



Use of media in e-learning

An epic white paper



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Introduction

This White Paper explores the use of media in e-learning and how to combine them into an effective learning experience. We have specifically concentrated on the use of text, audio, graphics, animation and video in 'traditional' e-learning i.e learning delivered on a PC/mobile device, via the Internet/intranet or on CD/DVD. Our thoughts on 'social media', such as that afforded by Web 2.0 technologies, are covered by other Epic White Papers, so are excluded here.

The following outlines the advantages/disadvantages of each type of media and how they should be used for effective learning.

Psychology and media

Technology is always ahead of psychology

Technology is always streaking ahead of psychology. Text, audio, graphics, animation and video are available through smartphones, PDAs, iPods, PCs, games consoles, digital radio, DVD and interactive television. There's an avalanche of purchasable and downloadable digital media available. Consequently we see the crude use of media in e-learning driven by the ability to use the medium, rather than lessons drawn from research or from the psychology of learning.

What e-learning has to cope with is the issue of how to mix these media in the most appropriate way for learners. E-learning is the one area where the convergence of digital media comes into its own. No other digital application is so needy in terms of the breadth of media it can usefully employ and the importance of getting the media mix fit for purpose – that

purpose being learning.

Early multimedia looked very much like a car cobbled together from different scrap yards with components of different sizes, colours, models and ages. It was a mongrel beast. As client devices got more powerful and bandwidth exploded, interactive and instructional designers had the freedom to use text, audio, graphics, animation and video in all sorts of combinations.

As expected, there's an initial reaction to this digital abundance. We have had a flood of websites with flash intros that did little more than annoy users. At this stage the designers were in control, playing with the tools and supplying what they thought users wanted. Then came the backlash from users who actually preferred things kept simple and easy to use. This initial exuberance gave way to a sensible and far richer,

user-centric use of the medium, especially in educational

e-learning. It is this measured approach to the use of media that is needed in e-learning, a matching of media and media mix to learners' expectations and learning needs.

Mind and media

Let's start with the psychological question of how people perceive media when presented through computers. This is a fascinating question, as it would appear that we are hardwired to see media as living and animate. *The Media Equation: How People Treat Computers, Television and New Media Like Real People and Places* by Byron Reeves and Clifford Nass, two Stanford academics, provides a compelling case, backed up with 35 empirical studies, to show that people confuse media with real life. This is actually a highly useful confusion: it is what makes movies, television, radio and the web work.

These psychological studies into

the human reaction to media all point towards the simple proposition that **media equals real life**. By this it is meant that people react towards media socially even though, at a conscious level, they believe it is not reasonable to do so. They can't help it. In short, people think that computers are people.

Why is this so? The answer is that we evolved in a world where humans exhibit rich social behaviours and in which all perceived objects are real objects. Anything that seems real is taken to be real. We do not willingly suspend disbelief, it just happens. Think of a ventriloquist – it is hard not to see the puppet as a real person - similarly with good media and e-learning.

'People can't always overcome the powerful assumption that mediated presentations are actual people and objects.' We swear at cars when they break down and kick objects when they cause us harm. We do it because we're programmed that way. *'Acceptance of what only seems to be real, even*

though at times inappropriate, is automatic.' Our senses are at once highly attuned and highly gullible: attuned, in that they allow us to impute human characteristics such as attitude and personality from such scant physical evidence (the twitch of an eyebrow, the turn of a head); gullible, in that they allow us to be fooled into thinking of the dummy as a real person, which it is not.

However, this is only true '*as long as a media technology is consistent with social and physical rules*'. The spell is easily broken. If the media technology fails to conform to these human expectations - we will NOT accept it. This is a fascinating lesson for e-learning. We must learn to design our courseware as if it were being delivered by real people in a human fashion.

The effectiveness of the user experience on an emotional level will depend as much on these considerations as on the scriptwriting and graphic design. It all has to work seamlessly, or the illusion of humanity fails. This has huge implications in terms of the use of media and media

mix.

Let's take just one example - the phenomenon of arousal. Arouse people at the start and they will remember more. Yet the first experience many learners have in an e-learning programme is a detailed registration procedure followed by a dull list of learning objectives. There is a strong argument for emotional engagement at the start of an e-learning programme and not the usual list of objectives. On the other hand, as we shall see, persistent arousal can be counterproductive.

Another simple finding, that shows we have real life expectations for media, is our dislike of unnatural timing. Slight pauses, waits and unexpected events cause disturbance. Audio-video asynchrony, such as poor lip-synch or jerky, low frame-rate video, will result in negative evaluations of the speaker. These problems are cognitively disturbing.

