

## **System Dynamics Analysis of Experiences Gained During Personal Quality Improvement Projects**

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### **Abstract**

This paper shows the connection between the softer tools of system dynamics and the foundation of personal quality. This is accomplished by portraying the problems and issues students experienced while engaged in individual personal quality improvement projects using system archetypes or causal loop diagramming. A major objective of the improvement project was to provide a critical and fuller glimpse of organizational quality by building on personal experience. Because the feedback from own actions is rapid and unambiguous while working within the framework of personal quality improvement project, it becomes possible to learn about the important systemic issues in a relatively short duration. Furthermore the visual representation of the issues using system dynamic tools preserved the learned lessons.



## **System Dynamics Analysis of Experiences Gained During Personal Quality Improvement Projects**

A system perspective shows that for every situation there are three levels of explanations -- events, patterns of events, and process or system structure, but their usefulness is quite different. Events are the occurrences we experience every day: an alarm does not go off, we did not study, a friend stopped by, or we did not complete the homework. Patterns of events focus on the longer-term behavior- they can uncover an orderly and recurring behavior. Process or system structure then can be used to explain why and how various events occur over time. Shifting focus from the level of events to the level of system structure increases our ability to influence the future. As we move from the level of events toward the level of system structure, the focus also shifts from being short-term orientation to being longer-term orientation. Personal quality management framework can give us a head start in understanding this system perspective. After identifying a quality improvement area, the framework requires individuals to generate explicit data points (events) over several weeks for analysis using the quality management tools. However, the associated run charts provide dynamic patterns of the data points (pattern of events). The framework also encourages one to keep a daily journal, which can be a useful source for identifying system structures at play. Thus the framework has capability of generating all of the necessary ingredients for recognition of system archetypes, which can provide explanation at the process or system structure level.

The system thinkers recognize dynamically complex and subtle structures and see the patterns when others see only events and forces to react to and the "system archetypes" represent the key to learning to see the structures in personal as well as organizational lives (Senge, 1990). The purpose is to recondition our perceptions, so as to be able to see structures at play, and to see the leverage in those structures. Mastering the system archetypes begins the organization on the right path, but requires putting system perspective into practice. The relatively few archetypes are common to many management situations. They also recur in personal lives, biology, psychology, economics and many other fields. One of the ways to begin to recognize an archetype is to examine own behavior. The Personal Quality Project offers a systemic way to collect necessary information.

The next section provides some background on the personal quality management and the associated framework. The section following this will cover archetypes representations of typical issues and problems faced by the students. None of the students had any background in system dynamics. Little less than half of the students were undergraduate students. The archetypes or causal loops were developed using the descriptive part of their reflections about the experience as appeared in their end of the term reports.

### **Personal Quality Management**

According to Roberts and Sergesketter (1993):

"Quality as practiced by the individuals is the foundation on which Total Quality Management (TQM) is built. Quality is based on the actions of people. Total Quality Management cannot exist without all the people in an organization understanding and practicing the principles of quality at a personal level."

The above statements imply that one best way to comprehend the concepts of organizational quality (TQM) is by first engaging in improving some aspects of personal quality and then by making connection to a larger organization by reflecting upon one's experience. Similar inference can be made about system thinking.

How to get started?

First, identify some area of improvement that has potential to improve one's productivity, health, improve time management, reduce waste, etc. Next step is to draw up a checklist of defects that are relevant to the area of quality improvement selected. The defects should reflect personal habits that are preventing from achievement of the targeted personal quality goals. This may be the most difficult part. Once a checklist has been drawn up, the data collection is relatively effortless. You just tally the defects by stroke-marks on a pre-prepared form as they are observed. After a few weeks of data collection efforts, it would be possible to apply many of the simpler quality management tools (Pareto, run charts, fishbone, etc.) See appendix A for a step by step process one can follow to get started.

It is important to make sure that the goals are attainable but somewhat ambitious. An objective is to force oneself to think about achieving these goals by behaving differently. If goals set are modest, they can be met without making any changes in the behavior. One objective is to minimize the defects. However, learning from the pattern of defects to make structural changes in one's behavior is probably more important.

