

PROCESS ISSUES: HOW WE TROUBLE SHOOT D.R. Woods, McMaster University, 2002

Four things to look for in an effective trouble shooter: overall approach to problem solving, data handling, synthesis, and decision making

● **PROBLEM SOLVING IN GENERAL: HOW YOU DID IT**

Theme	Detracting behaviors	Enriching behaviors
Monitors the thought process	- No assessment of potential gain from a question or action.	- Asks "What will this get me?"
	- Unclear of type and purpose of question asked; just asks what pops into mind.	- Knows clearly the purpose: ask fishing or shooting questions; whether creating hypotheses or checking for change or gathering information for clarification.
	- Does not monitor or ask questions as to Why? or implications.	Asks "Am I through?", "Am I finished with this task?", "Where is this leading me?", "This should tell me..."
Checks & double checks	- Assumes everything is OK. Does not check instruments, diagrams, hardware, procedures.	-Checks and double checks instruments; checks if the equipment and lines are as on diagrams. Calibrates and recalibrates instruments.
Is systematic	- Jumps all around, confused, and no apparent plan.	Identifies plan and follows it systematically yet flexibly. Use of tables or charts to keep track of idea flow.
Subproblems & perspective	Keeps whole problem and does not identify subproblems, no identification of a strategy.	Breaks overall task into ones of situation clarification, or hypothesis testing and /or identify the change; into emergency action, cause identification, fault correction and future problem prevention.
	Confuses issues, factors, fault detection, solutions.	Identifies phases clearly and works through systematically.
	Solves a minor fault while the process explodes.	Keeps situation in perspective, does not get lost in a subproblem.

● DATA HANDLING: WHAT YOU DID

Theme	Detracting behaviours	Enriching behaviours
Data resolution	Gathers data but does not know what it tells him/her.	Correctly identifies the usefulness of the data collected.
	Asks any old question	Matches <i>hypotheses</i> with the <i>observed evidence</i> to see if the hypothesis is consistent with the evidence
	Believes all he/she sees and hears; unclear of errors in information.	Explicitly states limitations of the instruments, measurements and checks these systematically.
	No data gathered explicitly. Jumps in making corrective action without stating possible hypothesis or cause.	Gathers data for problem clarification and hypothesis testing/or change rather than jumping in with corrective action without any data.
	Gathers data expensively, Takes process apart for everything. Overlooks simple ways of gathering information.	Gathers data easily through simple changes in operating procedure, puts controllers on manual.
	Asks for samples, but assumes that sample locations and procedures are as usual.	Is present when samples are taken, bottles labelled.
	Gives imprecise instructions: "Check out the instrument"; "Open up the exchanger".	Gives precise instructions.
Actions based on fundamentals	Based on intuition.	Based on fundamentals; estimates behaviour based on fundamentals.
		Does mass and energy balances with at least two independent measurements.
		Does pressure profiles through units.
Reasoning	Jumps to invalid conclusions.	Draws valid conclusions; tests both positive and negative: what is; what is not; if it does happen; if it does not.
	Error in inference: Confirmational bias	
Completeness	Uses only part of the information. Doesn't check the design calculations, or data from startup or data from initial, clean fluid; didn't think of human error.	Uses all resources.

● SYNTHESIS: HOW YOU PUT IT ALL TOGETHER

Hypotheses	Detracking behaviours	Enriching behaviours
	Becomes fixed, thinks of only or selects one hypotheses; selects one at the start and cannot become unfixed	Keeps at least four working one hypothesis; keeps options open as data are gathered
	Makes everything complex	Keeps it simple, especially if there is a "big failure"
	One view	Many viewpoints: operators, design, human error, instruments, corrosion
	Critical of ideas; limited brainstorming	Defers judgement when appropriate
Flexibility	Considers only a "hypothesis" strategy or a "change" strategy and sticks with it regardless of the evidence.	Selects either a "hypothesis" strategy or a "change" strategy. Shifts strategy when its warranted
	Considers steady state only; considers only the facts	Considers unsteady state as well; considers the people too (the stress they might be under; the environment that allows open discussion; turf fights).
Overall synthesis	Cannot put all the ideas together into a reasonable story. becomes fixed on one cause even when evidence points otherwise.	Can put the ideas together into a plausible explanation.

● DECISION MAKING: HOW YOU PUT IT ALL TOGETHER

Priorities	Detracking behaviours	Enriching behaviours
	No priorities for hypotheses; just start anywhere; indeed, may not even create a hypothesis!	Sets and uses priorities. Keeps track and moves from top priority to second. at least four working one hypothesis; keeps options open as data are gathered
	No priorities for gathering evidence; just collects something	Prioritizes; gathers the easy and cheap tests first. Visits the site.
	No priorities about the urgency of the situation; diddles around while the plant explodes; keeps customers waiting until completely solve the problem.	Prioritizes urgency; willing to use a contingency plan to get things going safely and later correct the real fault.
Bias	Biased, stacks the deck so the favourite fault will be selected even when the evidence refutes it.	Unbiased. Selects either a "hypothesis" strategy or a "change" strategy. Shifts strategy when its warranted
	Biased: tests for only positive elements.	Tests for both positive and negative. Proves that hypothesis is correct and the other options are not correct.
Overall process	No criteria used, or if they are, they are not measurable.	Uses measurable criteria to make decisions.

Observer's Feedback

TS name _____ Case _____ Initials ES _____ Obs _____

Rough work area:

PROCESS: HOW DATA/ ANALYSIS: WHAT
Monitoring _____ Data resolution _____
Checking _____ Fundamentals? _____
Systematic _____ Reasoning _____
Subs and perspective _____ Completeness _____

DECISION MAKING:HOW SYNTHESIS: WHAT
Priorities _____ Hypotheses _____
Bias _____ Flexibility _____

RATING AND FEEDBACK

Clarity of Communication

None | Some | Most | All
0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____

Process used:

None | Some | Most | All
0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____

Data collections and analysis:

None | Some | Most | All
0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____

Synthesis:

None | Some | Most | All
0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____

Decision-making:

None | Some | Most | All
0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____

Five Strengths: Two areas for improvement
