NDT Training, working with Generation X.

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Abstract
Training in NDT is not inline with the everyday stimulus that we are accustomed to. This makes it very hard to concentrate and retain information when attending a course. Studies indicate that retention of information from when presented using an audio visual approach is more then 50% greater than compared to the more traditional oral only presentation. By analysing the average Joe and how he receives his daily information, for example the evening news, we can see that he is accustomed to audio/visual presentation that is provided in short segments. If we were to structure NDT courses in this fashion which candidates are generally more accustomed to, it would provide them with an increased chance of passing the exam. It should also and more importantly provide them with a more solid foundation of the fundamentals on which they can build upon as well as refer to when necessary.

Keywords: NDT course lecturing, attention span, audio / video concept simplification.

1. Introduction

One of the basic foundations in any industry is training and certification, the purpose of which is to provide a candidate with knowledge via classroom training and course content, providing them with enough information and the required skills to be able to complete predefined tasks. It comes as no surprise then, the training and certification is one of the themes for the 18th World conference in Non Destructive Testing.

2. Statement of the problem

Non Destructive Testing is a constantly changing environment. There is always new technology that we embrace in order to improve our inspections, increase our P.O.D. etc. But how much of this change have we embraced in training? I feel that by introducing some change to the current training routine, candidates will have a more in-depth understanding of the material, and draw maximum value from the knowledge that’s shared. I believe that the training program should be structured in a more enjoyable fashion in order to prolong the trainees’ concentration and interest. If candidates have a stronger foundation of the basic concepts, they will be able to use this when problem solving.

Many of us may have experienced a situation where a candidate is certified to a certain level, is requested to carry out a task, but doesn’t know where to start. Theoretically, the candidate should know this. You may ask how it’s possible that this person has passed an exam without knowing how to carry out the specific exercise? Have you ever had an Ultrasonic Testing technician that could not calibrate an analogue machine? Or encountered a technician that couldn’t read the screen without the aid of a gate? This happens more often than you think. In most cases, many technicians learn to cope with a task briefly in order to pass an exam and upon completion they simply forget it because it’s not practiced routinely. Essentially, they’ve learnt a task in isolation, with no practical understanding of how to apply this to their everyday work. In the event that they are requested to perform this task, they can’t apply their knowledge to solve the problem.
It’s human nature. Few people have photographic memories. One can only expect that by not practicing a certain skill, the skill will diminish with time. This also means that technicians will essentially be stumped when presented with a problem that they are unfamiliar with, and will be unable to carry out duties for which they are certified, in a worst case scenario. My argument is that if the initial training had more of an impact, that this would make it easier for the candidate to reflect on concepts covered in training and work towards problem solving. In order to improve on this situation we will first need to analyse our target audience.

Academic Calibre.
A problem we face is that the majority of NDT candidates that enter the classroom did not have NDT as their primary choice. To be honest, it’s not a vocation that children grow up aspiring towards. The reason they enter into the industry is because they have come across an opportunity to make some money by doing a job that they can. These opportunities are normally taken up at a stage in one’s life when tertiary education is no longer an option due to the learning curve becoming too demanding or something of that sort. Alternatively, it’s at a stage when your initial job/business is not working out / paying enough.

The crux of the matter is that the majority of candidates entering the field are not “academically” inclined. So how can we be expected to train them in such a short space of time?

The answer would be to familiarise ourselves with this target crowd. To find out what makes them tick and them capitalise on that.

A New Generation.
The motives for progressing in an NDT career have not changed much over the past few decades. However, the personnel entering into the industry have. Recent years have given rise to a new breed of workers – Let us call then Generation X.