What TQM concepts does one learn by engaging in this experience?

The potential of learning from the experience depends upon the seriousness with which one engages in this experiment. An objective is to make connection between the lessons one learns and the issues and problems arising when an organization tries to adopt the principles of TQM. The students identified many lessons. The following TQM concepts were ranked high among the lessons identified.

1. Concepts of constancy of purpose and commitment
2. Recognizing that our habits are part of the common causes and thus part of the system
3. Appreciating why people resist change
4. Understanding the concept of quality of data and data collection process: just in time vs. batch processing
5. Learning to apply quality tools
6. Treating symptoms vs treating the root causes

The list reflects not only the salient ideas of TQM but also some concepts of system thinking. Visualization of an organization as a system of interdependent processes has been a cornerstone of the entire field of system dynamics, but also emphasized as one of the TQM fundamentals. However, systems thinking tools offered by the system dynamics field are more powerful than what are generally found in TQM tool-kit for this purpose. One way to capture the individual experiences of working on the personal quality projects would be to use causal loop diagramming or archetypes.

### **System Archetypes and Personal Quality Projects**

The source material used for developing system archetypes were more than forty personal quality improvement reports. They are classified by the improvement area selected by the students and are tabulated in the Appendix B. Most of the reports dealt with time management, study habits, and health improvement.

Limit to Success

In majority of cases "limits to success" structure come into play. Figure 1 shows this structure. If the reinforcing process of quality improvement, enthusiasm, and proactive involvement operated unimpeded, the only limit (not shown) would be zero defects.

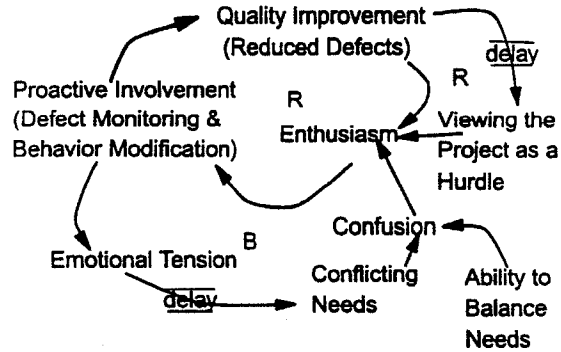


Figure 1: Limits to Success

It was critical that the students did not view this project as just one hurdle. In order to convince them, they were assured that it is not the result, but the participation in the process was more important. To convince the students further, the students were allowed to grade themselves on their performance and written presentation. The weight given to their self evaluation was 67% of the total allocated for this project. The instructor's evaluation received the remaining 33% of the weight. However, many reported that they were uncomfortable, until midway through the term they began to see their own quality improvement.

After few weeks of involvement, several students reported stress and felt tensed, which lead to conflicting needs and thus felt confused and discouraged. Their enthusiasm toward the project declined. Couple of students gave up and basically worked through mechanics without active involvement.

Drifting Goals

Several students midway through modified the operating definitions of the defects they chose initially. For an example, one student, who chose fitness as the quality improvement area, had one of the defects defined as "eating anything between meals." She decided to change the definition of this defect to allow herself to eat once between meals. Many students modified definition of defect related to number of hours of television viewing. Figure 2 shows this "Drifting Goals" archetype.

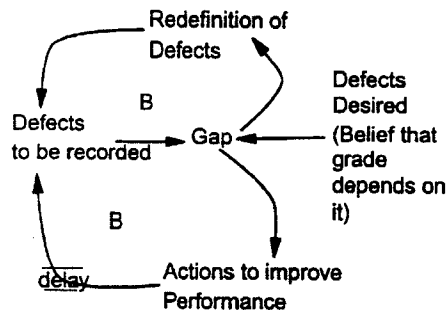


Figure 2: Drifting Goals

Success to the Successful

Many who chose time management or study habit's improvement as their area reported conflict in time allocation. The "Success to the Successful" archetype represented this process as shown in the Figure 3.

