Training – time lost or gained?

Lack of time is one of the major reasons quoted for the drastic reduction in training activities that we are experiencing since a few years in almost all companies. Attending a training course for a few days or even for a week or two certainly puts extra strain on the company staff since the workforce has been reduced over the last years in such a way it can hardly can fulfill their obligations - even at full strength. Yet on the long run, the time spent for training is not wasted but will pay back many, many times- both in the form of time saved in daily work afterwards and in the form of the monetary rewards coming from the better control solutions.

A further argument for training would be that it is undisputed that the demands on the performance of the plants and processes have steadily increased over time which inherently also demands higher performance from the controllers and control schemes. This in turn requires on one hand better utilization of standard technology like the PID controller and on the other hand more intensive use of more capable advanced techniques. Furthermore, several new techniques have been developed in recent years that can help to significantly increase the profitability of the plant but of course can and will only benefit those who know to use them efficiently and effectively.

Less staff means less time

Over the last several years we have seen a permanent reduction in workforce throughout the industry and throughout all functions. Also process control, which was traditionally never extremely comfortably manned, has not been spared. One of the consequences of this reduction, that becomes more and more evident is, that the activities of the control professionals (technicians and engineers) are more and more limited to resolving just the most pressing problems and that there is practically no time left for more time consuming yet profit making activities like optimizing controllers or control schemes, investigating the process and operations in depth in order to locate further improvement opportunities or developing higher level control strategies. Another effect is that there is hardly any time left for training: Today when we ask why a person was not allowed to take a particular training course then in most cases the lack of time is given as the main reason – unlike years ago where we heard more arguments about the training cost.

We have less time but face higher demands

The reduction in workforce has, however, not stopped another long term trend, namely that the demands on the production are being constantly increased and, as a consequence, also the demands on the staff: Mastering the ever more complex processes and running them ever closer to their limits makes the task more and more complex and challenging. Just a few examples shall make that more evident:

- Many years back the main focus of operations has been on the products and the equipment. Today they also have to take all the effects of the production on the environment into account. Until some years ago it was commonly accepted that the flare was burning for some time when operations switched from one type to another. Today even after a few minutes of flaring angry phone calls come in from people living nearby and in some countries even every minute of flaring ai punished with a hefty fine. This means that the precision of these changes has to be much higher today than in the past.

- In addition, the plant equipment has become more complex and more difficult to operate: Integration of different plant parts or of common utilities (heat integration) has brought the effect with it that all changes and disturbances are not any more confined to the part where they occur but are carried from one part of the plant to others as well. This of course has some consequences regarding the way we have to operate the processes:

    - Any correcting actions taken at one place inevitably acts as a disturbance at some other part and need therefore to be carried out much more smoothly and carefully than in the case of isolated units – whether they are made by an operator or a controller.
    - Troubleshooting and especially the clear identification and separation of cause and effect has become much more difficult and complex because of the inherent feedback effects.

- Furthermore, In order to stay profitable the equipment is pushed much closer to its physical limits. There is much less of a safety margin, on the other hand there is much less acceptance of any violation of a limit: Even the blowing of a safety valve is monitored in some countries and punished with a fine.

- And last but not least, product specifications are in many cases tighter than former and thus more difficult to achieve and in other cases we see many more different grades and products than for example 10 years ago.

All this certainly requires more skills and knowledge. In addition , the process control technology has advanced further, new approaches haven been developed and existing ones refined. Also, today's control systems offer many more possibilities and much more power which in turn allows to make more intensive use of 'heavyweight' technology. So we do have today the possibilities to be able to deal with the higher demands – of course, provided that we know how to use them effectively.

With other words: all these factors together ask for a higher level (broader and deeper) of knowledge, namely

- better process knowledge and esp. better knowledge of the dynamic behavior and the main influences
- better knowledge of the different process control techniques or technologies
- better knowledge of the features and possibilities of the control system.

