Pre-Work | Problem Solving 101

Root Cause Analysis & Logic Trees

This note addresses an important method for organizing your thinking and structuring a research endeavor. Participants in the SDP Institute for Leadership in Analytics should familiarize themselves with these concepts prior to arriving at the Harvard Graduate School of Education. The Problem Solving 101 session at the Institute will explore these concepts in greater detail, and many elements will be relevant for the balance of the session. This note introduces some key concepts to help properly frame research questions, as well as highlights some tools to help manage for success along the way.

The Problem Statement

Fundamentally, policy analysis and improvement science are well served by asking the questions “What problem are we solving?” and “Why are we solving this problem, now?” Unfortunately, these questions often go undiscussed in many organizations, resulting in poor research agendas, and likely disagreement between key leaders or stakeholders. A problem definition should be neither too broad nor too narrow, and should confront issues about tractability and scope. Is this effort realistic? Are the data available? Who is the champion? Is there a path to impact? What are the roadblocks? During the Institute, we will explore a template for a comprehensive problem statement, which includes sections for a description of the basic issue at hand, any relevant context, the project scope and definition of what success would look like, and any major constraints that need to be accounted for. You may want to think about these categories in advance for your own work, as well.

Root cause analysis helps to break down complex problems into more actionable issues. It can help education agencies address improvement areas more effectively by attempting to identify and correct the root causes of events, as opposed to simply addressing their symptoms. Identifying root causes helps you develop an action plan to execute, test, and modify until the problem is resolved.

Root cause analysis can take many forms, ranging from the deceptively simple to the overwhelmingly complex. Many resources exist to inform root cause analysis. While they are not the focus of the Institute, we will spend some time structuring and discussing a simple tool called a logic tree to develop and structure a problem and its root causes and possible solutions.

How to Build and Use Logic Trees

The logic tree – a term sometimes used interchangeably with its close cousins the “issue tree” or “decision tree” – is a way of visually breaking down a problem statement or question into its component parts. Here’s a simple illustrative example of a boy trying to save enough money to buy a new bicycle:
Using a logic tree, the boy is able to lay out a comprehensive set of options to allow him to get enough money to buy a bicycle. This boy can look down each possible set of branches and determine the likelihood of success as well as weigh the possible total dollars involved. Some branches involve a lot of unknowns: How many lawns would he be able to mow? Others involve real constraints: Would his parents actually let him sell his violin? Similarly, when we construct problem statements using logic trees for education policy, some branches quickly appear more feasible than others.

Note that at each stage where new branches form, it’s important for the branches to be “MECE” – lingo for mutually exclusive and collectively exhaustive. Each branch represents something different, and all the possibilities are there. You should ensure that branches do not overlap or appear more than once. If you have trouble getting started, start by listing potential root causes or categories on a piece of paper – you can determine logical groupings later. Also, you may choose to write the hierarchy as questions (see example above) which frames the logic tree branches toward possible interventions, or you could think about the tree looking back in time. Somehow, the boy managed to finance a new bicycle – how did this happen?
An Exercise for You to Try

Try to put together a logic tree for a key project or research question that you’re thinking about in advance of the Institute (we recommend using the project in your Key Projects Update). How would you draw this? Note that it’s not as easy as it might sound at first glance! Start with a blank sheet of paper and try out a few variations and see how the hierarchy of questions or root causes evolves. You do not have to submit your practice logic trees.

At the Institute, we plan to tackle some big questions that may include the following:

- How can we improve teacher effectiveness?
- How can we increase the number of graduates who seamlessly attend and graduate from college?

Steps to Developing an Analysis Plan

During the Institute, we will discuss in greater detail how to use a logic tree to assist in the creation of an analysis plan. In advance of our session, you should consider the following:

1. Specify hypotheses about the relative importance of logic tree branches
2. Prune your tree of solutions outside your constraints (or the wildly implausible)
3. Determine level of certainty required for analyses
4. Determine time and data required (or available)
5. Share with others to “socialize” the ideas: are you missing something?

The analysis plan will also contain information about timing. Planning for key dependencies is a critical effort in making sure that appropriate expectations are set and that the effort will run as smoothly as possible.

We look forward to seeing you!