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Pipeline Training and Consultancy

‘CHANGING THE WAY WE LEARN: From Classroom to Tablet?’

1. Introduction

We are all aware of the skills shortage in the oil and gas industry, and the ageing profile of the workforce is well-documented¹. These issues are not easy to resolve: they are urgent, complex, and critical. One way to help solve these problems is to rapidly educate and train a new workforce, but it is acknowledged that education and training will only partly prepare engineers for industry: experience and mentoring are both essential and irreplaceable.

Universities, technical schools, and training providers can all offer some level of learning, but most of this learning is ‘classroom-based’, which immediately limits availability and accessibility. The obvious solution is to provide some of this learning via the internet. Today’s (and tomorrow’s) workforce have and use their smartphones and tablets ‘24/7’, and base many parts of their lives on these tools. So... why not ‘e-learning’?

‘E-learning’, means learning using electronic devices, usually via the internet. It has been previously called ‘distance learning’, ‘internet-based learning’, etc., and historically it has not been popular; for example ‘computers cannot do everything’. But times have changed – witness the number of people reading e-books on an airplane or reading newspapers on-line. Who would have predicted that paper books and paper newspapers would be slowly disappearing?

This article explains how e-learning has been introduced into the pipeline industry, and how partnerships with academia can help this introduction. It also explains some of the problems that need to be overcome to ensure ‘distance learning’ works well, and the science behind the solutions. The article describes an MSc program in pipeline engineering in the UK, delivered by e-learning and the internet. Finally, the ‘pros and cons’ of e-learning are presented, and some important lessons learnt.

2. Changing Technology and its Effect on Time and Space

Technology and the Rules of Engagement

Last century, the famous German philosopher Martin Heidegger (1889-1976) observed the creation and growth of technologies and communications (radio, TV, and film), and noted their effect. He noted that all distances (in both time and space) were shrinking: the airplane reduced travel from days to hours, and information that had taken years to reach you, was now instantly available via radio, TV, or film. Hence, the identical effects of today’s smart phones, social networking, etc., are neither new nor surprising – they are merely evolutionary. This may surprise the X and Y generations, who might believe these things to be revolutionary.

The big difference between Dr Heidegger’s time and today is availability and affordability. Computers, smart phones, internet, etc., are now available to most in the Developed World. This opens up the possibility of e-learning via the internet: quick, easy, comprehensive, convenient, and cheap. Learn when you want, where you want, and how you want.

That sounds easy, and the obvious ‘way to go’. But there is a problem... and we go back to Heidegger for insight. He not only noted the facts that technology shrank space and time, but he also alerted us to a major problem: as technology shrinks distances and time, it also shrinks our own world. The effect is that we become isolated in our quest to gather data. We may be doing things quicker, but the things we view on the TV are still a long way away, and our friends on Facebook are still in another country, but we are still devoting time – alone – to gain information from them. We have all heard of the teenager with 500 ‘friends’ on Facebook, who never leaves his/her bedroom, as he/she is too busy with Facebook....

This means that technology must be carefully applied when used, and this is particularly true in education. If we want to move to on-line, e-learning, we must ensure the experience and

technology does not lead to a student's isolation. It is not easy moving from a vibrant, noisy, social classroom, to a lonely study... and this is a big challenge for today's educationalists.

This paper will explain a method of internet-based, on-line learning that helps prevent this isolation.

Distance, and the Rules of Engagement

The phrase 'distance learning' contains a word ('distance') that immediately causes concern. This concern is justified: distance affects engagement. In the late 1970's, Professor Tom Allen conducted research [2] that showed that the distance between engineers' offices coincided with the level of regular technical communication between them: there was a logarithmic relationship between distance and frequency of communication. This meant that those sitting close to each other have frequent communication, but separations of more than 50 metres lead to negligible contact.

