TRAINING QUALITY ASSESSMENT IN THE PROCESS INDUSTRY

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"Throughout any assessment process the aim should always be to give every individual every opportunity to prove their competency, whilst maintaining the integrity of the standard against which they are being assessed" Dave Loubser, Senior Staff Consultant, KBC Advanced Technologies.

Introduction

For many years now KBC's Human Performance Improvement product line has assisted clients to develop and implement knowledge and skills assessment systems, processes and tools.

Although KBC's Basic Operator Training Program features regular built in knowledge assessment elements, we have not yet had the call to develop structured skills assessment tools, until recently that is.

Supporting these clients has provided KBC with a valuable opportunity to not only see what our clients are doing in this field but also to develop practical, purposeful knowledge and skills assessment systems and tools. Our clients can deploy these tools with the knowledge that they are structured and have a high consistency and repeatability factor.

Some of these clients have up until now been using "soft" assessment methods such as unstructured interviews and presentations delivered by the assesse. Typically these assessments have been subjective and the results can be interpreted in any manner of ways. Deployment of KBC designed assessments, notably KBC's End of Module Test from the Basic Operator Training Program have highlighted some glaring gaps in basic equipment, process, physics and chemistry and safety knowledge and skills amongst operations and engineering staff across a wide spectrum extending from new hires all the way to experienced ex-pat staff.

I will briefly discuss experiences from two sites in the Middle East in particular.

At the first site, a large contingent of Operations and Engineering staff were assessed. The tool used was KBC's End of Module Test assessment tool identified gaps in knowledge and understanding of the basic function of process knowledge, equipment operation, basic physics and chemistry and safety, something that the client was not aware of until the skills assessment. It should be noted that the target group included new hires right through to experienced and in some cases long serving operations and engineering staff.

What this really identifies is the fundamental lack of a structured, well defined capability quality assurance system with associated training, knowledge and skills assessment tools, systems and processes supported by qualified trainers and assessors. It also identifies the sometimes overrated reliance on "experienced" ex patriot staff where it assumed that due to their back ground and long service in the industry that they are competent at their jobs.

At the second site, a smaller group of staff were assessed against an abbreviated version of the afore mentioned KBC End of Module Test, and the results also identified gaps in the same knowledge areas, namely process knowledge, equipment operation, basic physics and chemistry and safety. At this site however, the assessment identified that almost all of the field operators assessed were not deemed competent against the standard.

The conclusion drawn from this is that it would appear that taking the "softer" assessment approach does not identify specific knowledge and skills gaps but could rather have the effect of masking reality.

The following chart is a representative sample of the assessment results and is a clear indication of the knowledge gaps that exist on one of the above client sites.

The "GAP" symbol shown in the table below represents knowledge areas where less than 25% of the assessment responses were correct.

Refinery Processing Plant 1									
Shift	Area	Competent			Knowledge Areas Assessed				
		Shift Team Lead	Panel Operators	Field Operators	Process	Equipment	Physics	Chemistry	Safety
A	Area 1	0	1	0	GAP	GAP	GAP	GAP	GAP
B	Area 1	0	0	1	GAP	GAP			
C	Area 1	1	0	0	GAP	GAP	GAP		GAP
D	Area 1	1	0	1	GAP	GAP	GAP	GAP	GAP
A	Area 2	1	0	1	GAP	GAP	GAP		
B	Area 2	2	1	2	GAP	GAP	GAP	GAP	GAP
C	Area 2	0	1	4	GAP	GAP	GAP	GAP	
D	Area 2	2	2	1	GAP			GAP	
A	Area 3	2	0	4	GAP	GAP	GAP	GAP	GAP
B	Area 3	0	2	2	GAP	GAP	GAP	GAP	
C	Area 3	4	1	1	GAP	GAP	GAP		
D	Area 3	1	2	1	GAP	GAP	GAP		GAP

Figure A: A representative results sample

Testing Times…

Just mention the word test to anyone and you can see apprehension and distrust start to grow. No one really likes to be tested, but if you think about it we are tested from the day we are born right up until the day we decide to retire. In fact our first test occurs minutes after we are born and it is called the Apgar test, a test which is used to assess a new born baby's general health at birth.

We write tests and examinations all through our school and tertiary education and once we enter adult life the tests continue. For example who could ever forget our Driving test, the studying of the theory regarding road signs and the rules of the road followed by the practical test, administered usually by a stern looking traffic inspector?

