The PDCA Continuous Improvement Cycle Module 6.4

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These materials were developed as part of MIT's ESD.60 course on "Lean/Six Sigma Systems." In some cases, the materials were produced by the lead instructor, Joel Cutcher-Gershenfeld, and in some cases by student teams working with LFM alumni/ae. Where the materials were developed by student teams, additional inputs from the faculty and from the technical instructor, Chris Musso, are reflected in some of the text or in an appendix

Overview

- Learning Objectives
  - Understand the different steps in the PDCA (continuous improvement) cycle
  - Learn how to apply the steps to solve real world problems
  - Understand the potential disconnects using examples and exercises

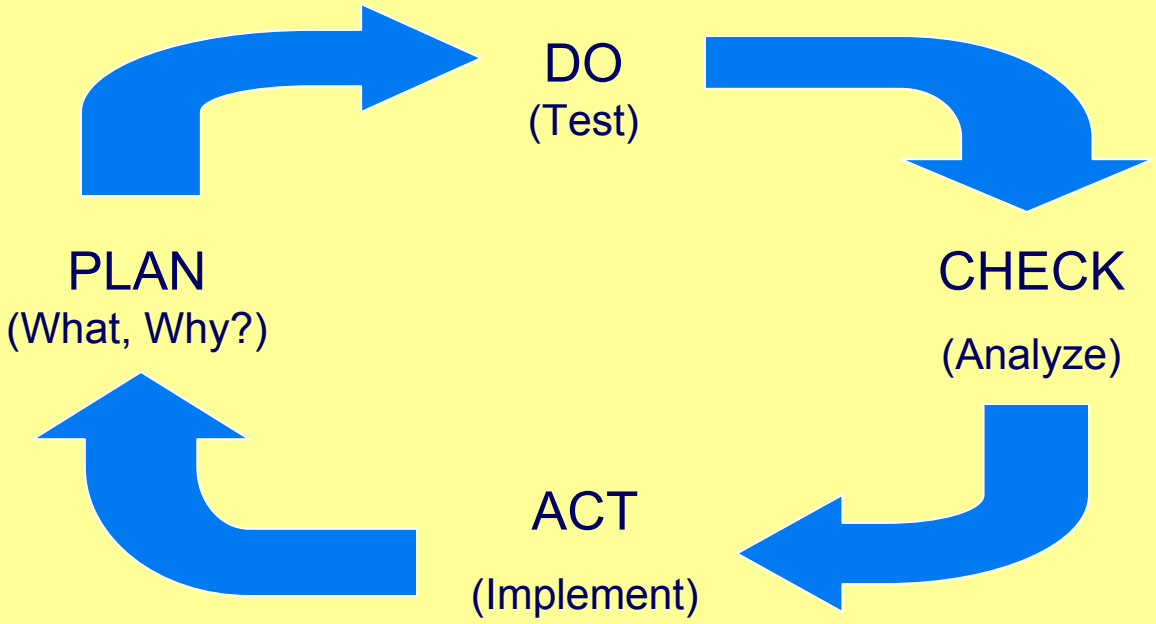
- Session Design (20-30 min.)
  - ***Part I:*** *Introduction and Learning Objectives (1-2 min.)*
  - ***Part II:*** *Key Concept or Principle Defined and Explained (5-7 min.)*
  - ***Part III:*** *Exercise or Activity Based on Field Data that Illustrates the Concept or Principle (5-15 min.)*
  - ***Part IV:*** *Common "Disconnects," Relevant Measures of Success, and Potential Action Assignment(s) to Apply Lessons Learned (5-7 min.)*
  - ***Part V:*** *Evaluation and Concluding Comments (1-2 min.)*

What is PDCA?
Different steps.
How are they applied
What are the common disconnects.