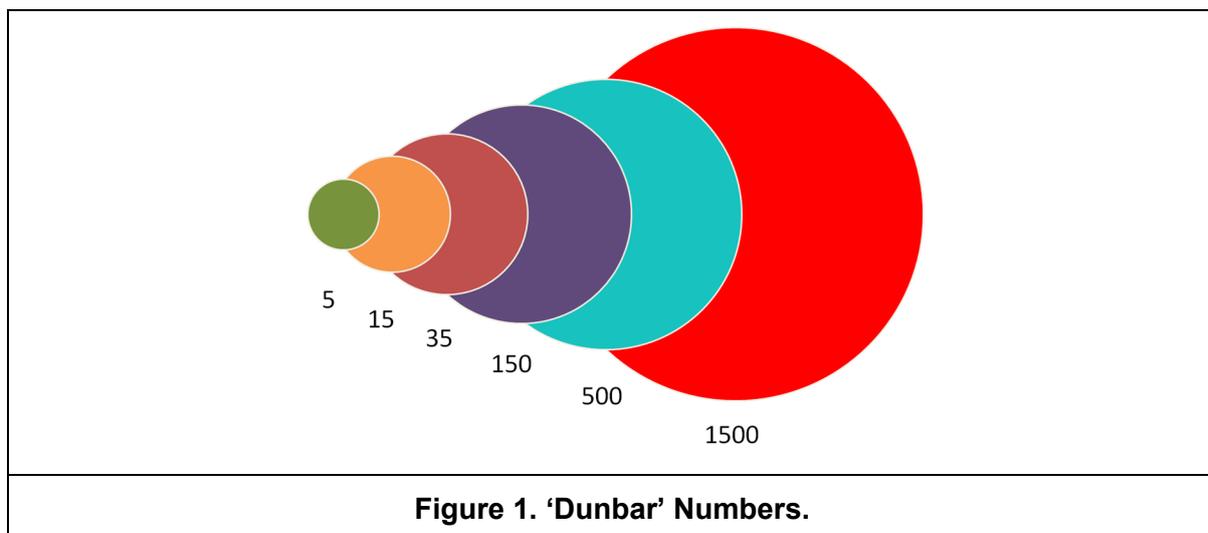
Any distance learning course must have methods and tools that assist the student in communications and engagement, otherwise the student will quickly become lonely. This problem with distance requires careful thought, and multiple solutions such as virtual chat rooms, video conferencing, etc..

Learning and the Rules of Engagement

Class sizes have always been important, and most governments around the world have a goal of reducing staff/pupil ratios. But what are the optimum numbers for distance learning? Again, science can help, and we can use the 'Dunbar' numbers [3].

Dr Robin Dunbar concluded that our brain limits the size of the social network that an individual of any given species can develop. He concluded that the human brain allows stable networks of about 148 (rounded to 150): if we return to Facebook, this means you cannot realistically have more than 150 friends....

He further developed optimum numbers for engagement, etc., Figure 1. These allow an understanding of groups of students, classes, etc.: 5 students is an ideal tutorial group, 15 students is an ideal class size for interaction, whereas 35 students is a limit for a lecture. The numbers may be contentious, but it forces educationalists to consider and optimise student cohorts, and work groups. This is particularly important when grouping students in a distance learning programme.



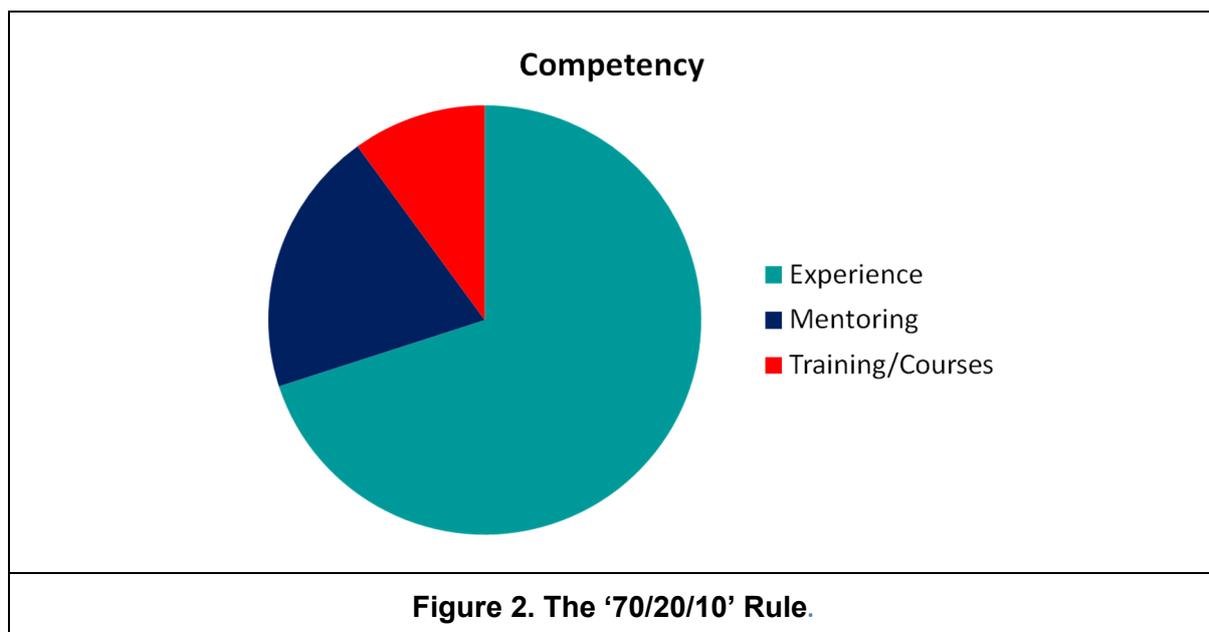
The Move to ‘Competency’