Besides this, we can clearly see the more need for specific practice oriented training, since the traditional education is often either incomplete or too theoretical: Still a lot of time is spent on methods that are of theoretical interest but are hardly used in industry. I would like to illustrate this with a few examples that I have experienced:

One day I introduced myself to the new process control head of a plant that I knew very well. In the discussion I also mentioned our upcoming training courses. His response was that he a) would not need any further education since he had studied process control in University and b) that he was too busy to leave that plant: Since six weeks already he was working very hard to set up and tune a feedforward on the main reactor. From my plant knowledge I knew, however, that that task should have not taken him more than a two to three days. The man certainly had deep and solid theoretical knowledge but not the necessary practical skills to quickly find the solution in the plant: Getting that knowledge of how to carry out meaningful tests and how to estimate the necessary process parameters and how to set up such a scheme in the DCS and how to handle the initialization properly would have cost him a few days, but saved him several weeks – not to speak about the money the control scheme would have made because of the earlier availability.

In the next case, I was called for help with a new cascade control scheme consisting of two temperature controllers. This scheme had given problems since its installation and has caused an intensive tuning and re-tuning effort over some weeks. A quick evaluation showed that the dynamics of both loops were almost equal and that a cascade could not bring any advantage – just the opposite. So the solution was clear and brought immediate improvement. Without the full background and without knowing the necessary conditions for cascades to function, they had just copied the scheme from another part of the plant because it seemed to be the fastest solution.

Concerning PID controller tuning we make over and over the same experience: Practically every control professional knows the original Ziegler –Nichols closed loop test. And they also know that bringing a controller into a stable oscillation just for tuning purposes is out of the question in the process industry. Consequently they do not apply it and normally resort to trial and error tuning, which can be quite time consuming. Yet hardly anybody knows that enhanced Ziegler-Nichols methods do exist that allow a closed loop test, which is preferred over open loop tests, but eliminate the main disadvantage – the oscillation, and that there are tools around that allow to calculate from the test results both the process parameters and the PID tuning in a couple minutes.

Another frequent observation is that most control professionals are just familiar with the PID controller and try to solve practically any control task with that one controller type: But, as we know, the PID has big problems in handling long deadtime and that there are other control techniques that can do this much easier. There have been many cases where a model based controller has not brought a big performance advantage over a PID but could be set up and tuned in much shorter time than what would have been needed for 'force-fitting' the PID.

I think these 'technical' examples speak a clear language. But there is on bigger problem out there that is not so visible: One subject that is practically never found in any education program is the calculation of the economical value of production improvement from better process control. Economics was always a very important subject but has even gained more weight nowadays since the shortfall in the resources forces us to justify every effort (and of course) spending very convincingly.

And what is more convincing to management than hard figures about the credits that can be realized by a certain task or action. Also, knowing the value of one's contributions brings the control engineer some extra job security: We have just too many times seen that in cases where certain functions or organizations could not proof their added value, that their tasks have been simply taken over by outside organization, that they were outsourced.

Knowledge – a key factor for profitable operation

How important the factor knowledge is has been shown both very surprisingly and very impressively by a study done by the Solomon & Associates in the early 90ies. The objective of this study was to determine the most important factors that effect the profitability of a production plant. In order to get truly credible results, this study was carried out for oil refineries. This industry was chose because they have a relative small number of different processes which means that there is a large number of comparable situations which allows statistically solid results. It was expected that factors such as the age of the equipment, the location etc. would come out as the main factors, but surprisingly enough only two other factors showed a truly statistical significance:

1) the intensity of the use of Advanced Process Control (APC) and
2) the level of the education of the plant personnel.

If we take all these factors and findings into account then we come to the conclusion that thorough education is more than ever a necessity – and certainly not a luxury or a special bonus for the individual.

And there is another point that hardly stands in any study report: If a training course is indeed fully practical oriented, then several real life situations will be discussed and the participants can also bring their most pressing problems (or also special solutions respectively) up for discussion. We have indeed very often experienced that the course instructor or another participant had already found the solution to the problems of one participant – what of course saved him typically more time than the course required.

Conclusion

There is no doubt that only those that have all the necessary practical know how are in a position to bring existing controllers to better performance, to further improve the performance of key variables by additional means like feedforwards et., to develop new, higher level control strategies, to find better answers to problems and thus to make significant contributions to the productivity and profitability of the plant.

And they will not only be able to deliver better results, they certainly will also fulfill their tasks in shorter time. This in turn means that the original time investment by attending a course will be paid back in the same 'currency' – and even more, there will be substantial economical incentives the plant will enjoy from the improved operation. But just as with any project or undertaking we have first to invest before we can harvest the results. And time is a precious commodity in which investing – also by means of training – is certainly worth doing.

Hans H. Eder

ACT

hans.eder@act-control.com
www.act-control.com