

NASA's Project Management Learning LAB Think-Act-Reflect¹

Lawrence Suda

Abstract

Maintaining a talented pool of project managers at NASA is critical to the space program, scientific community and the general public. NASA's Academy for Project Program Engineering Leadership (APPEL) actively promotes a unique disciplinary cultural approach that goes beyond the boundaries of conventional project management. One program out of a series of training programs is the Lab. The Lab is a five-day workshop using various learning technologies, including: simulations, 360 leadership and team assessments and promoting the unconventional mixing of disparate learning approaches to create a powerful learning design. The lab encourages people to Think-Act-Reflect in real time just like the must do on their real-life projects.

Key words: Simulations, Leadership, Management, Learning Lab, NASA

Introduction: Practicing the Game of Project Management

The project leader reached for his fourth cup of coffee. It was only 9:30 am and he was already stressed by all the bad news: One key team member resigned; the client was upset about the quality and schedule and wanted to meet immediately; and his manager was not happy about the potential cost overruns of 50%. Everything that could go wrong was going wrong and worse yet all at the same time. To add more fire to this particularly hellish week: there was a new round of complaints about a key engineer's abrasive style, and technical quality of work. He was sent out for some technical training. That's five days of work we'll never get back. A consultant was hired "on the cheap" -- only to learn, once again, that you get what you pay for. He was fired, which was a huge distraction and waste of time and money.

Now the good news: these events didn't happen anywhere in what we call "real life" and in some sense they didn't "happen" at all. Despite the rocky performance and, fortunate for this project leader, all these problems were the direct result of a project simulation exercise used by NASA to help train current and future project managers. The entire experience unfolded on the screen of a laptop computer running a "Project Management Leadership Simulation," as part of the NASA's "Project Management Leadership Laboratory." The program uses a computer based simulation designed and developed by the Palatine Group, a New York based company.

¹ *Second Editions are previously published papers that have continued relevance in today's project management world, or which were originally published in conference proceedings or in a language other than English. Original publication acknowledged; authors retain copyright. This paper was originally published as part of the PMI® Global Congress 2016—North America proceedings. It is republished here with the author's permission.*

Why” Simulations

Virtually every significant marketplace innovation and success in recent history is a direct result of extensive prototyping and simulation. Airplanes, automobile design, animated motion pictures, personal computers, leveraged buyouts and mergers, DNA biotechnology, are all the direct result of shifting from physical clay models to virtual models. In all these instances, the most important raw material is and has always been the interplay between the individuals and the expression of their ideas. To paraphrase Leroi-Gourhan the evolution of the human mind is basically the evolution of its expressive means. The same thing is true for the evolution of projects and our organizations. In today's world it is fashionable to assert that managerial minds are possessed by “mental models” that invariably determine what decisions get made. But this is one of the truisms that obscure a larger reality. The mind gets far more credit that it deserves according to Jay Forrester, the father of systems dynamics. According to Forrester, “Our mental models are fuzzy.” They are incomplete and imprecise. Furthermore, within one individual, a mental model changes with time and even during the flow of a single conversation. The human mind assembles a few relationships to fit the context of a discussion and as the conversation shifts, so does their mental model. Each participant in the conversation employs a different mental model to interpret the topic. Fundamental assumptions differ but are never brought into the open.

In order to have actionable meaning, fuzzy ideas (mental models) in a project manager's mind must ultimately be externalized in representations the entire project team and customer can grasp. Simulations can help mental models become less tacit and more tangible and actionable. Simulations engage the project team's thinking in the explicit. They externalize thought and spark dialogue. A truly effective simulation goes beyond the visual to appeal to the tactile and kinesthetic. A genuine, authentic model activates the mind and adrenal glands and engages people in conversation and debates that forge collaboration and ignite innovative approaches to tough project issues. Consequently, good simulations are not just tools for individual thought, but are inherently social media mechanisms.

The business environment is so turbulent that that running a business or managing a project team can be as treacherous as piloting an aircraft. The uncomfortable reality in most organizations is that people are making more complex decisions in less time, with fewer resources and no margin for error. Being great requires something few people have -- opportunities to practice. That's the value of simulation. . Business simulations let project managers sit in a virtual cockpit and practice their technique.

