'Can eLearning develop and measure *competence*, or just give learners *knowledge*?'

RTSS Conference, Stockholm, June 11 2008

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Many organisations delivering technical training still fall into the trap of confusing the *transfer of information* to the learner with the *development of understanding and competence*.

If all of the technical information needed to complete a task is readily available at the time and place it is needed on the job (ie: *'just in time')* then the role of any training we produce should concentrate instead on building a broad understanding of areas such as theory of operation, information flow, diagnostic approaches, etc. Filling learners' heads with facts and figures from endless PowerPoint slides has become a pointless exercise and the old model of testing the retention of information with quizzes to pronounce someone 'competent' is fatally flawed.

As the reliability of mechanical and electronic systems increases, the chances are that most *factual* information committed so diligently to memory during training will have evaporated months or even years later when faced with a problem to solve.

This presentation demonstrated practical approaches to designing ‘eLearning’ programs that engage learners of all abilities in *tackling realistic tasks and demonstrating their competence in solving problems*, using low cost equipment simulations. The techniques demonstated included:

- Creating convincing simulated work environments including 3D scenarios
- Posing plausible, job-related tasks to be completed (eg: fault-finding, with animations, sound effects, etc.)
- Providing incremental guidance and help (allows one program to suit all abilities)
- Access to fault reports and reference material available in the workplace
- Allowing unsafe/unwise/unnecessary actions to be taken and the outcomes demonstrated (sometimes dramatically)
- Recording every action taken (eg: parts tested/adjusted/replaced, job time spent and costs incurred)
- Competence report after completing a task, compared with a 'best practice' model that an expert would have achieved

‘Knowledge is power’ … or is it?
The days are over when being an ‘expert’ required us to carry vast amounts of information in our heads. With unlimited data instantly at our fingertips via PCs, PDAs or mobile phones, the possession of *knowledge* is no longer crucial to effective performance.

What matters is the *good judgement* someone uses in tackling a task, only a small part of which may actually demand the use of information recall.

So, if we accept the argument that training is a waste of time if it seeks only to impart facts and to measure their recall with a quiz shortly after, and that intuitive wisdom and skill are developed only over time spent ‘on the job’, what does this leave for eLearning to accomplish?

Let's first consider what eLearning can - and cannot – be expected to do.

On the face of it, eLearning has everything going for it … study any subject wherever and whenever you choose, work at your own pace, even explore with one click material held literally on the other side of the world. Audios, videos, case studies, simulations, interactive games - they're all there, without even leaving your desk.

From an employer's point of view, eLearning can be a highly attractive alternative to the classroom – flexible, cheaper to maintain and operate and with the ability to centrally track and measure the progress of remote learners.

But here's the snag – in a classroom, it's the *tutor* who rates the ability of a learner in applying not only knowledge but skill and judgement to complete a task '*competently'*. How *sensitively* did the learner ask the distressed colleague for an explanation in the role play? How *confidently* did they deal with the mock industrial accident? These are not behaviours that are easily measured with eLearning. In fact, most computer assessments of 'competence' are simply quizzes which measure little more than information recall.

Of course, there will always be parts of training that must be carried out on the job or in role play, with opportunities for feedback and discussion. But if eLearning is to grow up and be taken really seriously then we must challenge the way we design and create self-study assessments.

To measure 'competence' we have to get the foundation right – defining the *Learning Objectives*.

'Learning Objectives' are as old as learning itself. Study without learning objectives may well result in learning but who will know how successful it has been?

To be effective, learning objectives must be:

- achievable using the materials available (or from previous experience)
- unambiguous
- measurable
- and their achievement (or the reasons for failure) must be explained to the learner

Consider paramedic training. A *classroom* session may have the learning objective: '*To be able to rapidly locate and accurately measure the pulse of an infant*'.

The training session might include the study of diagrams of the body, reading explanatory text, watching a live demonstration and practising the techniques under supervision. When the learner believes he is competent, he is assessed. Without any help from the trainer he demonstrates that he can satisfy the learning objective. Of course, in the *classroom* this works well since a *human* is assessing the learner's performance, not an insensitive computer program.