‘Competence’ is a combination of practical and thinking skills, experience and knowledge [4]. In the oil and gas industry there is clear evidence of a lack of competency in staff: a review of major accidents across hazardous industries found that a lack of competence contributed to many of those incidents [5]. ‘... *human error was, by far, the most frequent cause for “loss-of-containment events”*’. Also, in the pipeline industry, there can be limitation in their management systems: ‘... *most PIMS [pipeline integrity management systems] do not stipulate the human competencies that are required to manage the systems they support*’ [6].

Competency and the Role of Training/Courses

Training helps develop competencies, but it is emphasised that training alone is not sufficient alone to develop competencies: ‘... *it is not enough to assume that exposure to training and experience assures competence.*’ [7]

Indeed, the ‘70:20:10’^[1] model indicates that it will only contribute about 10% [8]: experience and mentoring contribute 90%, Figure 2. Many training and learning departments do not appreciate this bias towards experience rather than training/courses, and – instead – emphasise training courses as a route to competency. This is a huge mistake.



This is a major perspective on learning: experience and mentoring are still key to learning, regardless of the method of learning.

We will now look at a successful education programme [9] that set out to help the oil and gas industry to solve its skills gap, by a novel distance learning solution.

^[1] The '70:20:10' model suggests that most (70%) learning takes place at work through experience, whereas relationships/mentoring/coaching account for 20%. Training/education is 10%.

3. Case Study: Penspen and Northumbria University - A Partnership to Develop Pipeline Engineers

The Motivation

The oil and gas industry has acknowledged a serious skills gap, and a review [1] of current staff age profile showed a shortfall in the number of qualified pipeline engineers. Penspen Ltd., a UK engineering consultancy business, approached various universities in the UK, with an innovative idea to meet this shortfall. The main drivers were:

- ensuring the skills base and competencies of our workforce for years to come; and,
- the development of a partnership to provide 'flexible'^[2] learning to staff in the pipeline industry.

The Context

Penspen has presented public and in-house training courses for many years, and has also helped deliver post-graduate residential courses in universities. Their trainers recognised that the next generation of employees would be more likely to respond to learning opportunities delivered via the internet: on-line distance learning solution provides global access and appeal to busy and modern learners.

Northumbria university in the UK was keen to be part of a strong, industry-led partnership that contributes to workforce development. Accordingly, Penspen and the university established a pilot programme – the Postgraduate Certificate ('PgC' in Pipeline Integrity Management – with a specific design:

- the course, cohort numbers, interaction with tutors, and student interaction/engagement were key considerations;
- it would be delivered entirely on-line (and so would be accessible to anyone with an internet connection);
- it would be developed in collaboration with industry; and,
- it would be updated regularly with industry input to ensure continued relevance.

The PgC was successfully launched in June 2001, and upgraded to a Postgraduate Diploma (PgD) and a Master of Science (MSc) [9] in September 2013.

The Impact

The Programme is relatively young; therefore, it is difficult to measure the long-term impact. However, there have been measurable successes springing from the initiative:

- The Programme has enrolled over 90 students across 3 years, and those who have completed the programme have recommended it to other colleagues. Approximately 10% of current students are sponsored by the same companies who have sponsored students in the past.
- The partnership is now expanding to other universities in Latin America.
- The initiative started as a means to international students who had no access to UK-based education, hence the distance learning delivery mode was adopted. A mark of the success of the Programme (and of its growing reputation) is that UK-based companies have now sponsored about 30% of students taking part in the Programme.