Actors, athletes, and musicians wouldn't dream of performing without practicing. But how do business people practice? Mostly they attend the school of hard knocks -- encountering new situations, making mistakes, learning from what goes wrong. But learning from real mistakes gets expensive -- both for the company and the people who make them. Simulation creates a "virtual practice field" that allows people and teams to test assumptions and experiment with ideas without having to suffer financial reversals or career setbacks. You can compare business

simulations to what goes on in the NFL between games. "Football coaches and players look at game film because it helps them understand what happened. In a game film, away from the confusion of real action, each player can step back and look at the whole field, not just his corner of it. Simulations create that same whole-field perspective an element of control: Imagine if you could run game films -- and change the play! What if the coach could say, 'Thomas, you should have blocked this guy, not that guy, and if you did, here's what would have happened?' That's what simulation does.

The NASA Lab simulation helps NASA project managers learn about project and team behaviors: how the simulation technology behaves, how people behave and how the simulation and people behave, and sometimes misbehave, together. Ultimately the real test of the people on the project is not so much what they know; it's what they do with their knowledge. Making a decision is not the same as implementing it. Knowledge, insight and project wisdom are needed to fully execute a successful project.

“What” is the NASA Lab Simulation?

The NASA Lab simulation provides a powerful context for applying both individual and collective learning. Simulation takes advantage of the opportunity to maximize active and enjoyable involvement in the learning process. Participants generate creative, emotional tension that encourages them to explore, conceptualize, inquire, experiment, and critically analyze while using their multiple senses. The simulation places them in another time and space where they become the agents of their own learning, and shift the classroom to a learning laboratory, while providing a metaphoric structure for analyzing past, present and future circumstances. With the focus on learning rather than teaching, each participant builds upon the collective experiences and knowledge of all the participants, and makes the lessons come “alive”. They are provided the opportunity to explore from various new perspectives and encourage new thinking and using new behaviors. The collapsing of time and space found in this well-designed and artfully crafted simulation makes it possible to recognize what is often clouded or seemingly invisible, tacit knowledge. This mode of learning is consistent with the core values of self-determination, teamwork, collaboration inherent in our project management profession. We also know that there is no panacea or “silver bullet” that, alone, can possibly address the complexity and expected chaos of interrelationships in a complex project system. Yet, we have found that experientially-based, well designed simulation that incorporate the concepts and principles has the significantly accelerated the transformational learning of individuals, and project teams.

Traditional education has focused on individual learning, rather than on group or organizational change. The NASA Lab simulation is an experiential program and as such formulated on David Kolb's view of learning, and the cyclical model of learning. The basic premise of Kolb's work is that learning is a circular four-step process. Essentially, an effective learner must possess four distinct abilities: The first is the ability to act; the second is the ability to observe and reflect on the experience you have while doing the activity; the third

is the ability to conceptualize around the experience; and, the fourth is the ability to experiment with new behavior(s) that may have more efficacy than current or old behavior(s).

This cyclical process is shown in **Exhibit 1**. The learning cycle appears as this: action provides the basis for observation and reflection. The observations coalesce into a new approach or behavior and new implications for action are then deduced; the new behavior serves as a guide for further action or experimentation that then creates new experiences.