Generation X is a group of people that have been conditioned to convenience, and results on demand. As an example, how many of us are dependent on our cellular phones? The cell phone was almost non existent in SA in the early 1990’s. People got around just fine. Today we rely on them and don’t know what to do without them. At present, generation X forms the majority of the work force and if you are not part of generation X, you have to at least have become accustomed to their lifestyle. Generation X is one that works on instant results using as short as possible inputs to produce more than sufficient results. Take Google for example. If I want information on a subject, I type in XYZ and within 0.023seconds I have 8760 related pages. Generation X is structured around short term efforts, smaller, bite-sized portions. So in order to improve training, I feel that this should be accounted for.

To overcome these problems we need to find the lowest common denominator. What will the majority of the class find interesting?
Two things come to mind - Gaming and Movies.

These two forms of entertainment have become customary in the majority of homes around the world. Let us take a closer look at the gaming industry because of its more interactive nature. Computer games require us to learn a wide array of skills in order to progress through the game. However they have dedicated an almost insignificant amount of time towards the training process and yet users encounter very few issues with this with the learning curve. In a game you are expected to master particular skills. These are taught to you, one skill at a time. You are then given a chance to try it out in a simple scenario. By doing this you get the feel of the skill as well as learn what to expect from it. Once this step is completed, you will have an
opportunity to use it in a more difficult scenario. As you apply the skill, you learn its limitations as well as its advantages. Once this is completed you will have the ability to use it at will, as well as in combination with other items in your arsenal. You will decide when it is more suitable and will work more to your advantage or complement your style.

At the end of this process you have mastered a certain skill with only the slightest tuition. The reason you are more comfortable with it is because you could test it out at your own pace.

Moving on from the training part of a game lets look at the game itself. Games are specifically designed to deal with psychological needs. These include video games, board games, school-yard games, even sport. Games can be played against other people, against yourself, against a computer, or perhaps even against the forces of nature. What they all have in common is that they have set goals with set rules that you have to follow. This makes it much easier for us to decide what to do and makes measuring the outcome much simpler. We also have the learning aspect in games since in most games we will have to keep improving our skills in order to beat the competition (or our previous record).

Have you ever seen someone playing a video game? People from all age groups, genders, demographics experience almost total immersion in the game. Be it a light task at hand or an intense battle. The only difference is the intensity of immersion. The gamer will not even be able to hear you or might not even see you enter the room. The gamer’s concentration is of the highest levels. It is almost unbelievable to think that this fluency has been developed in a matter of minutes with the least amount of training. How has this been achieved?

Mihaly Csikszentmihalyi’s concept of positive psychology explains this phenomenon very well. He defines it as Flow. According to Csikszentmihályi, flow is completely focused motivation. It is a single minded immersion and represents perhaps the ultimate in harnessing the emotions in the service of performing and learning.

There are several factors that have been identified to accompany flow. I have listed four that can be incorporated into NDT courses.

1. **Clear goals.** By setting a target the candidate will be able to understand how the activity at hand forms a piece of a puzzle.

2. **Concentration.** A high degree of concentration on a limited field of attention. When possible, new information should be broken down into single/bite size concepts.

3. **Direct and immediate feedback.** Successes and failures in the course of the activity are apparent, so that behaviour can be adjusted as needed.

4. **Balance between ability level and challenge.** The activity is neither too easy nor too difficult.
NDT candidates.
NDT generally has a mix of younger as well as older students. One thing that they have in common is that they are all adults. The learning pattern of adults is considerably different to children.

According to Susan Zemke adults who are motivated to seek out a learning experience, do so primarily because:

- they have a use for the knowledge or skill being sought.

Here’s a scenario. An NDT department requires a UT II technician. In order for the current UT I tech to fulfil this position he is required to attend a UT II course.

- Adults tend to prefer single concept, single-theory courses that focus heavily on the application of the concept to relevant problems. This tendency increases with age.

We find it harder to learn with age. We also realise that time is precious. Thus we prefer not to dabble on learning a skill or theory that we cannot identify a use for. We feel that if we are going to invest time and effort in what we learn, it must be a useful.

