

Evidence-Based Use of technology: teaching with VLEs and ICT

Geoff Petty 4th version 2015

A more detailed version of this paper can be downloaded from:

<http://www.geoffpetty.com/whatsnew.html>

Learning with the help of technology such as computers, interactive whiteboards etc. has been called "e-learning", "ILT" or "ICT". I call it e-learning here.

This document first looks at designing e-learning tasks, then how to design an e-learning module to teach a short topic, and later (page 26) at how to integrate e-learning into a whole course. Updates of this document can be obtained from www.geoffpetty.com/whatsnew.html

In chapter 36 of "Teaching Today" (3rd Edition) I explain how a teacher of any subject needs to explore the following intertwining 'strands', usually simultaneously:

1. Develop your own technology skills e.g. using a computer, video camera, uploading pictures from a digital camera into Word etc.
2. Search for useful e-learning or ILT resources, e.g. useful websites for your subject
3. Create a personal resource bank of resources. E.g. develop a few pages of useful links or an Intranet site, or a scheme of work with hyperlinks, and/or a CD of useful images and text etc
- 4. Design student activities that require students to use resources**
5. Reflect on your progress in the use of technology, in and out of the classroom, by you and by your students.

I worry that the fourth strand is not given sufficient emphasis by most teachers, though this might be due to lack of time. Chapter 36 of *Teaching Today* deals with 2-5 above in more detail, but let's look at '4' now.

"It is therefore the pedagogy of the application of the technology in the classroom which is important: the how not the what"

Professor Steve Higgins

'The Impact of Digital Learning' The Sutton Trust

Finding resources

Don't entirely rely on your favourite search engine, search the following with a few typical topics in your subject to see what they can offer:

<http://xtlearn.net/NLN> (was www.nln.ac.uk/)
www.bbc.co.uk/learning/
www.TES.co.uk/teaching-resources/
www.youtube.com/education
Knowmia.com
Khan Academy (www.khanacademy.org)
<http://www.watchknowlearn.org>
www.excellencegateway.org.uk

When you use Google ask for the level, and type of resource as well as the topic, eg Googling:

Video osmosis A level
Quiz health and safety level 1

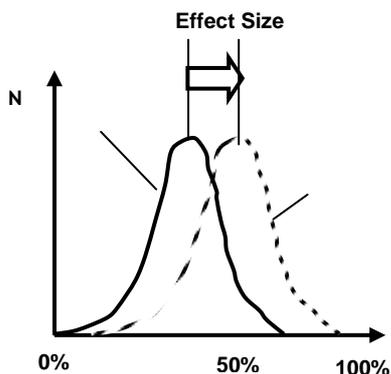
Designing e-learning tasks

What student activities should we use? We know a lot about this and we should focus on our choice of student activities not on the technology. It is what goes on in the students' heads that creates learning, not what's on their computer screen.

What works?: the evidence

Randomised control group trials and similar research have created over 500,000 peer reviewed effect sizes. These show that "what works" is remarkably unaffected by context. The most powerful methods or factors have improved learning by two GCSE/A level grades compared to the control group, i.e. compared to good conventional teaching. This is equivalent to improving pass rates by more than 30%. We may not achieve the same improvement, but we would be mad not to try what has worked best in these trials.

Prof John Hattie's effect size table synthesises all these experiments, showing the factors with the greatest average effect on student achievement: i.e. greatest average 'effect size'. The common factors in the highest effect size studies are:

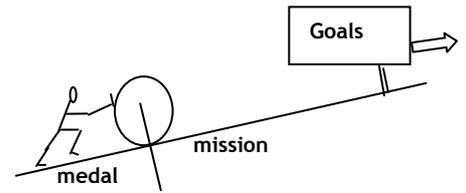


- **Challenging tasks:** e.g. reasoning tasks, not just reproduction tasks
- **Active Learning** with clear purpose and strong teacher direction
- **Feedback** to the learner and to the teacher

Black and Wiliam's review on how to give effective feedback:

Feedback must be informative:

- Medal and mission feedback with clear goals
- Avoid grading and comparing too regularly
- Use active feedback methods: self, peer and spoof assessment



Professor Robert Marzano has reviewed and synthesised classroom based research just like Hattie, and isolated the student activities with the highest effect size. They are very widely applicable tasks suitable for almost any subject or topic. I call them the Top Ten Active Learning Methods.

Top ten active learning methods

Remember, it is not what the technology does that makes it effective, but what the student does. Here are Marzano's top ten methods. The figure in brackets after each method is the average 'effect size' in experimental trials. An effect size of 1.0 is roughly equivalent to two grades at GCSE or A level. All these methods are described in detail in my 'Evidence Based Teaching' (2006).