Penspen and Northumbria university have a strong sense of achievement: the development of a flexible education programme that offers students the opportunity to complete a formal recognised degree. Pipeline companies – and those employing pipeline engineers - are now able to develop and assess the competencies of their staff.

^[2] Choices about when, where, and how we learn.

The key demonstrable success of the programme is the upgrading of a short programme to a full MSc, with many students already doing it, and many others having completed a number of PgCs, and PgDs.

How does it work?

Students access a set of on-line classes over a 12 week period via the University Learning Management System. Students are formally assessed (examined) at the end of this period by the University. The result is a qualification from an accredited university, and demonstrable competencies is a range of topics.

A unique characteristic of the classes is that they combine the traditional teaching method 'chalk and talk' with a modern e-learning delivery. The classes are presented in a virtual platform, which does not allow printing. Students are, therefore, expected to read and take notes as they read, allowing learning in a different way to what they are used to.

How to manage the 'distance' problem?

Students are encouraged to form discussion groups, and a set of tasks is provided to assist these forums. Building this professional network is a key part of the programme, and has been welcomed by students around the world. They have the same technical problems, and have now a strong link with pipeline engineers working in different locations.

A standard cohort normally takes 15 students. This is a good size group for interaction and engagement (see earlier). Team-work is encouraged. The course leader normally supports the formation of study-buddies to carry out group work. This also helps to overcome the lack of traditional contact with other students... they can still ask how far behind with the classes the buddy is, when he/she expects to submit coursework, etc..

A student taking a distance learning programme can still prepare presentations and deliver them to the tutor or the group. Using the current modern tools (Bluejeans, Lync, Webex) this is now very easy to do. Virtual meetings and chat reduce the problem of distance.

'Pros and Cons' of E-learning

The Pros

E- learning is a flexible way of learning, and has many advantages:

- easy technology (modern technology tools now capture completely the attention of most people: they are used to spending most of the day in front of a computer/tablet/phone);
- available technology (e-learning is available using the devices that everybody has and is familiar with);
- easy ('24/7') access which is ideal when engineers work in remote areas;
- students can learn in their own time and pace;
- students can align their studies with their social and work commitments; and,
- it gives engineers in many countries the opportunity to gain a qualification otherwise impossible to achieve.

The Cons

The Programme at Northumbria university is a post-graduate course, that can lead to a masters degree: it is not an easy education option. This means students must work long hours and master many difficult topics, and doing this through distance learning can add to the difficulty. These additional problems can be summarised as:

- students who have not previously attended a distance learning course have found it difficult to adapt to this new way of learning (the earlier sections of this article highlight the causes of this difficulty);
- e-learning can lead to a 'lack of feeling' of a cohort; however, most students are now very happy to build their study network as they do with their 'LinkedIn' or 'Facebook' connections;
- some more traditional students are reluctant to use new communication tools, and can feel isolated completing their studies;
- university e-learning courses (they are usually 3 years) take longer to complete than residential courses, and are at risk due to students' personal circumstances changing in this longer time period, and causing them to break/stop their studies;
- e-learning has a bad reputation in some countries, as there are many very low quality degrees offered online.

Lessons Learnt

Training departments and universities may be considering embarking on e-learning, but this should be done with caution:

COST: the development of on-line materials for academic studies is very expensive: the materials must pass strict university quality assurance requirements, and pass academic content scrutiny;

COMMITMENT: both students and lecturers must be committed to e-learning, as it is a 'new world' for all parties;

DELIVERY SOFTWARE: software is needed to deliver the materials, and available software has been shown to have many limitations, creating extra cost and delays;

THE INTERNET: on-line connections are not always reliable, and this can cause inconvenience to students working on site or in remote locations;

ACADEMIA: the quality standards of academia, and their examination process are key to success, but constant changes in academic staff/organisations can cause problems with continuity.

4. Conclusions

The recognised skills shortage in the pipeline industry can be partly overcome by industry-university partnerships which can offer innovative programmes using modern delivery modes that appeal to engineers around the world.

A carefully designed distance learning programme is helping to educate a number of pipeline engineers, who would have not had access to a formal accredited academic programme otherwise.

On-line distance learning is a relatively modern concept, and it takes some time to adapt and become an experienced and successful 'distance learner'.

The results from the e-learning programme at Northumbria university are very positive, with full cohorts each year. This e-learning model can be extended to both universities and training providers, but in both cases strict quality and content standards must be met to ensure demonstrable competencies.

5. References

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