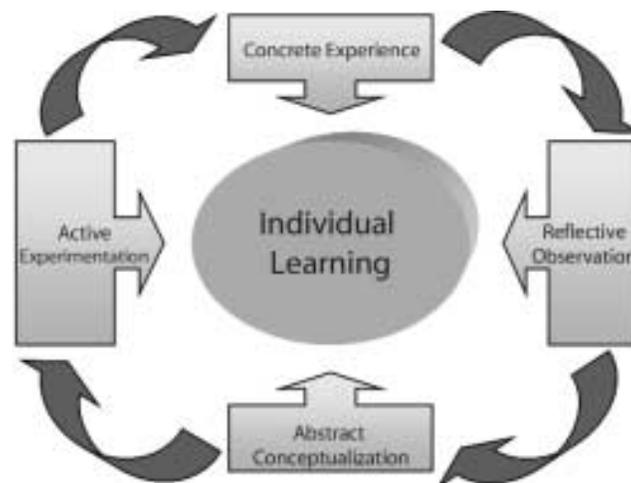


Exhibit 1

In the first stage of learning, there is immersion in the concrete action ... just doing it. Participants move through a simulated experience rather naively while storing up experiences without completely understanding them. In the second step, private experiences are examined through observation and reflection to obtain a whole picture or “Gestalt” of the experience. This image helps them answer and gain insight into key questions: What is going on here? What are my personal experiences with the simulation? When these questions are answered at the end of this step, a metaphor or story emerges. The metaphor can be further broken down to smaller components, facts or observations, but the important thing is the appearance of a total image. In the third step, the movement is into more abstract reasoning and conceptual understanding. From the vast amounts of data, connections are made to the image as patterns emerge from the set of experiences. New ideas, concepts, and theories develop that help explain the experiences. In the fourth stage, the new behaviors are tested with the fresh hope for better success. The primary focus is on discovering and selecting a way of examining a behavior in action and on developing an instinctive feeling about what new action to take to improve performance and deciding to test it. At this point, the process begins again at the first step in the learning cycle.

Other researches have expanded Kolb’s four-step learning model. Chris Argyris augmented Kolb’s model by inserting the notion of “mental models” into Kolb’s abstract conceptualization

stage. This implies that all individuals need to examine their own mental constructs if they really want to learn. These rules of behavior or “mental models” help participants interpret their own reality as well as that of others. They are a view of the world and provide the context for interpreting actions and for determining how each piece of new information relates to a given situation. Mental models also influence how they involve themselves into any new experience and determine how they interpret those experiences and develop new learning from them.

Argyris also presented two other concepts to expand on Kolb’s model: (1) Single loop learning and (2) Double loop learning. In single loop learning, Argyris explains as learning by making corrections in their behavior without examining our original mental map. While in double loop learning, cognitive acts taken by individuals with the examination of their mental maps. In double loop learning, an error in reasoning or acting between the response of the simulated “real world” and a person’s mental map causes an examination of old maps and to new ways of thinking and behaving.

Argyris’s concepts suggest two important points. First, that the NASA Lab simulation and experiential training facilitates double loop learning, and, second, the simulation helps NASA participants examine their own mental models and this, in turn, provides important information for the progress they are making towards learning new behaviors.

However, explicit in this research is the fact that traditional educational methods have limitations teams. This is because individual learning does not necessarily create team learning and change. Even when individuals learn and make significant personal changes, this learning alone may not produce team changes, and in most cases individual learning is hard to transfer back to the workplace because of the rigid organizational rules and practices. A paradox exists in that teams learn only when individuals learn, but team learning is much more than just a collection of individual members learning. This suggests that for teams to learn as a whole and change, they must learn as a team. For the project management profession to have an impact on the organization we need to move beyond our current mindset to something that more effectively incorporates a model for organizational learning and change.

Team learning is in many ways similar to individual learning. In both, there must be action and reflection of that experience, the examination of current and old mental model errors and then further experimentation. However, team learning and reflection are more complex and dynamic than individual learning.

The NASA Lab presents an approach of: discovering ... unearthing ... examining individual shared mental maps as the basic first step for learning at the individual and team levels. These shared mental models create a holistic view of the project. Individuals have their models stored in habits, routines and mindsets, whereas team models are stored in the organization’s memory through cultural norms, values, policies, rules, and procedures. For these collective mental models to be of value, the shared mental model must be tested publicly. In this

manner, the team creates a double loop learning model through shared experiences with that model. The collective experiences can lead to the team developing new values, norms, policies, and procedures.

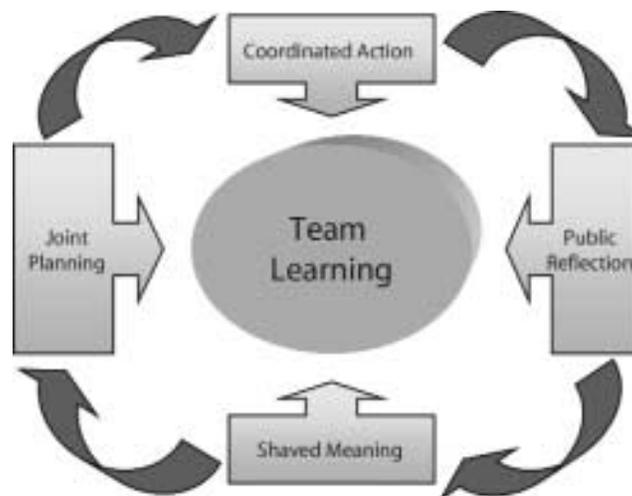


Exhibit 2

Exhibit 2 presents the team learning model. Each step is similar to the Kolb experiential learning cycle, but each step in the model represents a team learning level. Public Observation and Reflection is the process of collective review and involves the collaborative process of team members sharing common experiences while suspending final judgment. The important point is that members talk about their experiences, the context, and their responses to the mental models. Shared Meaning is the process of coming to a common understanding, refining the beliefs, values and the updating the shared mental model. Joint Planning involves the team in collaborative design of the new actions and the testing of those actions. Coordinated Action has members involved openly and honestly discussing their common experiences. All these steps are open and public.