When presenting new information, skills etc

Advance organisers: (Average effect size from .48 to .78 depending on complexity)

Giving students summaries in advanced of what they are about to learn, they are like 'cues' above, but are much more detailed. They provide a means for students to structure the topic. I don't know why the effect size is lower than for 'Cues', is it because Advance organisers are too detailed to be readily recalled? Any ideas!?

- The effect of Advanced Organisers on students' understanding of topics that require understanding of relations, connections etc shown by the organiser. .78
- It's effect on the ability of students to recall facts, cause and effect sequences etc. .56
- Using Advanced Organisers to teach mental skills such as data analysis, evaluating a historical document etc. .60

(Note that Advance Organisers have most effect when the learning is complex)

Relevant recall questions (Average effect size 0.93)

These are questions designed to bring useful, and essential prior learning into the learner's short-term memory, and to check it, before building the new learning upon these foundations.

- Questions requiring students to recall what they already know about the topic or skill to be learned, for example recalling relevant learning from the previous lesson, or from a term ago.
- Questions recalling prior experience that can be built upon. For example a maths teacher might get students to recall experience of '*cutting things up*' and '*sharing things out*' before teaching them the concept of division as described in chapter 2.

For best results these questions should be asked both before and during the lesson.

Challenging tasks (Average effect size up to 1.21 for more complex topics)

This works best if you set tasks for a topic before you explain the topic. If students know what they are about to do with information, they are more likely to attend to explanations of that information.

When getting students to apply their learning

'Same and different': (Average effect size 1.32)

This is a task that requires the learner to identify similarities and differences between two or more topics or concepts, often one they are familiar with, and one they are presently studying. The best strategies involve students developing analogies that link new content with old. This is sometimes called 'compare and contrast'. Students can be asked to compare an analogy with the real thing, or to create analogies.

Related activities include:

- what do these have in common
- classify these (this involves looking for important similarities and differences in what is being classified)

Graphic Organisers: (Average effect size 1.24)

The student creates their own diagrammatic representation of what they are learning, for example in a mind-map, flow diagram or comparison table.

Note Making. (Average effect size .99)

Students create personal notes on the information being presented. Some strategies involve the teacher indicating key points and then leaving time for students to embed them in notes, others offer no assistance to the learner. Students need to get feedback on the quality of their notes, but this can be gained by checking their notes against key points (if these weren't given earlier).

Decisions-Decisions: (Average effect size .89)

Students physically manipulate cards or objects or symbols which represent concepts or ideas they are learning about. See 'Decisions-Decisions' chapter in 'Teaching Today'. Some computer simulation activities have an effect size of 1.45.

Cooperative learning (.78) these are methods like 'Jigsaw' that require students to teach each other and to check each other's learning.

Feedback (formative assessment) (1.13)

Feedback gives students information about what they have done well and what they need to improve either directly, or indirectly e.g. by requiring them to mark their own and each other's work against model answers or mark schemes and other 'formative teaching methods'. Do stress that achievement comes from effort not ability.

- Medal and mission feedback (1.13)
- Medals alone (.74) (this is not praise but information about what was done well)
- Stressing effort over ability (0.8) (formative teaching methods do this.)
- Praise alone e.g. 'well done that is very good' has very little effect, about 0.08

Peer- and self-assessment have very high effect sizes, for example a student marking their own work, or that of a peer, using a model or a set of criteria provided by you. This is very useful in e-learning

Generating and testing hypotheses (0.79)

These all require the students to use high order reasoning on material that has been presented to them

Testing hypotheses directly: you give students some basic ideas and principles, e.g. about photosynthesis in plants, and students work out ways of testing the hypothesis. They devise an experiment and carry this test out. Students need to state their hypothesis clearly.

"What would happen if" questions: e.g. you teach students about government system to improve employment and then give students questions in a "what would happen if" format and students must produce a reasoned response using their knowledge of the system.

Problem solving: students suggest a solution and test it or get feedback on their ideas in some other way.

Historical investigation: students create a hypothesis and then look for evidence for and against it.

Invention: students use their knowledge e.g. of quality systems in order to devise one for a particular novel context.

Decision making: students use their knowledge to make a challenging decision.