However if the learning objective had been carelessly written it could have made it difficult or even impossible to reliably measure its achievement. An objective of '*To be able to rapidly locate and accurately measure the pulse of an infant*' says nothing about the speed, accuracy or gentleness of its execution and is simply not measurable.

In a classroom, the trainer can use discretion to assess learner performance but when we are designing training programs which will be tackled alone we face a

tough challenge to construct learning objectives that really are measurable. Quiz questions are easy to produce . . . True/False, Multi-choice, matching items between lists, etc. but these techniques are only measuring *knowledge* and not the wider skills of *using judgement*.

So what do we mean by *competence*?
If we can prove that we have satisfied a learning objective then we can claim that we are 'competent', at least in that topic. In order to provide examples of measurable learning objectives, consider the wide range of knowledge and skills required by staff in an organisation, from trainee to expert.

Let's propose that there are four broad phases of development through which all employees pass. If you are to train staff with an eLearning approach then each phase requires different types of learning objective and different measurement techniques to prove their competence. These are referred to below as 'competence phases' and are supported by examples of possible measurement techniques.

Phase 1 - *Basic understanding of the organisation and their place in it*
When an employee joins your company, he needs to understand the structure of the organisation, how the company runs and their own place in it, the marketplace it operates in, your products/services, your competition and more. Training at this stage is usually by an induction course. An eLearning program would be seeking to measure basic understanding and recall of facts.

Phase 2 – *Acquisition of the knowledge needed for their job*
The employee then starts the task of learning their own job. This may call for detailed technical product knowledge, getting to know suppliers and manufacturers and so on. It's a process that never ends. Again, an eLearning program would essentially be measuring their recall of *knowledge*.

Phase 3 – *Development of skills to perform the job effectively (applying knowledge)*
Through all our years of primary and secondary education, we are absorbing information and most of the testing we face is simply to confirm that we can recall it. But for an employee to acquire knowledge alone is of no value to an organisation – a database can do that and Google is only ever a click away. He must be able to use that knowledge to carry out tasks, in other words, to develop *skills*. To measure how well skills have been acquired, the eLearning program needs to present *tasks* to be completed, rather than *facts* to be recalled.

Phase 4 – *Development of wisdom (applying the skills effectively)*
The highest level of performance concerns not just being very skilled at a task but in being able to use *sound judgement* in applying those skills. Such wisdom comes not from a training program but from long term practice and experience. ELearning programs can provide cost-effective practice and in the examples described below, in some cases may be able to measure a learner's *judgement*.

Matching competence measurement techniques with the learning objectives
The scope of learning objectives are limited by the types of measurement we can perform. PC specification, speed of connection, browser plug-ins, etc… all of these factors will affect what is possible.

a) Measuring *Knowledge*
This is the most straightforward to measure and eLearning tests typically include

questions such as:

- True/False and Yes/No
- Multi-choice (one or several selections)
- Match items in one list with items in another
- Clickable images (selecting one or more 'hot spots')
- Drag words/phrases to fill spaces in a text passage
- Typed entry

We are asking the learner to recall, recognize, match and name information. Our measurable learning objectives might look like this:

"List the key advantages of the model T4000 generator"
"Identify the six major isolation switches in an electrical sub-station"
"Name our five major UK competitors"
"Match customer complaints with the most appropriate action"

b) Measuring *Skill*
Many tasks require a degree of manual dexterity in handling components or equipment in order to prove competence. For example, the rapid cleaning and assembly of a rifle or the correct insertion of a drip into a patient. 'Soft skills' such as interviewing techniques require face-to-face practice and assessment. For these tasks, 'blended learning' recognises the fact that eLearning has its limits and will often be supported by traditional training sessions and workshops.

However there are techniques where eLearning allows the learner to practise performing *tasks* and for the program to track and measure their actions. A 'task' may be to carry out research and use various resources provided (such as referring to an electronic service manual or taking measurements) before taking the action they feel is most appropriate.

Designing such a measurable task requires far more effort than simply testing for knowledge. However, the *completion* of the task can itself be a learning activity, provided that feedback and assistance are available within the program if the learner gets into difficulty or needs guidance. So the investment has a dual role: training *and* competence assessment.