'If the designers of media would only follow their (Nass and Reeves's) guidance, we would

*all gain through enhanced social
graces in our interactions with*

*media and technology,' says
Donald A Norman.*

A true evaluation of media and media mix needs to look at the pros and cons of each media type. It must then look at how media are combined and integrated. These are all psychological questions. We must understand not only the media but also how media combinations are perceived by the mind.

Mind and media mix

We know a lot about how people learn and, despite repeated statements about the lack of research in e-learning, there is also a great deal of detailed research on media and media mix in e-learning. This is not the place to summarise all that has been learnt about how we perceive different media. However, we do need to draw on relevant research and knowledge about how the processing of this information is limited by our working memory,

along with our ability to learn by reinforcing knowledge and skills into long term memory, followed by recall and transfer. None of this is simple, but it is well charted territory in cognitive psychology.

To select a media mix, designers must be conscious of these mechanisms and their limitations. The use of media is not only about the mechanics of learning, it's also about getting people started and retaining interest. We have to be careful, for the research shows that there are dangers in using media arousal techniques during the learning. The two aims often mutually interfere with and destroy each other:

The mind is highly selective. Learners have a limited capacity to absorb information so they select. They select because they have a limited working memory. This is why 'less is more' is a good principle in learning. The learner can only cope with so much information at any one time. Text, audio, graphics, animation and video that are surplus to requirements need to be eliminated. The

mind needs to integrate the different media elements, say text and graphics, into manageable chunks to cope with understanding.

The mind also needs to understand by integrating new knowledge into its existing knowledge structures. The right context may have to be provided in terms of realism, which also affects the choice of media in the media mix.

It is clear that different media use different processing channels – visual and aural. We now need to look at each medium in turn, along with its various combinations, to see how learning can be improved.

Media rich is not always mind rich

On a practical level, we have to be careful with what Neil Postman, in *Amusing Ourselves to Death* called, the 'peek-a-boo world', in which visual media displaces text. This is a world of fleeting pop-up imagery and insancy that lacks depth. Television is a dominating medium in our culture, but we

must be careful in embracing all of its charms in learning.

It's a mistake to think that media richness (audio, graphics, animation and video) leads to automatic improvements in learning. An abundance of audio can slow an e-learning experience down to an intolerable pace for fast readers who simply prefer text (imagine all help text files as audio only). Graphics can be completely specious when they're simply added to written scripts as a series of decorative, but not value-adding, images. Animation can annoy when it is overlong and illustrative rather than instructive. Video, in some cases, can be meaningless eye candy.

A headlong rush into using rich media, just because it's there, is inevitable. We have to consider the strengths of each media type as well as its relationship to other media in the mix against the nature of the target audience and type of learning. Just as blended learning is recommended for channels of delivery, a blend of appropriate media is recommended for e-learning.

There are some surprises in store here, as research suggests that some media mixes enhance but others inhibit learning. One must be careful not to overload the learners with too much media, even when it is relevant. In some cases audio, animation and video may be destructive. We must also be careful when combining media, as some combinations work, while others don't.

So what is the optimal media mix for a specific piece of learning?

Text

Reasons for using text in e-learning

Text is a much-maligned medium in e-learning. Content is often criticised for being little more than electronic page turning or too text-heavy. If a programme promises more than it delivers, such as high-end interactivity or simulations, then this criticism is valid. However, much e-learning, especially simple knowledge and procedural learning, may demand no more than a simple text or text and graphics approach.

We read quickly

Practised readers read at the rate of about 300 words per minute. This is roughly twice the speed of normal speech - and recorded narration can be even slower. The reason for this is that the grammar and meaning in written text is far more compressed and complex than in speech. Written text

tends to eliminate redundancy such as false starts, repetition, hesitation and asides. This has a considerable impact on the rate at which a learner will learn and complete the course.

Learners read at their own pace

Just as important is the simple fact that learners can read at their own pace. This is fundamental to comprehension and retention. Readers optimise their reading pace to extract meaning and often stop to repeat, reflect, skip and digest information. This is important in building internal models and relating new knowledge to existing knowledge. Text is in this sense more learner-centric than continuous flow media such as audio, animation and video.

The web is a user-centric medium. Users object to control being taken away from them through pop-up

ads and Flash movies at the start of websites (does 'skip intro' ever work?). The web is fundamentally text driven, not because of limited bandwidth, but because users feel they are in the driving seat. Do we really think that Amazon and eBay want their sites to be driven by audio and not text?