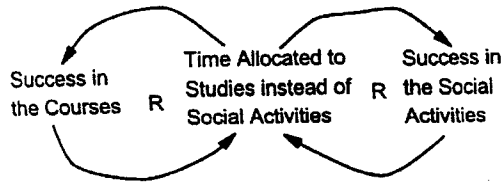


Figure 3: Success To The Successful

Addiction or Shifting the Burden

Figure 4 shows a typical archetype reflecting many reports. It was quite clear from their narrative that they refused to accept the responsibility for their lack of defect reduction performance. They always had somebody or something to blame to. They always had way to rationalize their own lack of commitment. It could be the girlfriend, a favorite TV show, a friend visiting, another professor, or just happened to be a weekend.

About four students reported why they selected improving study habits and time management as their quality improvement projects. Their descriptions basically fit the "Shifting the Burden" archetype as shown in the Figure 5. It can be hypothesized that this archetype is probably very common on the campuses.

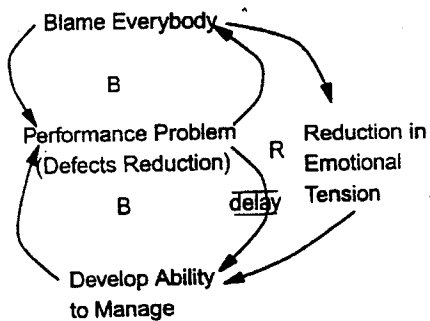


Figure 4: Addiction I

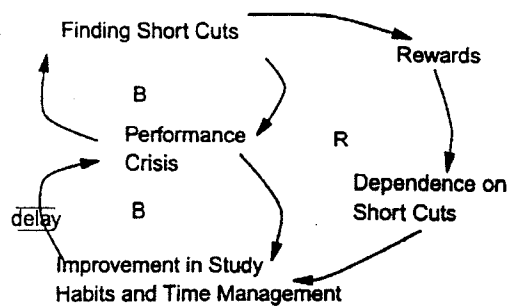


Figure 5: Addiction II

### **Conclusion**

The results of engaging students in personal quality improvement projects were gratifying. Besides providing students with some learning experience in the area of TQM, the process also showed a way of introducing the concepts of system thinking with the help of system archetypes by making connection to personal experiences. According to Forrester (1987) system dynamics have little impact unless the tools and the concepts change the way people perceive a situation. One major lesson the students took away with them was that implementation of any new program or technology requires skills (know how, what and why), will, and self-discipline.

### **References**

- Forrester, Jay W. 1987. Lessons from system dynamics modeling. System Dynamics Review Volume 3 Number 2 Summer.
- Roberts, Harry V. and Sergeketter, Bernard F. 1993. Quality is Personal: A Foundation for Total Quality Management. The Free Press.
- Senge, Peter M. 1990. The Fifth Discipline. Doubleday Currency.

**Appendix A  
Personal Quality Project**

**An objective of this project is to experience some of the fundamental implementation issues of total quality management by applying it to improve your own personal quality.**

Please follow the following steps:

**Step 1:** Identify an area of personal quality such that its improvement will lead to enhancement of your productivity, reduction in waste, increase in time available, improving your health, etc.

**Step 2:** Make a list at least five habits that influence the area of the personal quality selected. For an example: For the area "Reduction in Weight" I may choose eating between meals, eating deserts, not exercising, not drinking eight glasses of water and eating even after my stomach tells me it is full as potential habits, which I will call them defects.

**Step 3:** For each of the habits selected, provide an operational definition. For an example, eating between meals means putting edibles in the mouth each time between meals will be called a defect. An operational definition must be related to the root cause. For an example, if I select a habit of keeping my desk clean at the end of the day, I could simply shift all of the material in a box and call it a non-defect. It is wrong, because it does not address the root cause of reducing the backlog of work.