Consider this example: A company provides roadside breakdown assistance to motorists and employs a large number of mobile service engineers. New staff need to be trained at their local depot using eLearning programs and they must pass an assessment of their fault diagnosis skills before going on the road.

A Service Manager's ideal learning objective would be that the learner must '*demonstrate that they can locate the cause of an engine misfire as quickly and as economically as possible'*. The terms 'quick' and 'economical' mean nothing as far as a program is concerned so these must be specified for each task. An obvious electrical fault (a loose wire for example) may not take a competent engineer more than 10 minutes to locate and fix with no need for spare parts; conversely, an obscure problem in the engine management system might take an expert 45 minutes at a cost of £200 in parts. Some testing is required in order to 'calibrate' the training program with valid averages of time and cost for each task posed.

This type of task can be programmed using an interactive view under the bonnet of a vehicle. The task facing the learner is to find out which component is causing an engine mis-fire. The learner may 'zoom' into the image of the engine and move their view freely around. Clickable 'hot spots' are placed on components such as spark plugs, HT leads, pump, generator, etc. This exercise tracks the actual roadside task time spent (eg: replacing a

spark plug adds 8 minutes to the *elapsed time* for the job) as well as the *cumulative cost* of any parts used during fault-finding.

The learner may select items, examine them visually, test them and replace them. Every action is logged to the progress database. The total cost of parts replaced is also shown.

A learner who adopts a 'replace it anyway' attitude may fix the fault in a few minutes but at huge cost, destroying the profit margin on the job. So we can start to measure the *quality* of a learner's performance, not just if they are 'right' or 'wrong'.

Interactive Fault-finding task

Whilst principally being a measured assessment of *skill (knowledge + judgement)*, this example program could equally well serve as a training module. The simulation allows learners to 'play' safely and cost-effectively, see the outcomes of their decisions, restart the exercise (or a new one) and try again. When they feel ready to be assessed, they run the exercise in 'measurement mode' and this time their actions are recorded and no assistance is available.

Tracking and reviewing task results

The data recorded for each test session may be passed to a learning management system (LMS) for review and comparison. Over time, a rich set of performance data will be accumulated which gives real insight into the skill level across many staff.

The decision on whether a learner has achieved 'competence' is made *automatically* by the program. For example, competence may be considered to have been achieved if their best

task attempt (maximum of 3 attempts allowed) was completed in under 10 job minutes at a cost of no more than £75. The number of times they asked for a hint, referred to the Service Manual or tested a component would all be factored into the competence calculation.

There is no limit to the data which may be recorded for such exercises. For example, the *sequence* in which components were examined and replaced or the elapsed time between actions. We could even record and playback their sessions for a supervisor to review, showing every step they took.

This approach enables the Service Manager to set a measurable learning objective for what, on the face of it, may have seemed an illusive set of skills. Similar techniques could be devised for other types of skill training, practice and assessment, including the use of multimedia to enrich the experience and add even greater reality. In this example, the learner can actually listen to the engine running after changing/adjusting a component, just as they would on a genuine call-out.

c) Measuring *Wisdom and Judgement*
Our final category of 'competence' is concerned with the *wisdom* that an employee brings to a task.

Given two employees having identical levels of skill and knowledge, one will outperform the other by using superior *judgement*. We would normally assess such judgement in the workplace or in role-playing training sessions. The question is: can we also create measurable learning objectives that assess **judgement** using *eLearning*?

Suppose that you operate a chain of brake and tyre replacement centres. You want to implement self-study training (eLearning) for trainee Area Managers to cut out the cost and time of travelling to a central training centre. You put together an eLearning program rich in content . . . audio and video interviews, case studies, company rules, etc. But how do you measure their *competence*, at a distance?

Consider the following as a possible electronic *assessment of judgement* for this job. You present the individual with a '*So what would you do?*' challenge which they must deal with. The program presents a scenario and a range of possible choices, some appropriate and some not. You will have set in advance in the marking system what a 'model' response would be from an experienced Area Manager. The individual will earn marks for choosing a correct action in its correct sequence. They will lose points for selecting *inappropriate* actions and for repeatedly referring to the resources.

