# Teaching and Learning; A Synthesis

Learning and subject retention is a joint exercise between instructor and learner and how this might be achieved in an online, distance learning environment is the subject of this paper.



# Traditional Teaching

We all have a mental picture of traditional teaching; the lecturer or school teacher holding forth on some subject to a passive audience, who cannot or do not exchange ideas on that subject with their neighbours during class.

The collateral is often quite old and any new ideas need to be scribbled down, if there is time, and assimilated later along with reading that collateral. Asking questions of the instructor can elongate the class time, display one's ignorance or the answer confuse other students. This ability to ask questions at the time the particular sub-topic is covered is the main advantage this method has over online learning; the social interaction aspect is also pertinent.

Face to face tutorials and similar encounters are also useful in this environment but when it comes to scaling up this traditional method, there are obvious flaws, especially in volatile subjects like information technology (IT). The numbers of students handled is capped at, say, 20-30 for interactive teaching and if as a student you feel under the weather one day, you cannot put the instructor on 'hold' and restart him/her when you are ready.

There is, today, a worldwide skills shortage in cybersecurity of about 3.5 m. positions and that topic is by no means the only skill needed in modern workplace IT, despite being 'flavour of the month', along with AI.

## The Need for Online Learning

In short, and in the IT ecosphere, volume and volatility are the enemies of traditional teaching; this has given rise to more online learning, a trend accelerated by the Covid-19 pandemic. In the UK, even most primary schools resorted quickly to online teaching and where work was assessed or marked by teachers in similar mode. This eliminated the 'loneliness' syndrome to some extent but the environment had the benefit of one teacher to 20-30 pupils, a ratio not feasible in today's IT skills shortage due to the size of the skills deficit and the complexity and volatility of the subject material.

In short, face to face learning is synchronous and continuous, online learning can be asynchronous and self-paced to suit the learner

#### Computer Aided Learning

I am not sure of the true origins of this form of teaching and learning, but I remember when I was in IBM there was an avid proponent of this form of training in the early 1980s, possibly the late 1970s. The rest of us thought of him in the same light as we would a crazy religious sect member thus, this method of learning is not new and we IBM doubters have been proved wrong.

Learning online and at a distance from the educational source has the disadvantage that it generates *'The Loneliness of the Long Distance Learner'* syndrome. The absence of interaction with others or learning diversions can be detrimental to absorbing and retaining knowledge and can lead to staleness of the subject in the eyes of the learner.

In theory, there is no instructor involved, except in spirit in the material presented, and no interaction with one's peers. That presence needs to be woven into the online material somehow; this is discussed in the next section, as are the length of study periods involved, to increase the effectiveness of the training.

#### The Online Learning Needs

The need then is to simulate the face to face environment as closely as possible in the online/distance arena. These are the areas I feel need bolstering to lift this form of learning above the 'read page after page' online then tackle some review questions. Apart from the obvious quality, currency and relevance of the material needed, a modern online course should:

- Have standard user interface (UI) at least in the same organisation or course vendor. Some global guidelines may be more acceptable than a compulsory UI in the first instance.
- Have a *flow reflecting IT as a whole* and not be just a series of seemingly random topics without any obvious synergy. A hypothetical course which flouts this 'rule' would be one about the Motor Car which covers the Carnot cycle, adiabatic expansion, friction and combustion theory, carburettors etc. but left no impression that these entities comprise a motor car, whose purpose was to carry 'payloads' from A to B.

Neither did it cover map reading for journey planning, a guide to servicing and so on. In other words, it didn't cover the 'so what?' aspects of the topics it taught. Many courses whose curricula I have read follow the Motor Car course method. Try one sometime. • Be modular with the ability to stop at any point and restart there. In addition, it should allow students to skip sections which are patently not in their list of needs or offer an exit link to some other source which is.

• Emulate the campus feeling and the world of FAQs, it should be possible to use the course as a *forum* where peers can ask questions, exchange ideas, memory tips, give pointers to other material and so on. In short, create a Zoom/Skype subenvironment. If students abuse this by spending large blocks of time on it, they will suffer when the assessment/exam comes. The course might even measure this activity and suggest correcting this imbalance.

• Have a self-test facility with guided support in a Q & A session for the student, perhaps generating a forum question for peers if the topic refuses to stick in the student's mind.

• Give the feeling to the student that this course is not the end of learning, but emphasises that, like breathing, it is a lifetime occupation.

This emphasis might point the student to journals or sites where up to date articles and other supplementary information can be acquired. This implies a responsibility on the part of 'authors' in the general sense to make their material with student learning in mind, where appropriate.

This is part of ongoing education and a way to keep up to date without going through the course again to obtain this updated material.

• Have optional course *exit/re-entry* points, taking the student to an external medium, such as an internet article, YouTube video etc. to broaden the perspective of the sub-topic in hand. The correct and relevant positioning of these exits is decided by the course author(s).

This exit might well be a short external course, perhaps online, perhaps to meet the needs of a specific work area the students wishes to follow; see Figure 2.

• If multiple course developers are involved, their styles should conform to some standard, otherwise student confusion can arise. For example, if one course developer always adds a definition of the topic (like an abstract) but the co-author doesn't, this can be disturbing. Style is important in these cases.

• Have the material QA (quality assured) by experienced IT people for consistency, accuracy and adequate topic coverage.

• Eventually the course will need to be overhauled but a means for students to find the updated sections should be implemented.

• Other factors in making online mimic a campus environment.