Industry standards vary from country to country with pass rates for typical knowledge tests ranging from as low as 70% to as high as 95% depending on the organisation and the subject matter being tested. Practical demonstrations usually demand a 100% pass rate.

The Problem

The thing is, there are tests and then there are tests. The majority of the tests, examinations or practical evaluations we endure through our schooling and university years typically have a defined pass rate that is anywhere between 50 and 70%, meaning that all we really need to do is satisfy the pass rate plus 1%. In contrast, a typical motor vehicle driving tests is usually developed to a very high standard and will include knowledge and skills evaluations due to the hazards presented by driving a motor vehicle on public roads, and the pass rate could be set as high as 100% for specific aspects of the test.

In industry, now more than ever, due in part to the loss of the Baby Boomer generation to retirement, and the rapid growth of the industry, especially in the Middle East, it has become necessary for organisations to ensure that they have structured, rigorous, purposefully developed training quality assurance systems in place to cope with the rapid turnover in staff, especially at the junior or entry level. Typically, new staffs hired into an oil refinery field operator position are high school, technical school or college graduates who may or may not have been exposed to the basics of oil refining but who will require intense on the job training in order to develop them into qualified field operators.

With this in mind, industries are slowly being coerced into developing and implementing well defined, structured, and rigorous training and quality assurance systems.

The aim at the end of the day is to be able to confidently qualify staff internally using purpose developed, structured and objective training quality assurance systems, processes and tools to ensure a high degree of confidence, repeatability, and consistency.

Proposed Solution

The word assessment implies that the test activity will be rather more of a holistic one and will take into account not only the evaluation of theoretical knowledge but will also include demonstrated skills such as equipment operation and troubleshooting. Depending on the subject matter there may well be varying levels of minimum competency requirement.

When conducting an assessment you are in effect "collecting evidence" to support the notion that the person being assessed is competent to fulfil the job function for which they are being assessed. This evidence can be collected in several different ways and not only through the traditional question paper.

Although question papers are still an effective tool in their own right, other methods of gathering evidence to support competency can give a better understanding of an individual's performance level. These can include job observations, practical demonstrations or simulations, recognition of prior learning, third party evidence which can take the form of reports/dissertations and or projects, and finally testimonial evidence sourced from working colleagues and or supervisors or managers.

A structured training quality assurance system must cater effectively to gather all these types of evidence and the system should also be flexible enough to be adjusted to cater for the characteristics of individuals who will be assessed. Assessors must be identified either from within the organisation and trained to provide the assessment service or alternatively a third party can be used to fulfil this function.

For instance, the assessor has to recognise and make allowance for individuals who are more suited to carrying out a practical demonstration than writing a knowledge test and vice versa.

The assessor must take these factors into account when designing the assessment and should analyse the different assessment methods and tools available to design an appropriate assessment process targeting the required knowledge and skills levels for each job position whilst maintaining the applicable standards.

One common methodology is to analyse the evidence required to prove competency in a particular job or job function, and then to decide how the evidence can be successfully collected. This can be done on a general basis for similar job functions and/or job processes and then tailored for the individual at a later stage once the individual acknowledges that they are ready for assessment.

The assessment process itself must be well defined, structured and supported by an appropriate work process: competent trainers, appropriate training materials, sufficient training time, and supporting tools to guarantee a high and consistent standard. Provision must be made to ensure that each stage of the assessment process is recorded and that there is an auditable trail that can be reviewed and moderated if necessary.

In the interests of continuous improvement, the process should also evaluate the effectiveness of the trainers, training materials, the time allocated for training and any supporting tools such as simulation and or demonstration pieces.

Several organisations worldwide have developed sophisticated and well defined Competency Management Assessment Systems or variations of this and – if well designed – will probably incorporate all the elements described in this paper.

Outlined below is a proposed assessment process that in no way seeks to supersede any of these systems but rather outlines a structured approach that can be used to design and develop a best practice system for a client should no system be in place.

Pre-assessment

The candidate's supervisor, trainer or a trained assessor should conduct a preliminary assessment to ensure that they are confident that the candidate possesses entry level skills and knowledge to successfully completing the assessment. This preliminary assessment could include structured oral questioning and the demonstration of a particular task and should the candidate satisfy the supervisor, the supervisor should inform the assessor that the individual is ready for the assessment.

Should the candidate be unsuccessful in completing the pre-assessment, the supervisor and the candidate should meet to discuss the results of the pre assessment and to develop and agree on a plan to address those areas where the candidate fell short.

