Houston, we Have a Problem Solving Model for Training

Lacey Schmidt[1], Kelley Slack[1], Kathryn Keeton[1], Immanuel Barshi[2], Lynne Martin[3], Robert Mauro[4], William O'Keefe[5], Evelyn Baldwin[5], & Therese Huning[5]

Introduction

In late 2006, the Mission Operations Directorate (MOD) at NASA began looking at ways to make training more efficient for the flight controllers who support the International Space Station. The average certification times for flight controllers spanned from 18 months to three years and the MOD, responsible for technical training, was eager to develop creative solutions that would reduce the time to 12 months. Additionally, previously trained flight controllers sometimes participated in more than 50 very costly, eight-hour integrated simulations before becoming certified. New trainees needed to gain proficiency with far fewer lessons and training simulations than their predecessors.

The Problem: How do we help novices quickly become expert problem solvers?

The Solution? Explicitly model how experts solve problems in our context.

The Model: What does expert problem solving look like in Mission Control?
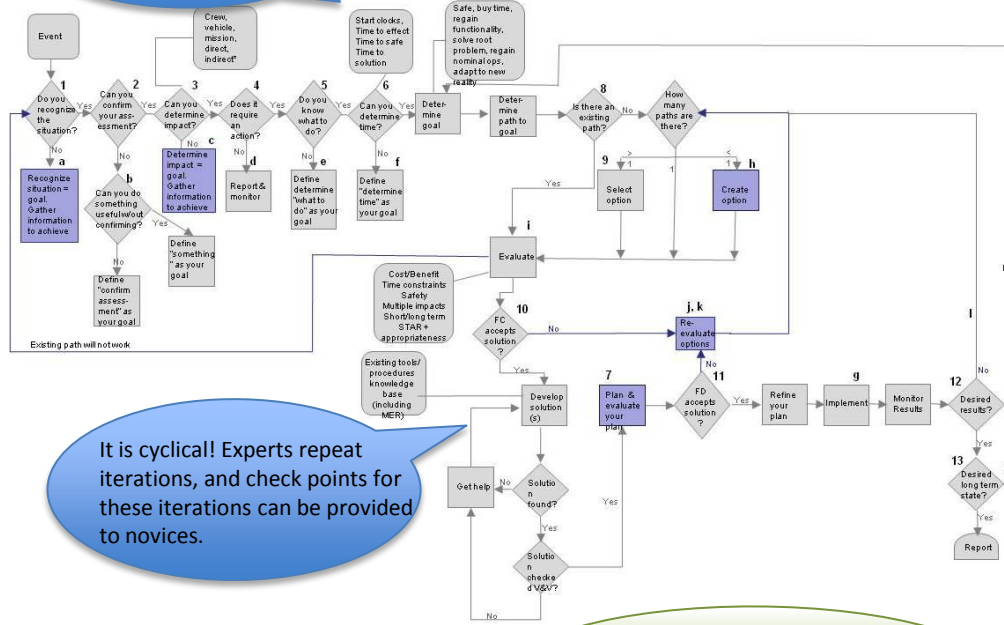
It is cyclical! Experts repeat iterations, and check points for these iterations can be provided to novices.

Approach

- Semi-structured critical incidents interviews conducted with seven experienced flight controllers.
- Model extracted from interviews by SME group.
- Model compared to nine existing models in literature and refined by SME group.
- Model tested and verified in reverse back to interviews by a research group.

Conclusions (to date)

- The modeling process promoted interest and learning within the organization.
- Having an explicit model increased the flexibility and fidelity of training plans.

Resulting Training

- Several model-based training options were proposed, including a classroom portion, paper-based simulations, mini-simulations with facilitated debriefs, and problem solving-focused mentoring sessions.
- Model can be used to help debrief and learn generalizable problem solving skills (rather than specific solutions unique to that particular case).

Does model-based instruction really reduce resources required to certify a flight controller? Work to be continued…

Novices can be taught how to question and "re-sort" problem solving steps for different situations.

What are the critical circum-stances? (what factors will you weigh any options against?)	What are the risks? (what are the chances and consequences of something going wrong?)		
To whom do you need to talk/ coordinate?	Can you (dis)confirm the failure?	What is your next goal?	What is your immediate goal?
How have you checked your thought process?	What are the impacts?	What are your options?	What is your plan?
Are there any immediate safety actions required?	What are the Times-to-Effect?	What are your benefits/ costs/ risk trades?	How can you tell if your plan is working?

Lschmidt@wylehou.com
William.s.okeefe@nasa.gov

1. Wyle 2. NASA Ames Research Center, 3. San Jose State Univ, 5. Decision Research, 4. United Space Alliance LLC