All of the above can easily be adapted to e-learning. Compare the effect sizes above with Hattie's average effect size for 'computer assisted instruction' of 0.37 (1999). This is a very modest effect. He writes that it is not the computers, but the teaching processes they can mimic and enhance that creates the effect. He noted a gradual improvement in the average effect for computer-assisted instruction over the previous decade. Perhaps this is due to more concentration on what the student does, than on what the technology does, i.e. more challenging goals and more feedback (interactivity).

"Technology is just a tool. In terms of getting the kids working together and motivating them, the teacher is the most important." --**Bill Gates** **Microsoft Corp. co-founder**

Let's use the 'top ten methods' on your resources.

An excellent strategy is for you to collect electronic resources suitable for your course and your students. Then you devise student activities that involve the student in using one of the 'top ten' methods with that resource. For example suppose you find a good website which could teach your students about colour printing, which is a topic on your course. You create an assignment perhaps on your "Virtual Learning Environment" (VLE), e.g. Moodle, which involves students in a 'graphic organiser ping pong' like that described just below. Other generic activities are described after this.

This 'Ping pong' involves the student in creating a '**graphic organiser**' in which they **self assess**. Both these have high effect sizes. The sequence of tasks below (1-7) is much better than 'have a look at this website'.

You will need to practice the use of high effect size methods in e-learning, and so will your students.

'success comes in cans, failure in can'ts'

Using graphic organisers with technology

Graphic Organiser Ping Pong:

1. you ask for a graphic organiser 
-  2. students create one and send it to you
3. you send them your model organiser 
-  4. they self assess their organiser, improve it and return it to you
5. you check there are improvements 
6. they take a quiz

Here students make a graphic organiser which 'ping pongs' between them and you:

1. You give the students the task of summarising the key points for a topic by creating a graphic organiser (mindmap or comparison table etc). You may give websites etc, or leave the student to find these unaided.
2. Students study the topic using resources such as websites DVDs etc. You might ask them to print out documents and highlight them.
3. Students create their graphic organiser using Word. A mindmapping software, or similar, hyperlinks to websites can be included in this document. They may add some notes too, written in their own words.
4. Students e-mail their graphic organiser and note to you.
5. Then you send them your graphic organiser asking the student to self assess their graphic organiser using yours as a model, and then to improve their organiser.
6. They e-mail their improved organiser to you.
7. They take an online quiz on the topic summarised by the organiser

You can of course stop at point 4. You can also ask students to peer-assess by e-mailing organisers to each other. This is described below. They can all upload their organisers onto a common VLE or website page, and compare their work with that of others. They can also present their organisers using PowerPoint, on shared web-pages, or on interactive whiteboards etc.

Complete the organiser

You give students a graphic organiser such as a table or mindmap that is nowhere near complete. In effect this is an advanced organiser, which summarises the most important points that they are about to learn.

Students complete this during the topic to create their own notes. This might be a useful activity to get students used to graphic organisers

Using a Graphic organiser to collect prior learning

Students can use Word or Powerpoint or similar to create their graphic organiser. However you might like to consider dedicated software such as:

Mindgenius www.mindgenius.com

Inspiration or a simpler version called Kidspiration see: www.techready.co.uk/inspiration,
Microsoft Visio,
Cmap tools, etc.

Google 'webmonkey for kids' or 'Animation Factory' help students to create animations.

There is free mind-map software on the internet too.

This is making use of 'relevant recall questions'. Students create a mindmap or similar graphic to summarise what they already know about a topic that you are about to teach. As they learn more about the topic, they improve and add to this organiser, to create a note. This could be done on an interactive whiteboard as a class either instead of the individual mindmap, or after those have been created.

Using Feedback with Technology

The above activities will work better if there is informative feedback to the student as to what they have done well and what they could improve. 'Ping pong' above already does this. Informative feedback like this has a high effect size, and can be helped by technology in the following ways.

These feedback approaches all have high effect sizes and could all be used with almost any other student activity in this document.

Self assessment using a model

This was the method used in graphic organiser 'ping pong' above. Students do some work, they e-mail it to you. You return a model which might be the task completed well by yourself or a previous student, a worked example, assessment criteria etc.

Students self assess by comparing their own work with the model

Students improve their work and then e-mail it back to you. They are allowed to keep the model.

Using Insert>Comment to aid feedback

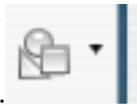
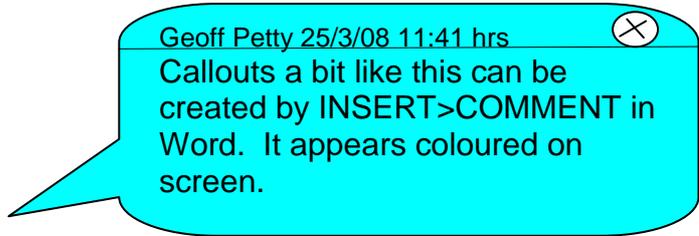
Microsoft Word allows you or students to write comments on a piece of work.

