we can see that the computer game facilitates learning because it shortens the delay between *action-->result*. It also demands structural explanations of the *action-->result* link which helps participants understand the

underlying forces that produce a given set of outcomes. The design of the LL also increases *reflection* and enhances *learning* out of which better decisions can arise.

The fact that the game model was never rejected by any of the groups is significant. This can be attributed to two main reasons: 1) they all had partial ownership of the model because the contributed to its creation in the conceptualization exercises and 2) they all understood that it was not meant to be *the* perfect nor correct model. Ideally, the model should be viewed as a learning opportunity for exploring multiple possibilities rather than as an answer generator.

It is extremely important to have people play the games in teams rather than singly. Teams of two people are ideal because the discussion and decision-making tend to be carried out with equal participation. Although three-person teams are preferred over leaving the odd person on his own, one person tends to phase out of the decision-making process in three-person groups.

In the debriefings, there was a tendency for people to focus on end results, specifically year-end numbers (in this case, whatever time period in which the game is interrupted) even though those charged with the task of querying the presenters were instructed to ask questions that focus on *how* and *why* the team ended up with the results they did. The reviewing group should be encouraged to press for an explanation of how the presenters are going to improve the situation in the future. Shifting the focus to address a longer time horizon elevates the discussion from being mired in operational details such as "why did you decide to hire x number of people in month 12?" to debating more systemic and strategic issues such as "given your adjuster capacity and the growth in features, how do you plan to maintain your quality level in the coming years?"

A side effect of having one group act as a Board of Directors in the CLL was that the participants became very conservative in their game plays and chose to only report good news while down playing the bad. In other words, the situation resembled real life too closely, stifling experimentation. Although this may be desirable in other settings, it was inconsistent with the goals of the CLL so the role of the querying group was subsequently changed to represent a group of colleagues rather than a group of superiors (e.g. the Board in this case).

The free plays session allowed the participants to be creative in their strategies—to freely choose their own goals and devise strategies to meet them. For the designers of the LL, this section provides the opportunity to challenge deep-rooted norms and assumptions, address specific "hot topics," or recreate various historical behavior modes for further exploration.

Discussion

All surface indicators of the CLL say that they are a tremendous success. Feedback from virtually every participant has been overwhelmingly positive. Comments such as "the best workshop I have ever attended" and "this is what management training should be all about" were repeated by many. People from other departments, such as administration and underwriting, have expressed a great deal of interest in developing a similar program for their respective functions. While all of this positive feedback is

encouraging, the real question of whether the CLL has any real impact back at the office still remains unanswered.

According to Wolfe[1985], effectiveness research must deal with all the different situation variables which have an impact on the gaming application. These include 1) game design characteristics, such as single function versus functionally integrative, complexity, algorithm validity/face validity, random events; 2) administration characteristics, including starting position, team size, team selection, team accountability, duration, pacing, trial or practice runs, debriefing, within-course placement, learning objectives; 3) player and group characteristics, consisting of motivation, aptitude and achievement, attitude, cognitive style, participation, decision-making method, team structure; and 4) administrator characteristics, such as game experience and involvement, motivation, subject matter familiarity.

To date, we have no empirical evidence for any of the variables mentioned above nor on the connection of "better management thinking" to bottom line numbers (a very difficult connection to make). Anecdotal evidence suggests, however, that the LL concept has great potential for helping managers reassess the way they think about their business. The post-CLL feedback done at the very end of the three days indicates that many common principles of systems thinking such as short-term/long-term trade-offs, delays, cost of overreacting, self-fulfilling prophecies and setting one's own limitations have been learned during the CLL.

Double-loop Learning

Of particular interest is how the LL can be used to engage the participants in what Argyris and Schön[1978] refer to as double-loop learning. In speaking of organizational learning, they differentiate between two types of learning modes, namely, Model I (single-loop learning) and Model II (double-loop learning).

Model I represents a mode of learning whereby the "members of the organization respond to changes in the internal and external environment of the organization by detecting errors which they can correct so as to maintain the central features of organizational theories-in-use [Argyris and Schön, 18] the inaccessibility, obscurity, or inadequacy of organizational theory of action provokes the participants to interactions which then reinforces those conditions for error" [Argyris and Schön, 47]. In a nutshell, Model I individuals and organizations solve problems only within the current frames of the existing system no matter how constricting or repressive the system may be. They never reframe the problem.

Double-loop learning is defined as "those sorts of organizational inquiry which resolve incompatible organizational norms by setting new priorities and weightings of norms, or by restructuring the norms themselves with associated strategies and assumptions" [Argyris and Schön, 24]. In Model II organizations, people openly inquire about the prevailing assumptions and are open to having them challenged, disconfirmed, and replaced by new ones. Throughout the course of the book, Argyris and Schön present a very articulate and convincing argument that *all* organizations currently fall under the Model I category. The CLL is a way of creating a double-loop learning environment.

Double-loop learning involves surfacing and challenging deep-rooted assumptions and norms of an organization that have previously been inaccessible either because they were unknown or because they

were known but undiscussable. Argyris and Schön suggest using action inquiry skills as a set of tools for helping people break out of the single-loop learning bind that keeps them from being able to discuss such issues. From a slightly different perspective, Schein[1987] sees those unquestioned basic assumptions as being at the core of an organization's culture, and by definition, the members are unaware of them. In both cases, however, those assumptions and norms are inaccessible because they are either known but undiscussable or simply not known. Argyris and Schön also differentiate between espoused theories (that which people say they believe) and theories-in-use (that which people actually do). They have often found that a gap exists between the two and that, in a Model I organization, the gap itself is undiscussable thus inhibiting their ability to make progress towards closing the gap.