PDCA Introduction

Shewhart Cycle/Deming Wheel

PDCA is a continuous improvement tool



Continuous improvement – keeps looping around (find new improvements)

Walter Shewhart
Discussed the concept of the continuous improvement cycle (Plan Do Check Act) in his 1939 book, "Statistical Method From the Viewpoint of Quality Control“

W. Edwards Deming
Modified and popularized the Shewart cycle (PDCA) to what is now referred to as the Deming Cycle (Plan, Do, Study, Act).

Key Figures in PDCA

PDCA defined
Plan

PLAN **Identify The Problem (What?)**	• Identify the problem to be examined • Formulate a specific problem statement to clearly define the problem • Set measurable and attainable goals • Identify stakeholders and develop necessary communication channels to communicate and gain approval
PLAN **Analyze The Problem (Why?)**	• Divide overall system into individual processes - map the process • Brainstorm potential causes for the problem • Collect and analyze data to validate the root cause • Formulate a hypothesis • Verify or revise the original problem statement

Tools:

- Direct observation of process
- Process mapping
- Flowcharting
- Cause and Effect diagrams
- Pareto analysis

What & why step - what (identify) & why (hypothesis) of problem

Each step has various tools – don't elaborate, you can do a SPL on each of the tools

pDCA defined
Do

DO **Develop Solutions**	•Establish experimental success criteria •Design experiment to test hypothesis •Gain stakeholder approval and support for the chosen solution
DO **Implement a Solution**	•Implement the experiment/solution on a trial or pilot basis

Tools:

- Design of Experiment (DOE)
- On job training
- Stakeholder management & communication

PDCA defined
Check

CHECK **Evaluate The Results**	•Gather/analyze data on the solution •Validate hypothesis
Achieve the desired goal	•If YES go to act •Else go to plan, revise hypothesis/problem statement

Tools:

- Direct observation of process
- Graphical analysis
- Control charts
- Key performance indicators

Decision step – either go to act if the desired goal is achieved or go back to the plan and revise the hypothesis or problem stmt

PDCA defined
Act

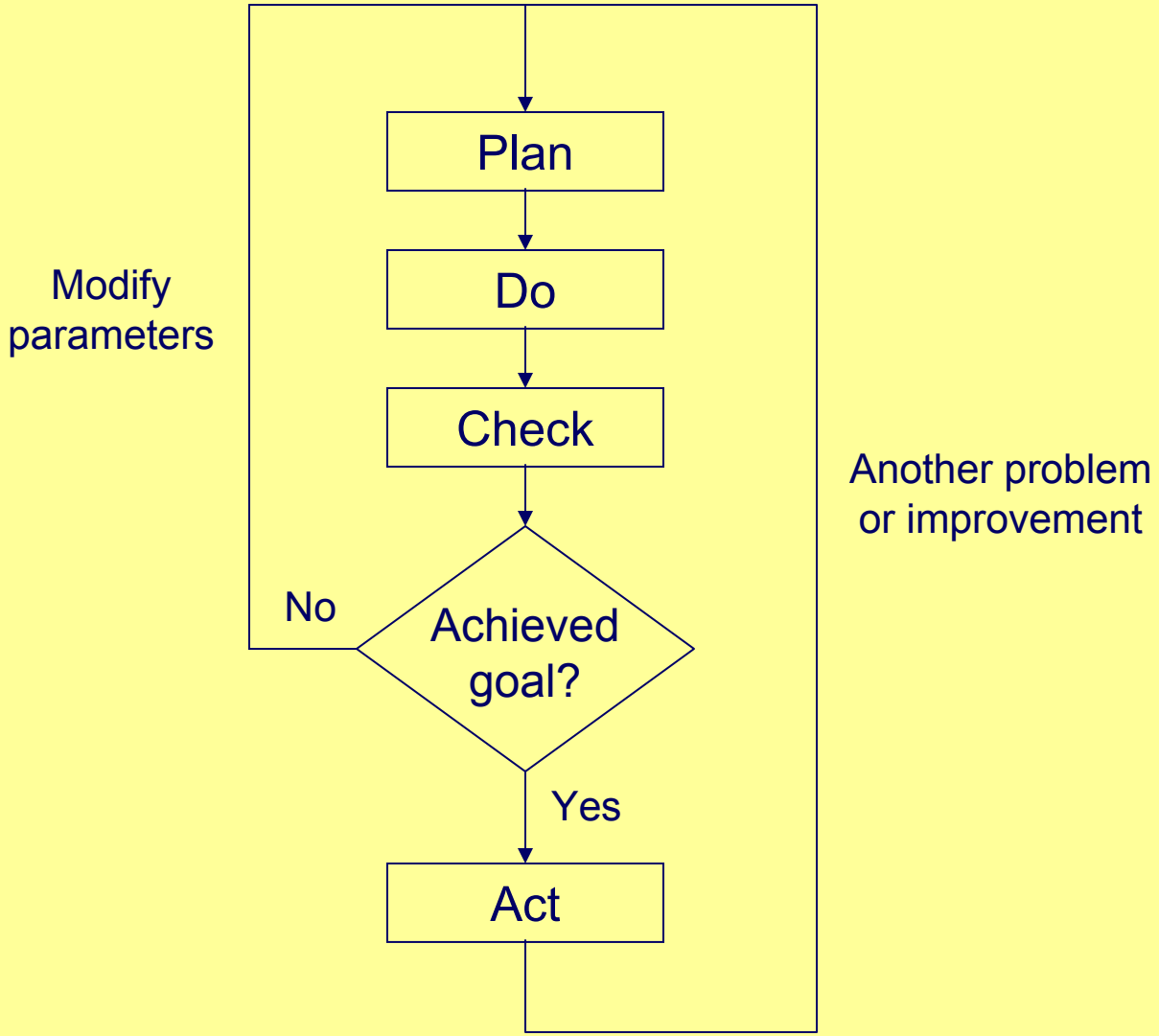
ACT **Implement The Full Scale Solution (and Capitalize on New Opportunities)**	•Identify systemic changes and training needs for full implementation •Plan ongoing monitoring of the solution •Continuous improvement •Look other improvement opportunities