Here's the scenario: "*It's 9.15 on your first morning as Area Manager for FlexiProd Ltd. There's a telephone message from a worried Gary James, supervisor at the Southampton centre. A customer had two new tyres fitted on Saturday and last night a tyre burst causing her to swerve into a tree. Her husband, a journalist, has three cracked ribs and the car is a write-off. She is furious and has contacted the police, her solicitor and her insurance company. There is also a reporter and camera crew from TV South East in reception asking for a live interview with you.*

So what would you do?"

Resources

The program could provide pieces of 'evidence' which the individual can review. These could include the frantic call from the depot supervisor, a report on the tyre and a photo of the damage, the company's policy on dealing with the press, etc.

These are some of the possible actions you might offer the learner:

- Refuse to meet the TV crew and send them away
- Call your company's solicitor for advice
- Phone the customer to offer your apologies
- Call your Press Relations officer and explain what has happened
- Drive to the Southampton centre to interview Gary James
- Close the Southampton centre until further notice
- Agree to the TV interview but deny all liability, pending an enquiry
- Call for details of the tyres fitted and suspend all sales of this make
- Close all centres in your region while this make of tyre is removed
- Trace all customers who have had this tyre fitted in the past 6 months and
- phone them to offer a free replacement
- Arrange to meet the customer as soon as possible
- Trace all customers who have had this tyre fitted in the past 6 months and write to them to offer a free replacement
- Refuse to meet TV crew but refer them to company's Press Relations officer
- Call your immediate boss, the UK Operations Director to brief him/her
- Refuse the TV interview but write a statement for them apologising for the incident and assuring the public that there is no widespread safety problem
- Identify the fitter who worked on the car and suspend him
- Contact your company's insurance company and brief them
- Send flowers and a letter of apology to the customer's home
- Contact the police and request an inspection of the tyre and wheel

The individual selects which actions they would take and the *order* they would take them. Next to each action you invite them to type any comments, expanding on their thinking. These comments are not marked but give you insight into their reasoning. The tracking database saves their decisions, scores, the text they entered next to each action, the number of times they examined resources (audio, reports, etc) and the time they spent completing the assessment. The report you receive may be sorted in whatever order you prefer, for example by 'Rank' as shown in the table below:

Employee	Rank	Score %	Date	Total Minutes	Resources accessed?	Employee No.	Competent?
Peter Robinson	1	96	14/09/07	102	3	0023	**Y**
Melanie Porter	2	95	11/12/07	87	4	0235	**Y**
Graham Smythe	3	87	11/02/08	127	4	0008	**Y**
Elaine Mitchell	4	73	12/02/08	92	9	0289	**N**
Richard Bishop	5	34	13/11/07	186	21	0126	**N**
Etc.							

‘Competence’ is achieved with a score of over 85%, and is calculated by the program from the actions they selected and the order they put them in. You would be correct to argue that the program has given them clues by suggesting all the actions, a luxury they wouldn’t have in a face-to-face assessment. But if you design and phrase the actions with care this type of assessment does provide insight into each person’s judgement. Conducted across hundreds of people (including experienced staff) the results will start to reveal those likely to use good judgement in similar situations.

If the exercise is being used as a training program the participant will need feedback on their decisions, to highlight where more appropriate actions might have been taken and why.

Let the participant know that you realise there are no completely ‘right’ or ‘wrong’ answers with this type of assessment but that you are seeking their *judgement* on the approach *they* would take.

This type of scenario, when supported by rich hints and tips (emulating the guidance of a tirelessly patient expert) can serve both as training *and* assessment.

We are not trying to measure the recall of facts, but to put the learner ‘on the spot’ in a situation which demands considered actions, taken in the most effective and appropriate sequence. As the learner starts to appreciate the outcome of their decisions (good or bad) they are effectively using their judgement to practise real-world tasks, leading to an increase in confidence and competence, *before* they are needed in the workplace.

The writer believes that such programs *can* develop and assess elements of competence rather than simply acquired knowledge, leading to far more effective self-paced training interventions.

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