

A personal approach to training

BY PAUL FREEDMAN, PRESIDENT AND CO-FOUNDER OF SIMLOG

Loading and hauling equipment that is matched perfectly to production, to the mine, and to each other can still be adversely affected up to 30% or more by the ability of the operator. Inadequate training leads to lower productivity and higher equipment maintenance and repair costs. Personal simulator training can save money in maintenance costs and extend machine life.

Modern mining equipment is increasingly complex, costly, and difficult to operate productively.

But there are wide variations in the proficiency of a typical company workforce, as shown in Figure 1 (below). And it's the 'weaker' operators with less proficiency that are typically responsible for most of the accidents that cause damage to your equipment (and possibly injury to your people), along with the premature wear-and-tear that results in higher maintenance costs.

This comes about because there are wide variations in operator 'aptitude', that special combination of psycho-motor, sensory/perceptual, and cognitive abilities.

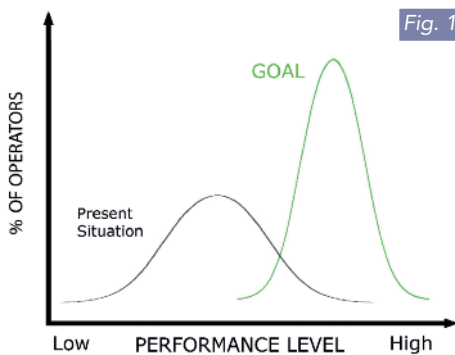


Fig. 1

So by better choosing your training candidates, everyone you train will go on to become truly proficient. And that's why, especially since the Second World War, industrial psychologies have developed psychometric tests (with pegboards to test how you move your fingers, or imaginary paper folding to test how you can 'turn things' in your head, to name just two) to measure that aptitude.

Not surprisingly, simulation will do that much better (at Simlog, we've done some side-by-side comparisons), just because it presents to the training candidate a simplified version of what the real work will be. And at Simlog, working with our customers, we have documented evidence that in a group of, say, 10 people putting up their hand ('please pick me!'), that there will be 2-3, sometimes 3-4,

who don't have enough aptitude to make the training, as an equipment operator, worthwhile. And this is true all around the world (Simlog now has customers in almost 60 countries).

But pre-screening for operator aptitude is just part of the 'Present Situation' in Figure 1, and that's because the other part is inadequate training that leads to lower productivity, higher fuel costs, increased tyre wear, and more equipment maintenance and repair.

The fact is, to reach the 'goal', as in Figure 1, people with enough aptitude also need to develop the right habits that are key to achieving true operating proficiency.

For example, consider tyre wear, something of concern to every company that owns haul trucks. Here are three typical 'symptoms' of poor operating practices:

- Turning the wheels when the truck is stopped
- 'Cornering' too fast, ie. turning the wheels too much for the current speed
- Driving with the tyres in contact with a berm



About the author

Paul Freedman, Ph.D. (Electrical Engineering), Eng. has been working with computers, control systems, and simulators for more than 35 years.

A registered professional engineer in the Province of Quebec, Canada, he is President and co-founder of Simlog, where he continues to lead his company's efforts to develop new, cost-effective, PC-based personal simulators to help train operators of heavy equipment across a number of construction related industries, including mining.



And here are some 'bad habits' that will lower productivity at the controls of a wheel loader:

- Driving into the stockpile to load the bucket while articulating (engine power is optimally transferred to the front end when articulation = 0)
- Loading trucks while articulating (material is optimally dumped into the truck box when articulation = 0)

Of course you can explain this to your operators and they will try to remember, but learning to be careful 'automatically' takes more than explaining, it takes developing the right habits. And that's where simulation's 'learning by doing' really shines.

Indeed, Simlog's haul truck and wheel loader simulation software features 'Performance Indicators' that track all of the poor operating practices previously cited. So when they occur, the occurrences are counted and appear in the simulation results, for both the operator and trainer to review.

But simulation is also a wonderful 'teaching by showing' tool, to help your trainer better explain what to and what not to do, and this capability will help improve the quality of your training programmes.

With Simlog's products, you can use the function keys on your keyboard and your computer mouse to arbitrarily change the point of view, and zoom in/out. In this way, a trainer can make sure that new operators really understand how the hinge pin attaching the excavator's bucket makes it open and close, or how twin pistons moving in twin cylinders raise and lower the excavator's boom.

Luckily, in 2014, 'training simulation' can require little more than a suitable PC, USB-ready simulator controls, a big screen display, quality speakers, and the right kind of simulation software.



Fig. 2

One haul truck simulator example, from Simlog, is shown in Figure 2.

And as the computing and graphics 'horsepower' of today's off-the-shelf PCs continues to increase, it becomes possible to bring increasing levels of realism to that simulation.

In parallel, home television continues to drive down the costs of plasma and LCD flat screens, making it possible to have bigger and bigger displays to put to work for simulation (here bigger means having a wider field of view, both vertically and especially horizontally, and that makes the simulation experience more 'immersive').

And the combination of better PCs and lower cost displays means that it becomes possible to use a single PC to drive multiple displays, as shown in Figure 2.

But better PCs also means better simulated physics with new 'wet/slippery' driving conditions eg. after the rain, or when roads are icy (in winter), featured in Simlog's haul truck simulation software.

To summarise, simulation today can help you decide:

- Whether your training candidates have enough aptitude to make your training investment worthwhile
- Whether your new operators have learned the right habits well enough to 'graduate' to the controls of your (real) equipment

And the combination of the two gives rise to documented improvement as reported by our customers and in Figure 3 (below), we present one such example ('Weeks in Training' refers to time spent at the controls of real equipment, so the simulator-based pre-screening and preparation that took place beforehand is not shown).

Today there are several companies with simulator products to help train mining equipment operators and, as a rule, complexity and price go hand-in-hand.

For that reason, the most expensive products, costing as much as \$1,000,000, are also the most complex with multiple PCs, special wrap around displays, real operator controls, a motion platform, a trainer's station, and hardware/software details that change with the particular make and model of the equipment that is

Aptitude screening

Today Simlog has mining industry customers in all the regions of the world and pre-screening for operator aptitude followed by simulator-based preparation, have become a key part of their recruiting efforts.

For example, as part of one study in Canada, a customer found that 25% of his training candidates were judged to be unsuited for training as equipment operators. As part of another study, this time in Mauritania, this rose to 42%.

After pre-screening comes the simulator-based preparation of new operators. And the simplest way to measure that added value is to compare what those operators are able to do at the controls of real equipment versus new operators who had no such simulator-based preparation (of course, to keep the comparison 'apples and apples', it's important to have both groups of people operate the same equipment under the same conditions for the same amount of time.)

A customer in Canada found that thanks to simulator-based preparation, his new operators were able to double their productivity over the training period of four weeks (of real work at the controls of real equipment).

In Brazil, a customer documented an even higher percentage, but was measuring increased productivity over the training period of six weeks (of real work).

simulated. Not surprisingly, these simulators are costly to purchase and maintain, with a big upfront price tag and an ongoing annual fee.

At Simlog, we believe that our simpler personal simulators offer much more cost-effectiveness, with prices well below \$100,000. And we encourage all readers to visit our website, and the websites of other simulator companies, to learn more because there is no 'one size fits all'.

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Fig. 3