The supervisor should document the pre-assessment as it forms an integral part of the assessment process. The pre-assessment could also form part of the candidate's performance management process and could be used to support the performance evaluation process.

Formal Assessment

The formal assessment process begins with a meeting where the logistics of the assessment are discussed with both the candidate and the supervisor to ensure that the individual is available to attend the assessment and also to discuss and inform the individual of the standards against which they are to be assessed.

Any specific logistical arrangements, such as access to the test facility and or demonstration equipment, simulation tools, or the provision of supervisory staff need to be finalised at this time. The assessor must ensure that all these arrangements have been made beforehand and any supporting personnel who may be required have been notified.

Typically, minutes are taken during this meeting and all three parties, the candidate, the assessor and the supervisor should sign off on the meeting.

Typical assessment tools would include a pen and paper knowledge test with an appropriate number of mandatory questions that must be answered correctly. Mandatory questions could relate to safety, equipment and or process critical knowledge areas.

Skills assessment tools include structured checklists, developed from Operating Procedures and or Good Operating Practices and or scenarios developed in an Operator Training Simulator.

The Assessment

The assessment itself should be carried out as was planned and the candidate should be given every opportunity to provide the evidence required to prove competency. Sufficient time must be allocated to each of the elements of the assessment, such as oral questioning, the written test and the skills demonstration.

Records of all the assessment activities must be retained as part of the auditable trail mentioned previously. Candidates who satisfy the assessment standards are referred to as "competent" and those who did not are referred to as "not yet competent" to reflect that fact they have successfully completed some of the elements of the assessment and are still to successfully satisfy all the required assessment criteria.

Each of the assessment tools must have pre-defined answer keys that can link the questions to the available training materials. When the candidate is required to submit to oral questioning, a written test or a skills demonstration, it is recommended that a detailed checklist with pre-defined answer keys are developed to ensure a thorough and consistently high standard of assessment.

The individual's supervisor or designee should be present as a witness to the test and/or demonstration to ensure that the process followed was as fair and as transparent as practical because any non-conformances will form part of the remediation training that will take place after the assessment.

Assessment Remediation

All written tests should be remediated to 100% to ensure full comprehension of the subject matter by the individual. The individual may well be required to carry out supplemental training with an associated assessment.

[1] Remediation is the review of the questions that were not correctly answered during the knowledge test to ensure that the individual clearly understands the knowledge area that was deficient.

The reason for this is the relatively hazardous nature of the work carried out in the industry and that mistakes made due to a lack of knowledge and or skill could result in serious and or expensive equipment damage, production loss and personal injury. Similarly, all practical demonstrations should be remediated to 100% to ensure that all safety and equipment or process critical conditions are fully understood.

Assessment Moderation

Any well-defined training quality assurance system must make provision for moderation. Although every effort is made to ensure that each assessment meets the assessment standards and protocols, it is a good practice to have a percentage of all the assessments moderated to ensure a consistently high standard, typically this is around 10 percent of all assessments. Moderation must be carried out by a competent assessor and/or moderator to ensure a consistent level of moderation.