- Adults need to be able to integrate new ideas with what they already know if they are going to keep and use the new information. Information that conflicts sharply with what is already held to be true, and thus forces a re-evaluation of the old material, is integrated more slowly.

Can you recall when you were first taught that the earth is not flat but a spherical shape? A common response is “then why don’t we fall off?”

If we analyse this response, we can see that falling off a spherical object as it rotates is a pre-existent understanding that has been learnt and holds true. Considering that the new information does not tie up with current information we can understand the confusion.

Invisible Methods.
A common problem we face in NDT is that a candidate learns a skill and tests it out, the forces at work are not exactly visible, and it is more of an action VS reaction.

We cannot sense ultrasonic pulses, radiation, magnetism, or capillary action in our day-to-day inspections. Training centres rely on artist impressions or provide us with visualisations. The propagation of an ultrasonic wave is similar to when you throw a stone into a pond. This is a brilliant example, but the lecturer is relying on the candidate to recall or imagine this.

Why do we not play a video clip of the example?
This ensures that the candidates will all be on the same page. This will also provide a micro beak from the lecture and renew concentration. As the proverb goes, a picture is worth a thousand words. As we already know, a video clip is worth a thousand pictures.

Attention Span.
How many of you have drifted off during a lecture and returned to reality several minutes later? You’ve missed essential information, you’re disorientated, and you panic because as the lesson progresses, the effects are compounded. Research indicates that the attention span of most healthy adults and teenagers and adults is approximately 20 minutes.

The attention span need to be taken into account. Transferring a litre of water into a container that can only hold 250ml only results in 750ml of waste. Yes the litre of water is finished but only 250ml is actually useful. In much the same way a lecture that lasts 3 hours will not have
the same effect of six lectures spaced out by 10 minutes. We can also summarise at the end of a lecture ensuring any students that might have fallen behind now have a chance to catch up.

Research Methodology.

Given the time constraints of my daily duties, I would not be able to present a full duration NDT course to test out the above. Therefore I opted to address the fundamentals of a Ultrasonic Testing level one course. I was allocated a day in which I intended to cover the very basics of the method upon which the candidates would be able to structure the upcoming lessons. The lesson was to cover A scan representations, 0 degree calibration, types of waves, attenuation of sound, D.A.C curves, beam spread, 6dB sizing technique, reflection, refraction, common welds, angle probes and finally Snell’s Law. I initiated the lesson with introductions and an explanation of proceedings notifying candidates that I had no say in their exams or results. The lesson was orally presented with aid of a power point presentation. Apart from the notes and pictures displayed, presentation included numerous short video clips. Amongst these was a clip of a chameleon walking which I used to draw the similarities to a compression wave. Another video clip was how a laser light was refracted by a semicircular Perspex block. This allows candidates to now understand to a certain degree the bending of sound waves at an interface. The presentation was to the point with everyday examples included wherever possible. 3D software was also used to carry out beam spread and other explanations that are normally left partially to the imagination. Each section was structured to overlap into allowing integration without delay.

Results.
Upon completion of the presentation candidates where extremely pleased and showed a greater confidence towards the method.
An increase in the pass rate of 15% was noted by the training center.

Conclusion

By extracting concepts and methods from fields in the entertainment industries that are not only extremely popular but bare a striking resemblance to learning NDT skills, we can advance the entire NDT industry. By unlocking students abilities via a resource that they are accustomed to we will be able to provide students with a greater understanding on which they can build upon.
In much the same way I feel that NDT could be tutored. The basics are covered and by repetition and experimentation the candidate will master a skill.
So keep the following in mind:

Keep lectures as interesting as possible and allow candidates to master one skill at a time.
Provide candidates with bite-sized portions and waste no time between tying the theory to the practical.
When introducing new concepts, tie them to something that the candidate has most likely experienced. If possible use more then one example.
Provide constant feedback and encouragement.
Make use of video clips and/or animations when explaining a concept to encourage understanding as opposed to encouraging a parrot fashioned repetition.
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