

USING SIMULATORS IN THE CLASSROOM ENVIRONMENT

Best Practices and Methods for Success!

Dave Young
Simtronics Corporation

Overview

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- ◎ But most people struggle to effectively harness the potential benefit of simulators

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Keys to success:

- 1) Make sure you understand the tool and its abilities.
 - What are the capabilities and limitations.
 - Where does the simulator fit within a curriculum.
 - Competence- not to be confused with mastery.
- 2) Have a plan.
 - You can't build a house without a blueprint.
- 3) Stick to the plan.

What level are we teaching to:

- ⦿ You have to walk before you run.
 - Learn basics before advanced.
- ⦿ Where are your students?
 - From what foundation are we starting from?
- ⦿ What application of the simulator will help them?

Bloom's Taxonomy

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis: Creativity
- Evaluation

1st Level- Knowledge

Knowledge is (here) defined as the **remembering (recalling)** of appropriate, previously learned information.

- Basic equipment identification.
- Understanding symbols on a flow diagram.
- What is going on in this unit.
- Also includes system navigation skills.

2nd Level- Comprehension

Grasping (**understanding**) the meaning of informational materials.

- ⦿ Pressure, Temperature, Flow and Level.
- ⦿ Heat Transfer
- ⦿ Material balances
- ⦿ What Ifs- watching and predicting.

3rd Level- Application

The use of previously learned information in new and concrete situations to solve problems that have single or best answers.

- ◎ Simple Troubleshooting.
 - Moving past watching and predicting.
 - Using skills to find root cause.
 - Error is relatively obvious.
 - Determine error within a flat environment.

4th level- Analysis

The breaking down of informational materials into their component parts, examining (and trying to understand the organizational structure of) such information to develop divergent conclusions by identifying motives or causes, making inferences, and/or finding evidence to support generalizations.

- ◎ Complex Troubleshooting.
 - Subtle upsets- determining root cause.
 - Detect upsets in an “agitated” environment.

5th level- Synthesis

Creatively or divergently applying prior knowledge and skills to produce a new or original whole.

- ◎ New best practice or procedure created.
 - Beyond 2 year degree level.
 - Requires Custom Simulator.
 - Operator knows unit well enough to think beyond given procedures.
 - Examples: Faster start-up, better emergency ops, etc.

6th Level- Evaluation

Judging the value of material based on **personal values/opinions**, resulting in an end product, with a given purpose, without real right or wrong answers.

⦿ Optimization

- Most processes are highly complex and the higher end of optimization becomes very subjective.
- This level of skill and depth of knowledge will not be attained by all.

Action Plan:

- ① We have some ideas about where things fit and examples of what to do.
- ② What is the best way to implement?

Step 1:

- ◎ Use the simulator as a classroom demonstration tool using an overhead or Smartboard.
 - Show students how the live simulator brings concepts into focus.
 - Students will become familiar with the software and interface.
 - Use the time to reinforce concepts learned in lecture.
 - (First level- knowledge)
 - Example. SPM-100 Design.

Step 2:

- ◎ Provide vendor documentation as a homework assignment.
 - If possible, start with a simpler unit.
 - Allow students to read up on their “new unit”
 - Knowledge and familiarity fosters success.
 - When possible, make sure schematics and/or P&IDs are included.
 - Would you let an operator on a real unit before they were familiar with the specs?
 - (First level- knowledge)
 - [Example](#)

Step 3:

- ◎ Unit start up and shut down
 - Use vendor provided procedures.
 - Helps student to gain confidence on the system.
 - “No pressure” as student is following a written procedure.
 - First understanding of the unit’s operation and characteristics are developed.
 - (Moving from first level to Second level-Comprehension)
 - Example. SPM-600 Start Up

Step 4:

- ⦿ Have students make changes and predict outcome.
 - Adjust feed rate, change reflux, etc.
 - Use What ifs as homework or classroom assignment.
 - (Level 3- Application)
 - Example. SPM-600 What if exercises.

Step 5:

- ◎ Group Troubleshooting
 - Collaborative effort.
 - Simulates real control room.
 - Another way to keep the learning curve manageable.
 - Good time to check the pulse of the class.
 - (Begins move from level 3 to level 4-Application)

Step 6:

- ◎ Simple Troubleshooting Exercise
 - By now the student has a good understanding of the unit- classroom demo, documentation, start up/shut down.
 - Give them the “real world” experience of an unplanned upset with alarms etc.
 - Keep it simple at this point.
 - A steady environment is best here.
 - (Level 4- Application)
 - Example. SPM-600 Ex. 5

Step 7:

◎ Complex Troubleshooting

- Start with a “disturbed” environment. This is closer to reality and makes it much harder to recognize the cause of an upset.
- Possibilities include multiple faults, subtle faults over time, indicator errors, faults involving complicated control loops.
- Applicable for incumbent operators and/or advanced PTEC students.
- (4th Level- Analysis)
- Example. SPM-700 Ex. 28

Step 8:

- ◎ Unit optimization.
 - Requires custom simulator for unit specific application.
 - Goes beyond principle level understanding.
 - Applying principles to “reality”.
 - (Level 5- Synthesis and Level 6- Evaluation)

Results:

- Following these steps will provide you with an effective and well structured simulation program.
- Available time and resources will create roadblocks and force some changes. Be creative and work around your specific challenges.
- Your specific training goal will dictate how far you go in the action plan.

Last thoughts:

- ⦿ Use the simulator results to help validate your curriculum.
 - If students consistently struggle or seem lost, make sure to re-evaluate how those ideas are taught.
- ⦿ Use your vendor as a resource!
 - There is no “stupid question”.
- ⦿ Remember to have some fun!
 - Everyone learns better when they are engaged and having fun. Create some games or contests to build enthusiasm!

Thank You!

Contact info:

Dave Young

Simtronics Corporation

Phone: 908-537-6734

Email: dyoung@simtronics.com