This is done with INSERT> COMMENT.

Comments appear as 'callouts' that look a bit like a cartoon speech bubble or the fake example above.

They can be deleted by clicking the cross at the top right of the callout. If different computers are used, the callouts have a different colour for each computer. The name of the registered user of the computer appears automatically, with the time and date of the comment, hence "Geoff Petty 25/3/08 11:41 hrs" appears at the top of a comment made on my computer. Using comments shifts the text being commented upon over to the left, and the comment appears in an enlarged right-hand margin.

If you don't like callouts, feedback can be given in different coloured text, in text boxes, or in callouts drawn



using the drawing tool in Word.

For sophisticates, 'New comment' on the 'mark up' menu is a button that inserts a comment (VIEW >MARK

UP). 'Track changes' is also worth exploring.



(these buttons are on the 'Mark Up' menu bar)

Peer assessment with callouts

This can be done synchronously (at the same time) or asynchronously (students do it at a time that is convenient to them, though there is usually a deadline.)

1. Students present work, perhaps by uploading it to a website.
2. Each student must then peer assess, say, three other students' work by inserting 'Comments' and/or by adding comments in ordinary text but in a different font colour to the original. This means that every student will have three sets of comments.
3. Students now improve their work before submitting it, deleting the comments or not as you request.

Peer assessment by group discussion

Students could just meet up in small groups to look at each other's work and discuss how this could be improved.

Self assessment with callouts

Students use INSERT>COMMENT to show where in their work they have met the assessment criteria for their work.

1. Students complete an assignment or homework etc using Word. The work has clear assessment criteria.
2. Students Insert 'Comments' into their work to show where they meet each criteria e.g. if an assessment criterion is:

'E. justify the policy' ...then students find where in their work they have done this, and with Insert >Comment creates a comment there that just reads 'E'

Teacher assessment with Comments

You can of course use Insert Comments to point out improvements required in a student's work. When the improvements have been made, the student is asked to delete the comment... but not before!

Alternatively ask the students to keep your Comments in so you can check they have been attended to, then ask for them to be deleted once you're happy with the improvements.

Peer assessment as a competition

This works well for graphic design, or other electronic art work, but could be used for any work that can be assessed reasonably quickly by students. However it requires some maturity and honesty amongst students.

Students present their work on a common website or similar. Each student must look at every other student's work and score it against assessment criteria, this can be done anonymously or not as you think fit. Students present their scores numerically on a spreadsheet:

Assessors ->	Pete	Phil	Clare
<i>Score Agate's work out of ten for these criteria:</i>			
Use of colour	3	2	3
Response to brief	4	2	3
Clarity	2	3	3
Impact	3	1	4
TOTAL	12	8	13

Total score from whole class: **20**

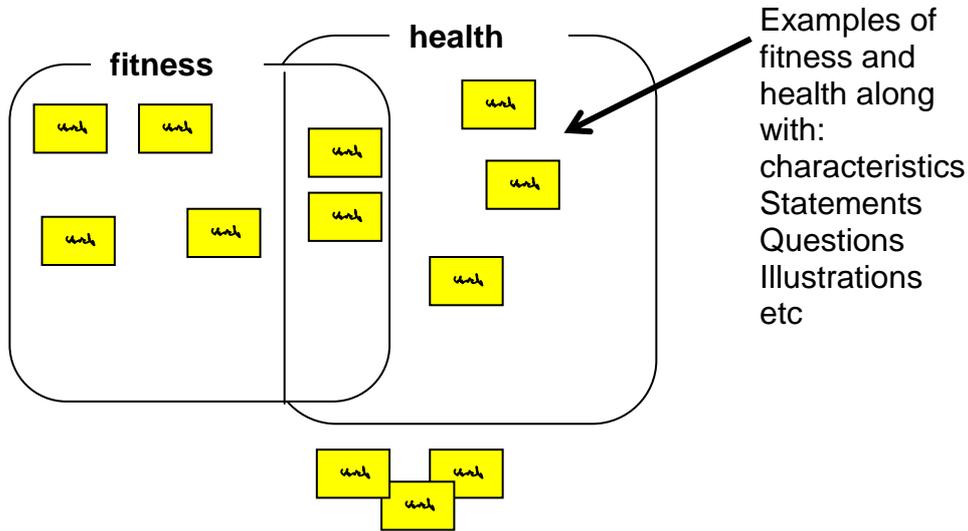
Eventually each student is scored by every other, and the highest scorer 'wins'. Needs maturity!