Tools:

- Process mapping (new process)
- Standardization of work and process
- Visual management
- Error proofing
- Formal training

The real deal step- implement the full scale solution
Visual mgmt (ex. Signs when traveling on highway)
Error (idiot) proofing
Formal training (workforce)

PDCA – Overview



Industry Tool – A3 Report

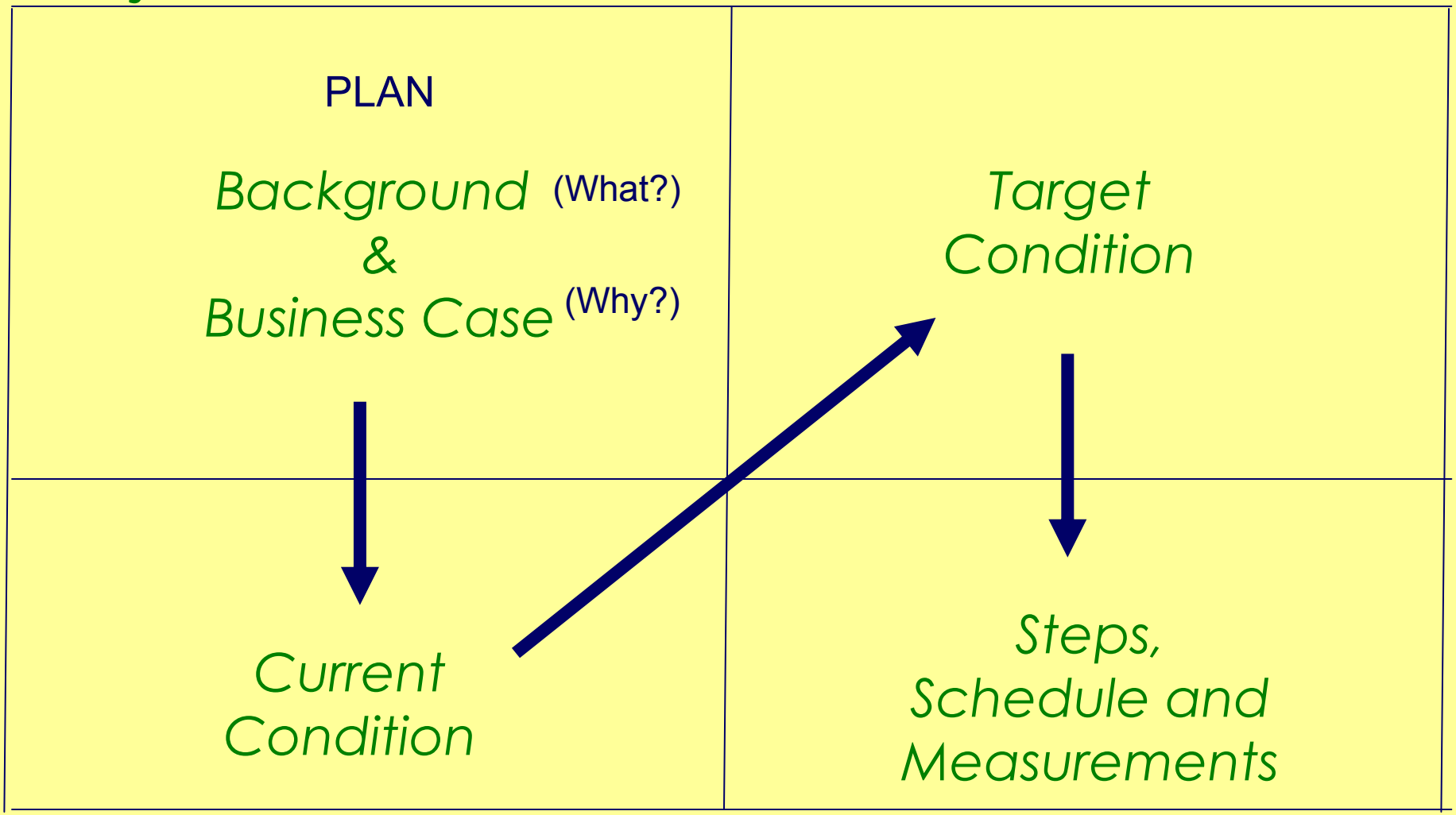
- Create an A3 report on a problem solved, a project started or an action item on a kaizen.
- Use 11x17 paper (or 2 8 ½ x 11's) and the format shown on the follow pages - 11x17 is big enough for the required information but still allows you to keep it to one page
- Write it in *pencil* - you won't cheat with smaller font sizes and it encourages you to draw pictures to describe the opportunity
- Every A3 should also help explain how the lean rules and principles are used to improve the business

Use as a living document. Don't just put the project on an A3 at the end, use it at every step of the process.

Source: Jamie Flinchbaugh, Lean Learning Center

Industry Tool – A3 Report (cont.)

Project Area: **Owner:**



Information should FLOW and be simple.

Source: Jamie Flinchbaugh, Lean Learning Center

Top left - Background (what), Business case (why) – this is the plan step

Bottom right – how you are going to get there and what you are going to use to measure against hypothesis

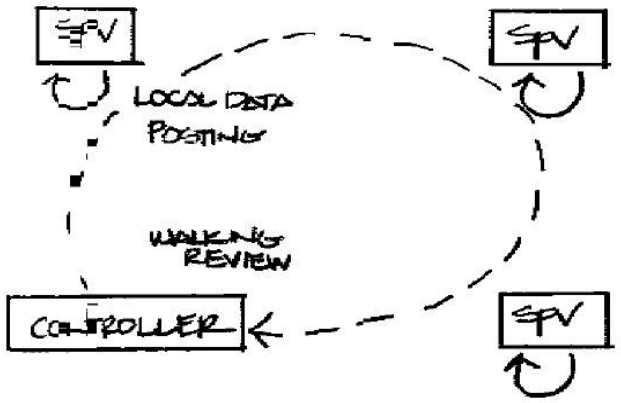
BACKGROUND (WHAT)