Of course, all these suggestions cannot be implemented upfront otherwise the course will be out of date before it is delivered but these items should be borne in mind when creating it. There will be other ideas generated when the course development and when execution takes place.

#### Learner Notes

We have looked at the 'instructor' responsibilities but the 'learner' has a duty to themselves to optimise their learning. It is rather like a dance; both partners have responsibilities and they must coordinate the to achieve the best result, that is, not falling over.

I have learned several things during my long sojourn in IT, including some 'gems' from other people.

- 1. IT careers (as opposed to a single job) needs a lifelong commitment to learning your trade and passing what you know on to others.
- 2. Learning and retaining knowledge is best achieved by studying on the (my) LOVE principle; Little, Often. Varied and Extensive. If you wanted to get to know a town or city in detail, walking up and down the main streets often will not suffice, but looking into nooks and crannies, getting off the beaten track, studying it from the air, driving round etc. will give you a much netter handle on that town or city. This is an example of the LOVE principle.

I also call this method '*osmotic learning*', osmosis being the gradual seeping of moisture into a substance; the LOVE form of learning mimics that and differs from the pouring of a large jug of water on the learner where it flows off and is lost; the *intensive course* approach, covered next, along with its disadvantages.

3. Cramming and intensive courses do not allow the retention of knowledge to the extent you may think. I spent a week on an intensive scientific computing course, working well into the evening each day. When asked a few weeks later what it covered, I had no idea.

Don't study for a fixed time, study a topic but break it up if over 45 minutes long, the attention span before lethargy sets in. Shorter periods can be even better.

If you are teaching, remember that the attention of the audience fades every 10 minutes and it is recommended that the speaker changes tack, perhaps with a joke or revelation to bring them back to attentiveness.

- 4. Organise your study; don't just go grind all the material in haphazard fashion as you will lose the ethos of your overall subject. It will just be a series of sub-topics, each of which you might understand but not comprehend the whole. Plan it against the flow chart of the subject (Figure 1).
- 5. Remember that the half-life of an IT job or position is about 24 months after which it will mutate, change radically or, in some cases, disappear. You should train for a career, not a job and this means getting a solid underpinning knowledge of IT so that you can ride the vagaries of the shifting IT ground under your feet. This has an equivalent in medicine where the aspirant needs to attend general medical school before attempting to specialise. This 'general' before 'special' mode of learning is rarely followed in IT, a big mistake and widespread.
- 6. Make sure you don't think you will do the same job forever (unless you want to die of boredom) and think 'career' and not 'this is a nice well-paid job'. The story below encapsulates what I am saying.

'There's an old story about two men working on a railroad track many years back. As they are laying track in the heat of the day, a person drives by and rolls down the window (not enough to let the air conditioning out, but enough to be heard). He yells, "Tom, is that you?" Tom, one of the men working on the track, replies, "Chris, it's great to see you! It must have been 20 years ... how are you?" They continue the conversation and eventually Chris drives off. When he leaves, another worker turns to Tom and says, "I know that was the owner of the railroad and he's worth nearly a billion dollars. How do you know him?" Tom replies, "Chris and I started working on the railroad, laying track, on the same day 20 years ago. The only difference between Chris and me is that I came to work for \$1.25/hour and he came to work for the railroad." '

#### An Overview in Pictures

It is said that a picture is worth a thousand words, but this maxim is rarely followed in most IT articles I read. The topics I illustrate are the flow of IT (no subjects mentioned) and the course surroundings, showing the exit points and destinations. There could be several more than just those illustrated.

I hope these diagrams will illustrate my thesis adequately.

**IT Activity Flow** 





These figures (or similar) never appear in any course curriculum I have examined yet it should be implanted in the brain of anyone working at any point in this activity circle. It would make sense then to place the topics in order of those steps in the cycle so they slot into place and the steps which feed their section and follow it should be known to that person.

Remember this picture as it represents IT, alpha to omega.

The next figure shows the possible enhancements to a bare online course to try to mimic the school or campus environments. You might say that the hundreds of course available

commercially can do this job; try to put together a base, underpinning IT course from what is available and make your own mind up, if you haven't blown it in the process.

#### **Course and Exits**



#### Figure 2: Main Online Course and Sample 'Learning' Exits/Re-entry

The items in Figure 2 should be self-evident and the *hands on* internship (or apprenticeship) are options to give real life exposure to an IT environment. None of these are mandatory but should be capable of being added as needed or to allow the course to be tailored to a great extent.

#### Summary

IT training is changing, due to the complexity of IT, its volatility and the changing computing requirements in the workplace. Traditional training often relies on books and chalk and talk by the instructor, often giving a course and that is the end of training in that area.

When I was with IBM, basic training comprised three 6 weeks courses plus 1 week of industry training. It also mandated an extra 22 days per year extra training for technical people and 15 for sales. This type of ongoing training seems to have gone by the board these days, and remember, in those days IT was almost moribund when compared with today's volatility.

In slow moving subjects, traditional methods may be adequate but in IT today, it is not. Covid-19 has triggered an apparently irreversible move to home working (WFH) and online IT training too, although not necessarily at home.

The skills shortage, which has been written about for over two decades is still with us and growing which, to my mind, means developing online material, accessible by large numbers of people, taught by the 'aces' at the topics and designed to avoid the '*Loneliness of the Long Distance Learner*'.

Endnote: 'It's what you learn after you know it all that counts' – US baseball coach.

The Author: Dr Terry Critchley's Books

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