



Tacit Knowledge and Learning from Experience

By Winston P. Ledet

A definition of tacit knowledge is: “Unwritten, unspoken, and hidden vast storehouse of knowledge held by practically every normal human being, based on his or her emotions, experiences, insights, intuition, observations and internalized information. Tacit knowledge is integral to the entirety of a person’s consciousness, is acquired largely through association with other people, and requires joint or shared activities to be imparted from one to another. Like the submerged part of an iceberg it constitutes the bulk of what one knows, and forms the underlying framework that makes explicit knowledge possible.”

For a long time we thought that tacit knowledge was knowledge that we have not yet articulated. Based on recent research it appears that a better perspective of tacit knowledge is that it is knowledge which cannot be articulated. The researchers label tacit knowledge as knowledge that cannot be codified. Codified here means put into a procedure or other means of capturing the logic to organize or collect together into a system or code (laws, rules, procedures, etc). Tacit knowledge is important for people to have when they operate, repair, and improve equipment, but this knowledge cannot be stored in a procedure or drawing.

The transfer of tacit knowledge from one person to another then must happen through actions taken together rather than conversations or written instructions or drawings. This is the reason that schools have laboratories to help students learn tacit knowledge by taking actions. Students learn about something in a lecture, but they learn how to work with this knowledge or to use it in a lab. The Manufacturing Game® was created using a System Dynamics model of manufacturing. The model was based on a worldwide benchmarking effort at DuPont. The reason for making it into a game was to create a “micro world” as defined in Peter Senge’s book, “The Fifth Discipline”. Senge recommends that we create a place for people to practice new behaviors before expecting them to perform them in their work.

We often get questions about the role of The Manufacturing Game® in helping organizations make a culture change in the reliability of equipment. The game is an experiential learning tool to help people understand how their whole system works and how to improve the system reliability through defect elimination. A key aspect of the workshop is establishing cross-functional teams as the vehicles for transforming

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Rio Tinto–Boron’s Good News Shares

Rio Tinto–Boron communicates success stories internally through their Good News Share stories, and they have agreed to share some with our TMG News readers.

Maintenance Truck Tool Up

Maintenance crews at the Shipping Department had to travel across the plant in order to get tools either from their personal locker or the central tool crib.

By tooling up the trucks with the most commonly used everyday items, the personal tools required on a daily basis are minimized



saving time and frustration. Each tool was engraved with the corresponding truck number and shadow boxed for ease of identification and inventory.

Lube Barn Static Removal

The oil storage totes in the lube barn had not been properly grounded for some time. When the Oilers would filter the oil, static would build up. Sometimes when the Oilers would come into contact with the totes or filters they would



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SCHEDULE

Throughout the year, The Manufacturing Game® holds workshops for the general public at universities and/or professional organizations.

For more information visit

www.mfg-game.com

Public Workshops

San Jacinto College hosting The Manufacturing Game®

at the Pasadena Campus
Pasadena, TX

March 1–2, 2012

See page 4 for more information or call (281)478-3698 to register.

Asset Operations Excellence Master Class and The Manufacturing Game®

Reliability Performance Institute
Fort Meyers, FL

April 24–26, 2012

Featuring John Mitchell lecturing on Operations Excellence and Winston P. Ledet presenting The Manufacturing Game®

For more information or to register visit www.MaintenanceConference.com or call (888) 575-1245

*As an additional benefit each participant at both workshops will receive a copy of the book “Don’t Just Fix It, Improve It!”

Conferences of Interest



NPRA

Reliability & Maintenance Conference

San Antonio, TX

May 22–25, 2012

For more information or to register visit: www.npra.org

Mark Your Calendar!



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the organization. This aspect was incorporated in the workshop based on benchmark data from Japan where Total Productive Maintenance has been used as the means for improving reliability. Over the years, observing people participate in Manufacturing Game workshops and reading research on socio-technical networks, we have concluded that the reason cross-functional teams are so effective is that they help people share tacit knowledge by taking action together.

In designing the workshop in the early 90’s, we learned from the University of Houston’s accelerated learning center that people cannot accept a new idea or behavior unless three parts of the brain agree that the new behavior is authentic. These are the intellectual part, the emotional part and the bodily control part of the brain. The instructors said that we should design our workshop to allow people to experience the new behavior in all three centers. The most difficult of these three parts was the bodily part, but it turned out that moving poker chips was enough of a bodily movement to convey the ideas to our bodies’ muscles. The emotional part takes place in the interaction of the people playing different roles in the game. The intellectual part is done with PowerPoint slides used intermittently throughout the workshop.

People who have had hands-on physical experience in the operation and maintenance of equipment find that the game feels exactly like what they do in the real world. The reason for this experience from a bodily point of view is that we have created a structure in our game that gives the same experience in our muscles that happens in a much larger way in the field with the equipment.

Since the game is rather complex and must be played as

a team of six people, the joint decisions required creates an emotionally charged atmosphere. In Jonah Lehrer’s book, “How We Decide”, he says that the act of deciding involves two types of memory—intellectual and emotional. Based on functional MRI brain scan studies, the intellectual memory is sorted out in the part of the brain where logic is the basic means of deciding. The emotional memory is stored in another part of the brain. It is connected to many more signals than the intellectual memory, and these signals are coming from other parts of the brain. Lehrer states that each of these memories comes to a conclusion about what decision should be made, and then the bodily control part of the brain receives input from both memories and makes the final decision as to what action to take. It appears that emotional memories are more like tacit knowledge and the intellectual memory is more like codified knowledge. This creates a rich interaction between people sitting across a table from each other where they can see the emotional state of each other by looking at each other’s faces. The discussions they have usually center on the logic, but quite often we hear comments like, “OK, if you feel that strongly about it, we can try it.” This seems to be a transfer of tacit knowledge.