**Step 4:** Prepare a worksheet like shown below to record your defects:

**A Personal Quality Checklist**

**Theme:** Reduce weight by 10 pounds and hold on to the gains. Quality Characteristic is weight.

Week of \_\_\_\_\_

Defect Category	M	T	W	Th	F	S	Su	Total
Eating Between Meals								
Eating Desserts								
Not exercising								
Not drinking eight glasses of water								
Eating even after my stomach tells me it is full								
Drinking alcoholic beverages								
<b>TOTAL</b>								

**Operational Definitions of Defect Categories:**

**Eating between meals:** A defect occurs anytime I put an edible in my mouth between meals.

**Eating desserts:** Any sweets at the end of the meal if eaten will be a defect.



**Not exercising:** Less than 20 minutes of exercise or an exercise routine that does not raise my heartbeat to 25 per 10 seconds is a defect.

**Not drinking eight glasses of water:** Less than eight glasses of liquid per day is a defect

**Eating even after my stomach tells me it is full:** If I eat after my stomach tells me it is full is a defect.

**Drinking alcoholic beverages:** Number of defects on Sunday through Thursday equal to number of drinks consumed and number of defects on Friday and Saturday equal to number of drinks consumed minus two.

**NOTE: YOU ARE REQUIRED TO COMPLETE STEPS 1 THROUGH 3 BY THE END OF THE FIRST WEEK OF THE CLASS AND TURN IN YOUR COPY BY THE FIRST SESSION OF THE SECOND WEEK. YOUR INSTRUCTOR WILL GET BACK TO YOU BY THE END OF THE SECOND WEEK, IF THERE ARE QUESTIONS. IF HE DOES NOT HAVE ANY QUESTIONS TO YOU SPECIFICALLY, ASSUME THAT IT IS OKAY TO PROCEED.**

**Step 4:** Prepare the worksheet like shown in the step 3 for each week and religiously make entries into them. You have to be honest to yourself. From time to time analyze the data using many of the quality tools you will be learning. Maintain a journal for recording the issues and problems as you encounter. You are welcome to share your work with your friends. More than one person can have identical project, except each one is expected to enter data from own respective experience.

**Step 5:** Develop a report at the end of ninth week and turn it in by the end of tenth week. Report should contain narrative describing your own observations and the use of quality tools. You can use your daily journal to write your report.

**Another Example**  
**A Student's Personal Quality Checklist:**  
**Quality Goal: Improve Grade**

Week of \_\_\_\_\_

Defect Category	M	T	W	Th	F	S	Su	Total
Late for class or an appointment								
Come to a class unprepared								
Delayed submission of assigned work								
Blaming others for poor performance								
Neglect to review the material covered in class within 36 hrs. or before the next session of the same course								
Not attending a class								
<b>TOTAL</b>								

Operational Definitions:

**Late for a class or an appointment:** Entering a class after the lecture has started.

**Come to a class unprepared:** Not reviewing the material ahead of its coverage in the class.

**Delayed submission of assigned work:** Not submitting the assigned work on it's announced due time.

**Blaming others for poor performance:** Finding an excuse for own poor performance.

**Neglect to review the material covered in a class within 36 hours or before the next session of the same course:** Self-explanatory.

**Not attending a class:** Self-explanatory.

**Appendix B****Personal Quality Improvement Project Distribution**

<b>Project Area</b>	<b>Number of Projects</b>
<b>Time Management</b>	<b>12</b>
<b>Study Habits or Grade</b>	<b>10</b>
<b>Health Improvement</b>	<b>9</b>
<b>Losing weight</b>	<b>4</b>
<b>Improve English Communication</b>	<b>2</b>
<b>Improve Standing with the Family Members</b>	<b>2</b>
<b>Keep Living Space Clean</b>	<b>2</b>
<b>Gain Weight (Football Player)</b>	<b>1</b>
<b>Reduce Electric Bill</b>	<b>1</b>
<b>Reduce Coffee Intake</b>	<b>1</b>
<b>Improve Speech (stuttering)</b>	<b>1</b>
<b>Improve Guitar Proficiency</b>	<b>1</b>
<b>TOTAL</b>	<b>46</b>