You can do this more automatically using www.surveymonkey.com.

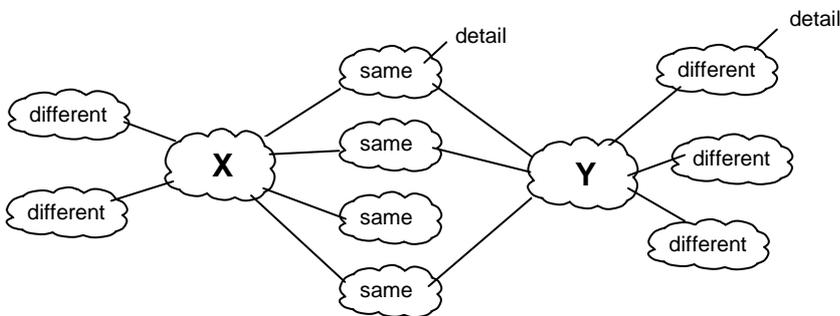
Using similarities and differences with technology

This has a particularly high effect size and so should be used often. It is often done best graphically by asking students to complete a graphic like one of the following. Alternatively they use a computer or interactive whiteboard to drag and drop text boxes or images to the correct place.

Same and different Venn diagram:



A same and different mindmap:



A comparison table

Criterion, factor, part, 'spectacle' etc	Tsarist Russia	Soviet/Communist Russia
Criterion 1		
Criterion 2		

Typical activities on a VLE

- Forums allowing students to have discussions
- Quizzes
- Polls (choice tool) where students choose one answer to one question, like an opinion poll.
- Electronic submission of Assignments
- Questionnaires and surveys
- Interactive lessons
- Collaborative glossaries
- Blogs & Wikis

There are five types of forum

A single simple discussion – a single question or discussion topic can be given, which everyone can reply to (this cannot be used with separate groups).

Each person posts one discussion – each student can post exactly one new question or discussion topic, then everyone can respond.

Q and A forum - students must post their own comments before they can view those of others.

Standard forum displayed in a blog like format – an open forum where anyone can start a new discussion at any time, and in which a range of discussion topics are displayed on one page with "discuss this topic" links.

Standard forum for general use – an open forum where anyone can start a new discussion at any time.

Quizzes.

Good quizzes find faults and fix learning errors and omissions. Most VLE quizzes typically consist of self-marked multiple choice, matching, numerical or short answer type questions. Ideally it should allow the tutor to provide feedback explaining why an answer is wrong. It takes time to construct these quizzes and to add these all-important feedback comments, but once created the quiz can be used for years, and is self-marking. The students like the immediate feedback. It is even possible to use conditional access settings so that the score in a quiz will dictate what a student does next.

Wikis.

A Wiki is a document written collaboratively by a group. Writing is an excellent way to develop understanding and thinking skills in your subject. For example students could work together to write:

- Revision guides

- A shared and annotated photo gallery
- Frequently asked questions – experienced second years could produce an online resource to support first years with information, tips and “Things I wish I’d known when I started this course”...
- Collaborative essays, books, and stories

More uses for your VLE

Find some very popular uses of VLEs by searching for ‘Moodle Tool Guide for Teachers the cat’s pyjamas’ or go here:

http://www.cats-pyjamas.net/wp-content/uploads/2010/05/MoodleToolGuideforTeachers_May2010_JS.pdf

There are adapted versions of this guide now: search for ‘[A Moodle 2 version of the Moodle Tool Guide](#)’ or go here:

<http://www.somerandomthoughts.com/blog/2012/03/15/a-moodle-2-version-of-the-moodle-tool-guide/>

Useful Online applications

There are a number of useful on-line applications for you and your students. These are not the only examples of their type:

Download a video from Youtube: <http://keepvid.com>

Cut a section from a Youtube video: www.tubechop.com

Editing video on-line: for example www.loopster.com

Podcast creation, record and share audio, e.g: www.recodmp3.org

On-line presentations: www.prezi.com

Create a chatroom: <http://todaysmeet.com>

Create a website e.g. <http://issuu.com>

Some links:

“Building Better Instruction: How Technology Supports Nine Research-Proven Instructional Strategies” Download from the McREL.org Web site.

<http://technologyandinspection.pbwiki.com/> this is by Jim Judges of Birmingham City University