There are two necessary requirements that direct and drive the process: (1) Dialogue and (2) Consensus. Dialogue is the process of collaborative reflection and is the process by which team members create shared meaning. Consensus is the process of reaching convergent thinking through discussion, advocacy, and inquiry. It is the means by which people gain agreement, make decisions, and take action. Using these two techniques in each step of the model promotes the beginning of team learning.

Summary of the NASA Project Management Leadership Lab

This paper proposes a new purpose for viewing simulations as not only a learning tool for individuals but also as a powerful vehicle in supporting organizational learning. The

conceptual framework presented suggests that simulations can contribute to organizational change in several specific ways:

1. The NASA Lab Simulation helps individuals learn best and useful project management practices and learn new skills behaviors and values.
2. The Lab simulation is a properly designed workshop format that provides participants with an experience of how to manage projects successfully.
3. The Lab simulation provides participants with a condensed experience of the dynamics of projects within their team and some potential sources of serious problems.
4. When the Lab is conducted with in-tack project teams, it results in the development of new and better approaches for planning, executing and teamwork.
5. Acting, experiencing, sharing mental models, reflecting, and joint planning can help transform the classroom experience into team action.
6. Through the simulation experience and metaphorical learning and discovery process, participants can learn to take responsibility for learning how to learn on their own and carry the lessons of continuous learning back to the job.
7. The Lab simulation create a framework for both dialogue and inquiry, which are key elements for team learning, and assist in viewing problems from different angles. This enables participants to both think about and dialogue with others about complex and difficult issues.

The challenge of navigating within these turbulent times calls for faster knowledge transfer that captures full understanding of the dynamic relationships within our environment. This equates to a generalized “systems” view as well as practical knowledge about how to manage in these turbulent times. Improving organizational and team learning requires more than one person moving in the right direction. All organizational members have to be able to move nimbly. They can accomplish this by: sharing different multiple perspectives on given problems; really learning to listen to each other with complete understanding; asking powerful questions of each other to gain better insights; and, by gaining a genuine understanding of the necessary steps for collective movement in a well-defined direction. We have found that well designed and crafted project simulations that incorporate the concepts and principles outlined in this paper have the potential to significantly accelerate individual, team and organizational enlightenment and learning.

References

- Argyris, Chris. (1993), *Knowledge for Action: A Guide to Overcoming Barriers*. 1993 Josey-Bassey, Inc. San Francisco, California, USA
- Kolb, David (2015), *Experiential Learning: Experience as the Source of Learning and Development*. Person Education, Upper Saddle River, New Jersey, USA

About the Author



Lawrence Suda

Management Worlds, Inc.
New York, USA



Lawrence Suda is the CEO and an Officer at Palatine group/Management Worlds, Inc. with over 30 years project and program management consulting and training experience to numerous government and private sector companies. The Palatine Group/Management Worlds specializes in creating computer-based simulations for project management and leadership training. Larry's career emphasis is on organization behavior, project management, operations management, strategic management and enterprise-wide project management for leading companies and government agencies throughout the world, including: NASA, US Navy, Departments of Commerce, Treasury, Energy, Health & Human Services , Agriculture, DAU and others and in the private sector to such companies as General Electric, Proctor & Gamble, ALCOA, URS, Verizon, Boeing, Lockheed/Martin, Hewlett-Packard, Perot Systems, PPG Industries, United States Steel and others.

Before founding Palatine Group/Management Worlds, Larry worked in the private and public sectors at the US Environmental Protection Agency and was an Assistant Professor at the University of Maryland. Mr. Suda is a frequent speaker at PMI and IPMA Conferences in the United States and Europe and has led workshops for PMI's Seminars World in various locations around the World. He is an adjunct professor at Drexel University teaching Global Project Leadership.

He can be contacted at lsuda@thepalatinegroup.com.