The LL provides a unique forum in which operating norms and assumptions can be questioned in a non-threatening way, via the game model, without the presence of an outside intervention specialist. In the CLL, for example, although the company professedly emphasized pursuing high quality standards[6], the behavior in the games showed that controlling expenses dominated people's actions. One manager remarked that while playing the game "I kept telling myself, 'don't add to staff, don't add to staff,' even though there is no one telling me not to *and* knowing that I really need to!" In many cases where there was extra adjuster capacity, people chose to either cut staff or push for more production to reduce expenses instead of pushing for reductions in settlement size.

Along a similar line, people consistently undervalued a dollar saved in claim settlements as compared with a dollar rise in expenses: people criticized an outcome because expenses rose by a dollar even though settlement costs were cut by more than a dollar. For example, in a scenario where settlement size was at $1400 (vs. $2000 in previous scenarios) and expenses per claim were around $500 (vs. $250 in previous scenarios), the majority of people focused on the $250 increase in expenses without giving equal weight to the $600 decrease in settlement costs, both of which contribute equally to the bottom line.

Another set of operating assumptions surfaced and challenged were the notions of "proper" adjuster workload and productivity. In the previous example, people went on to look at the number of claims pending per adjuster (work backlog per employee) and claims settled per employee (productivity as measured in number of claims) and concluded that the office was a "country club," i.e. an office with too little to do. Many responded by reducing the number of adjusters or pushing for more production from each adjuster in order to cut expenses per claim. This practice inevitably resulted in increases in settlement dollars in excess of any savings in expenses. Most participants acknowledged that they had made their decisions in the game (and admittedly, in real life as well) on the basis of assumed acceptable numbers, without questioning their appropriateness for a particular situation.

Future Directions

If we believe the premise that the world will continue to grow more complex and the speed in which that occurs will also continue to increase, then we must look for alternate ways to help managers deal with

[6]In the game, higher quality means lower settlement costs. This represents the notion that the easiest (and lower service quality) way to settle a claim is to simply pay more dollars—it takes time and energy to find out the real value of a claim. The underlying assumption is that current settlement costs are too high relative to their intrinsic value due to poor quality adjusting.

such an environment. Proponents of holistic thinking (Churchman [1979], Beckett [1971], Ackoff[1981], Checkland [1981], Senge [1989]) believe that acquiring systems thinking skills is paramount for managing in the future. The CLL is a beginning step in developing such skills within an organization.

Among the next steps in the CLL project are plans for a more rigorous assessment of how much was absorbed by the participants and to what extent they have been able to use any of the insights gained in the CLL. This will be examined by analyzing game play data and field interviews of a representative sample of claim manager participants. In designing subsequent LLs, the various stages necessary for developing systems thinking skills must be outlined with greater specificity. Dreyfus and Dreyfus[1987] outline a five-stage process of progressing from novice to expert (novice, advanced beginner, competent, proficient, expert) which may be good model on which to build. In that framework, the CLL may have moved a person from novice towards becoming an advanced beginner. The goal of the subsequent CLL is to then move a person to becoming an advanced beginner and moving towards becoming competent.

The CLL has demonstrated that a computer game as a virtual world in which managers practice their decision-making is an effective means of encouraging reflection, not only on their actions but the assumptions on which their actions were based. By providing immediate feedback on the consequences of their actions, the computer game short-circuits the "noise" of day-to-day activities and helps focus on the signals to which they should be paying attention. Whether the CLL experience, in fact, translates into a different (and better) way of managing a claims office remains to be seen. However, if the CLL has succeeded in getting the participants to begin "rethinking their thinking," and it appears that it has done so, then the first step has been taken towards that end.

References

Ackoff, Russell. (1981) *Creating the Corporate Future.* New York: Wiley and Sons.

Argyris, Chris and Donald Schön. (1978) *Organizational Learning: A Theory of Action Perspective.* Reading, MA: Addison-Wesley.

Beckett, John. (1971) *Management Dynamics: the new synthesis.* New York: McGraw-Hill

Checkland, Peter. (1981) *Systems Thinking, Systems Practice.* New York: Wiley and Sons.

Churchman, C. West. (1979) *Systems Approach* New York: Dell Publishing

Dreyfus, Hubert L. and Stuart E. Dreyfus. (1987) *Mind Over Machine.* New York: The Free Press.

Kardes, Frank (1987) Sloan working paper, MIT Sloan School of Management, Cambridge, MA.

Moississ, Alexander A. (1989) "Decision Making in the Insuarance Industry: A Dynamic Simulation Model and Experimental Results." Master's Thesis, MIT Sloan School of Management, Cambridge, MA.

Schein, Edgar H. (1987) *Organizational Culture and Leadership.* San Fransisco: Jossey-Bass.

Schön, Donald A. (1983) *The Relective Practitioner: How Professionals Think in Action.* New York: Basic Books, pp. 157-162.

Senge, Peter (1989) "Catalyzing Systems Thinking within Organizations," forthcoming in *Organization Development*, F. Masarik, Ed.

Toffler, Alvin (1970) *Future Shock.* New York: Random House.

Wolfe, Joseph. (1985) The Teaching Effectiveness of Games in Collegiate Business Courses. *Simulation & Games*, Vol. 16 No. 3, September , p. 251-288.