- DIFFICULTY IN HOW TO PROCESS & REVIEW OPERATIONAL DATA

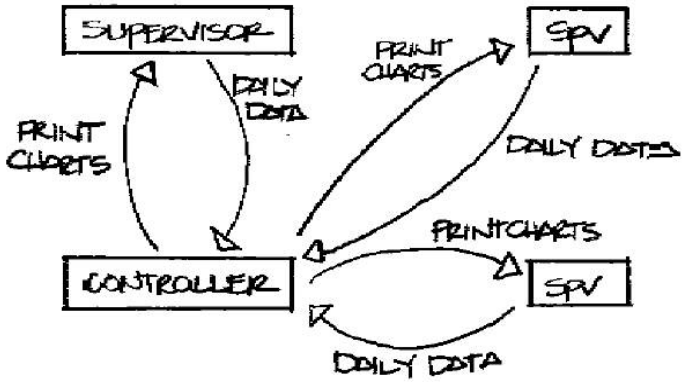
BUSINESS CASE (WHY)

- IMPORTANT TO STAY ON TOP OF OPERATIONAL DATA
- WASTE OF PAPER & PROCESSING TIME
- LACK OF OWNERSHIP OF OPERATIONAL MEASUREMENTS

TARGET CONDITION



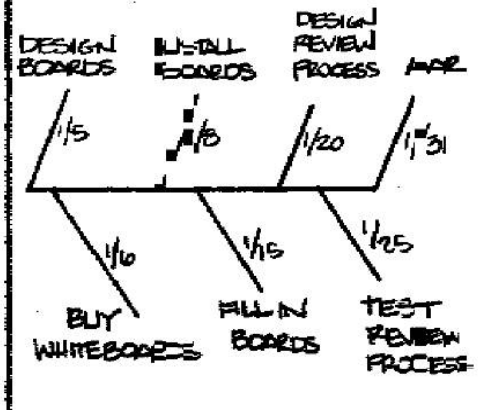
CURRENT CONDITION



STRATEGIC STEPS

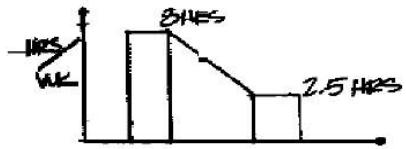
- DESIGN MEASUREMENT SCOREBOARD
- DEVELOP REVIEW PROCESS

SCHEDULE

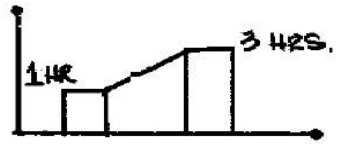


MEASUREMENT

TIME SPENT PROCESSING



TIME SPENT USING



Source: Jamie Flinchbaugh, Lean Learning Center

Example from Jamie

Sample Activities – PDCA

- Divide into small groups and take 2-3 minutes to discuss.
- Current Situation – Technicians have identified a time savings opportunity by moving a component rack closer to the manufacturing line.
  - Discuss the next steps using the continuous improvement cycle to accomplish this task (PDCA).
  - The new setup was found to decrease cycle time by 2x expectations. What are the next steps?
  - The new setup was found to increase the cycle time for the series of operations in question. What are the next steps?

Important part is to revisit the hypothesis in each case and ask why is it different than expected.
Learning can be derived from both successful and unsuccessful PDCA cycles.

PDCA Card Exercise

- DO NOT LOOK AT YOUR CARDS.
- Break into small groups for a game:
  - Objective – Divide the cards in your group as fast as possible so that every member of the group has the same numerical sum.
    - Aces are 1, 10s and face cards are 10, 2-9 are the amount shown.
  - DO NOT TOUCH YOUR CARDS
  - Do: GO – Raise your hand when you are done.
  - Check: Did you meet your goals? Discuss how to improve?

  - Plan: You have 4 minutes – DO NOT TOUCH YOUR CARDS
  - Do: GO – Raise your hand when you are done.
  - Check: Did you meet your goals?
  - Act: Document your solutions.