The moderator must produce a summary report detailing the aims of the assessment, the areas where the assessment met all the requirements and must also highlight any areas for improvement and any areas that are outstanding and can be shared throughout the organisation. The moderation process should examine the assessment process, the competency of the assessor, all the assessment tools used (question papers, skills demonstration checklists, reports, logs, and any other information provided to support competency), and should also include a short interview with the assessor, the candidate and the candidate's supervisor. Observations recorded during the audit should be fed back into the assessment process and used to ensure continuous improvement.
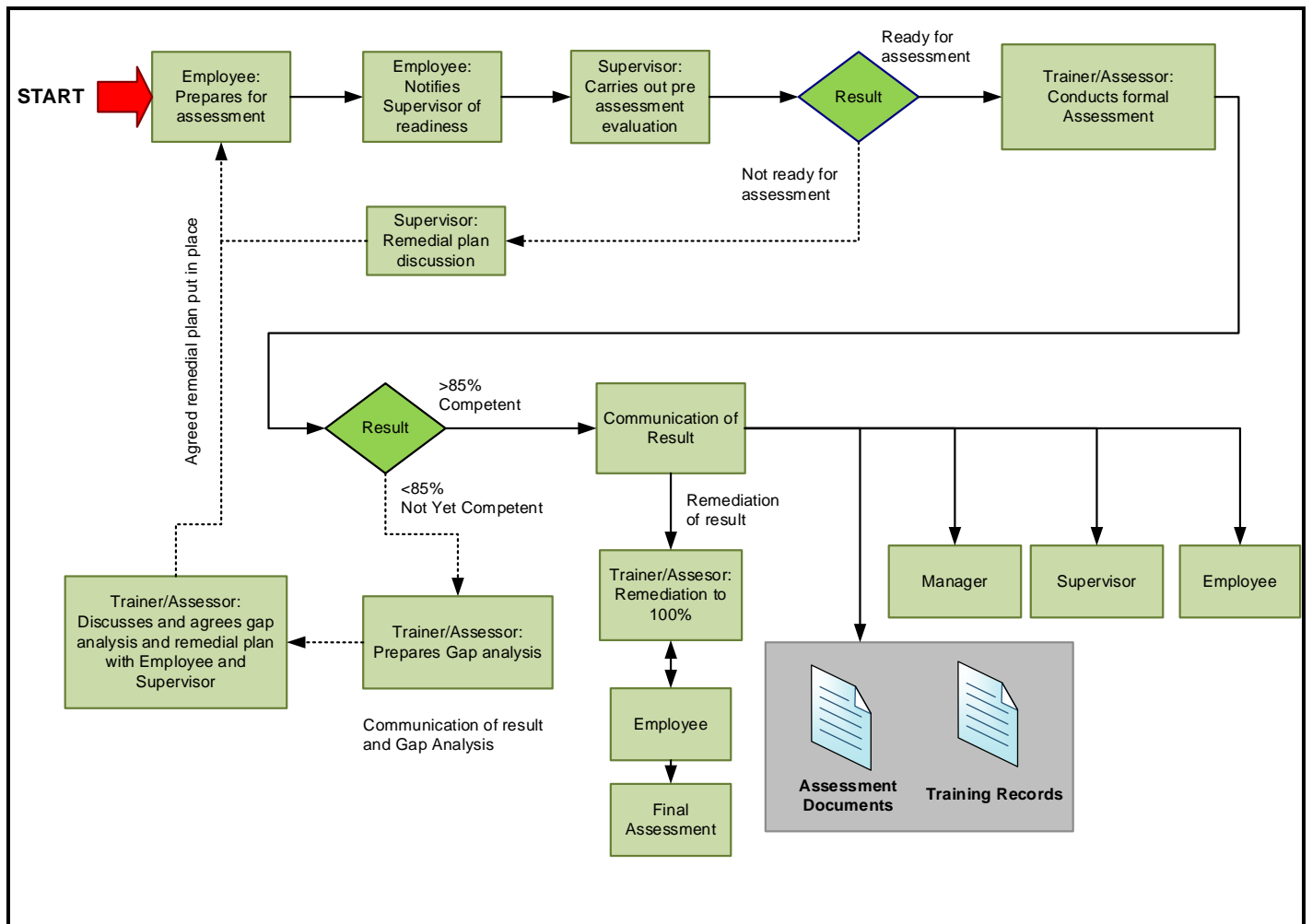
Figure B: Typical Knowledge Assessment Process

Summary

In summary, it is vitally important to ensure that whatever testing or assessment systems we design for our clients, we need to ensure that the system is well structured, complies with any local and/or Governmental legal requirements, and is fit for purpose.

A well designed assessment system will identify knowledge and skills gaps and will also provide for the development of a suitable gap closure strategy and plan to ensure that the person being assessed is able to successfully execute the job they were hired for.

A well designed and structured assessment process with associated processes and tools will also have the effect of assuring individuals that they will be given every chance to prove that they are competent rather than being a process where they are being tested to fail.

About the Author

Dave Loubser is an experienced project manager within the Human Performance Improvement consulting practice at KBC. He has had significant experience working with clients in the Middle East.

Prior to joining KBC, Dave was employed as the Refinery Operations Training Coordinator reporting to the Refinery Training Manager for the Engen Refinery in South Africa where he developed an Operator Fundamentals Training Program that was successfully delivered to 120 new hires before joining KBC.

Dave has over 30 years' experience in Refining within the Process Operations arena, and has participated in many new projects, project reviews, operability studies and HAZOPs. This included participating and leading start-up crews for a number of different process units. Dave has also acted as a co-coordinator for various shut downs and unit turnarounds.

About KBC

KBC Advanced Technologies is a leading consultancy and software provider to the global hydrocarbon processing industry. With over 30 years of experience, KBC combines industry leading technology with experienced engineers and operations personnel using robust methodologies to create personalised, sustainable solutions for its clients.

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