These experiences, in the workshop, then seem to create a bond between people that are applied to eliminating real defects in the equipment out in the field in the next 90 days. These action teams working in the field again share their knowledge to eliminate the sources of defects in equipment which validates what they learned in the workshop. These bonds are what create a much denser set of connections in the organization because the teams are always composed of people from different functions so that their solutions take the whole system into consideration

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and thereby avoid solving a problem in a way that causes a new problem in another function.

Ray Reagans and Bill McEvily in their publication, "Network Structure and Knowledge Transfer: The Effects of Cohesion and Range", report that the transfer of tacit knowledge is best accomplished in networks which have high cohesion and a broad range. Cohesion means a set of people who have a lot of common experience and knowledge. Therefore, people who work in the same function have higher cohesion than people from different functions. People from different functions just don't have enough common experience to communicate effectively. The Manufacturing Game® workshop provides a common context and

a common language. So people can take their experience in their function and relate it to how the game works and use that context to communicate with people from other functions. This creates more cohesion among the functions and helps create a socio-technical network.

The other aspect, range, is a measure of how much diversity there is in the network. By using cross-functional teams, the workshops extend the range to most of the functions in a manufacturing organization. This opens up many more channels of communication for transfer of tacit knowledge. When an organization engages the vast majority of employees in the workshops, the flow of tacit knowledge vastly increases, and the collective know-how of the organization expands

immensely. They become a learning organization where people learn daily from each other by sharing codified and tacit knowledge.

When companies are able to take advantage of the tacit knowledge and the codified knowledge of all of their employees they become a learning organization. This helps form a very stable situation for that company, and they are less likely to revert to the type of organization that they were in the past. It is like learning to ride a bike, no amount of instruction can teach it to you. You have to get on the bike and have the experience of learning how to pedal, steer and balance all at once...once you learn how to do that it is a skill that stays with you for the rest of your life...and by the way, learning to ride a bike IS probably tacit knowledge.

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get a strong static shock.

The Action Team announced that with help from the Oilers, I/E and the Asset Management Team they were successful at eliminating



99% of the static. With the proper parts they were able to have the tote bins correctly grounded to make it a safer work environment for their Oiler Crew.

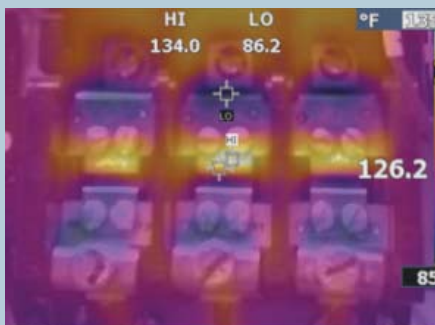
Preventive Maintenance Infrared Scan

The I/E Team recently purchased 2 thermal imaging cameras for less than \$10,000. These cameras have the ability to see what the human eye cannot, that is, infrared radiation. The first picture is a thermogram taken of the BAP P-19B Pump contactor. It is obvious from the image that the center phase is hotter than the



Before

other two. Generally speaking, things heat up before they blow-up. As a result, the I/E team preemptively replaced the overloads during a planned shutdown, therefore avoiding an approximate five hour unscheduled interruption to the crystallizer system.



After

New Lock Out Tag Out Center

This new LOTO center was created as an SSHC and 6S project to ensure the operators had the necessary tools to complete a detailed lockout easily accessible to them at all times. The area operators routinely review the board and replace or update items as needed.



A list of what should be present is kept at the board. The items include extra locks, clamshells, all required tags, caution and safety tape, and lock boxes. Also present is a current copy of the safety standard. Rio Tinto Boron is thankful to those who participated including Utility, for creating the background, and Maintenance, for the set up. The board is located in a very visible location so even those new to the area can easily access it.



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“Habits are safer than rules;
 you don’t have to follow them.
 You don’t have to keep them
 either.They keep you.”
 –Frank Crane



TMG News

Manufacturing Game Workshop coming to San Jacinto College in Pasadena, TX

San Jacinto College’s Department of Continuing and Professional Development will be presenting The Manufacturing Game Workshop March 1–2, 2012. The Manufacturing Game® is a hands on learning experience that creates a reliability culture. Participants will experience how they can increase reliability through defect elimination and cross functional work, become more proactive and increase business performance.

Without having to make the decision to host the entire event, this is the perfect opportunity to see how bringing the workshop into your company can reinforce and improve your reliability initiatives. It gives participants a chance to share their experiences with others. New and experienced employees

get an overall view of the manufacturing, refining, mining industries, etc.

The simulation and workshop allows participants to see the whole system at one time and not just the function in which they work. Because the simulation collapses time, participants experience how the actions of one area impact the functions of another in the course of the two days.

As an additional benefit each participant will receive the book “Don’t Just Fix It, Improve It!”.

The workshop will be held at the San Jacinto Interactive Learning Center (C-1) on 8060 Spencer Highway, Pasadena, TX 77505. Call (281) 478-3698 for more information or to register.



Level 5 Leadership at Work, coming soon to MRO-Zone.com

A Hero’s Journey guide to building a Level 5 leadership process for organizational change:

- Learn how to create a Level 5 leadership process
- Learn how defects affect bottom line results
- Learn how to use the Hero’s Journey to build a learning organization
- Discover the key to realizing the full potential of your organization
- And much, much more!

“Level 5 Leadership at Work” will be available January 27, 2012 at <http://MRO-Zone.com>. Preorders are being taken now.

The first book in the series “Don’t Just Fix It, Improve It!” is now available at <http://MRO-Zone.com> and www.Amazon.com.