For the first iteration, give the groups only 30 sec to try to divide the cards.

Common Disconnects in Industry

Technical Factors

- BIG "**P**"$_{DCA}$ – Overplanning
  - Team gets stuck in planning cycle – try to confirm beliefs in planning whereas lean model confirms beliefs in check
- LITTLE "P"**DCA** – Underplanning
  - Missing experimental hypothesis: no "why".
- Things work well for reasons beyond understanding with no knowledge of what worked and why.
- The hypothesis is not validated.

Social Factors

- Constrained resources and improper training cause PDCA to begin and end at "Do".

Other Industry Uses of PDCA

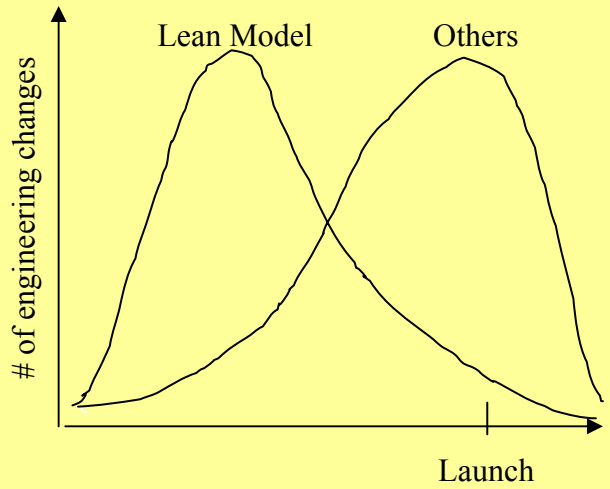
- Aluminum Foundry

  Company performs PDCA on an annual basis from top to bottom. Metrics and tasks are developed to meet overall goals. Status of metric is red, yellow or green.

  On a daily/weekly basis, individual teams present their metrics (checks) and plans.

  On a quarterly basis metrics are reviewed and those that have missed the mark are examined for root causes and new plans are made to meet yearly goals.

- PDCA in Process Development



- Toyota has demonstrated that a more rapid and effective use of the PDCA model in process development can lead to a dramatic decrease in engineering changes post launch.

The toyota example exemplifies how PDCA can be used in the product development cycle to save considerable dollars.

Concluding Comments

- The PDCA cycle can be an effective and rapid method for implementing continuous improvement.
- Each step: Plan, Do, Check, and Act are critical for consistent implementation of successful process improvements.
- Avoid the common disconnects as seen by one professional in industry, such as over/under-planning and not validating the hypothesis, even on successful results.
- Different industries will use the cycle uniquely, but companies that use it well develop tools around PDCA to use it effectively.

Appendix: Instructor's Comments and Class Discussion from 6.4

- Problems can stem from overplanning or underplanning—important to find the right PDCA balance
  - A decade to learn to "Plan," a decade to learn to "Do" . . .
- Constrained resources can lead to a lot of doing, and not much else
- Documentation is key to PDCA, so that knowledge can be recorded and internalize

Appendix: Instructor's Guide

Slide	*Time*	*Topic*	*Additional Talking Points*
1-4	2-3 min	Introduction, overview and learning objectives	• Identify overall themes – don't just read from the slide
5-10	5-7 min	Key Concepts	• Stress the value in each step and the link between steps.
11-15	5-15min	Exercises/Activities	• The A3 report is included as an example and does not need much elaboration. • The card game is more fun, but more time, cut it out and do the class discussion if time runs over.
16-17	3-5 min	Disconnects	• Stress the importance of validating the hypothesis and in effective planning.
18	1-2 min	Concluding comments	•

Refer to the NOTES for each slide for more details.

References

Dennis, Pascal. Lean Production Simplified: A Plain Language Guide to the World's Most Powerful Production Systems. Productivity Press, 2002.

http://www.hci.com.au/hcisite2/toolkit

http://www.balancedscorecard.org/bkgd/

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