Text can be subtle and sophisticated

A well-written piece of fiction or non-fiction leaves the learner to create images and reflections and possibilities, unpolluted by sounds and pictures supplied by others. It keeps the imagination free to create appropriate thoughts in learning and doesn't clutter learning up with inappropriate items. Text is personal, which is why books are so dearly loved.

Many sophisticated learners also prefer straight text delivery as they can read at their own pace, re-read for understanding and get absorbed in the structural or narrative flow. Academic learners are well versed in learning from academic papers and often resent the packaging

of learning in multimedia formats. In other words, there are some audiences for whom text alone can be sufficient.

Text is flexible and searchable

From the information architecture perspective, text is a very powerful medium. The information architect Saul Wurman claims there are only five ways to structure information, using the mnemonic LATCH:

Location – place, maps etc.

Alphabet – dictionary, index, glossary etc.

Time – timeline, storylines etc.

Category – themes, lists etc.

High and low – menus, numbered lists

Note that the alphabetic presentation of content in indexes, glossaries, lists, menus, dictionaries, encyclopaedias, and so on, is a feature of text itself. Rich storylines can also be text driven along with categories, themes, etc. In other words,

information of many kinds is often best represented in text. We should not ignore the sheer number of extensive, subtle and sophisticated ways in which text quite simply gets the job done.

Searchability is another simple but profound quality of text. The web is the web because of text. Google only works because of the ability of computers to handle and sift through strings of text. Text is eminently searchable and it is this searchability that gives us unique access to the web, now the largest learning resource on the planet. Even searches for other media are mediated by text tagging.

Needs simple skills and tools

Reading and writing, despite obvious problems with literacy, even in advanced societies, are still widespread skills. In most jobs we expect the employee to be able to read and write.

It is also commonplace to be able to use a word processor. Within this tool text is easy to manipulate, spell check,

grammar check and format. Specialist knowledge in the production of the medium is not necessary.

In this sense, production in terms of the tools is easy and cheap. This is not to say that writing good content is easy. Good writing, especially instructional writing, can be difficult and painful. It needs to be done by practised professionals. There's a world of difference between the skills needed to operate a word processor and those involved in writing a novel, for instance.

The fact remains that, in terms of e-learning, text is a medium that trainers, teachers, lecturers, instructional writers and subject matter experts know well. It is the easiest medium for learning professionals to deal with and produce. Therefore, in terms of resources, tools and skills it works well.

Requires low bandwidth

Text is so insignificantly small in file size that it is hardly worth worrying about in e-learning. Audio, graphics, animation and

video are far more bandwidth hungry. Neither does it require special plug-ins such as audio players, Flash or video players. This is important in terms of access, because even today, one of the major barriers to e-learning is the lack of bandwidth and poor technical infrastructure. Text is easy to get to learners.

Easy to update

Text is also easy to update. Changing a text file requires little in the way of technical knowledge or specialist tools. Changing one word on a piece of voiceover can involve getting the voiceover artist in, recording the new audio file, using specialist audio tools, getting the sound levels right and getting it programmed back into the original e-learning course. Graphics require specialist skills in both design and the use of graphics tools, and animation or video can be even more complicated to redo and edit. The simplicity of text is a real virtue.

Cut until it bleeds

However, text is not always effective in learning. Several pieces of research point towards overlong text as being destructive in learning. Mayer; Bove, Bryman, Mars and Tapangco (1996), Mckay (1999) and Lark and Mayer (2008), showed that too much text can reduce learning by up to 50%. The lesson is that text should be 'cut until it bleeds'. A good editor will reduce text like a good sauce.

Reading from screen

There is a difference between reading from the printed page and reading from a screen. Reading from paper makes use of reflected light, whereas the screen is lit from behind. This makes it more difficult to read on screen, particularly when large amounts of text are involved, and where the user is required to read for a long period of time. There is a danger in simply transferring text from the page or workbook to the screen, without taking into account this fundamental difference.

Text unsuitable for some learners

Text can also fail learners with visual impairment, those with low levels of literacy, and those for whom English is a second language. Many who do not read for pleasure find reading a daunting task. Some learners just don't take to reading at all, preferring other forms of delivery.

Table 1: Use of text - pros and cons.

Pros	Cons
Text is a low bandwidth, high quality medium that has several advantages in terms of learning:	Text may be inadequate in learning for several reasons:
<ul style="list-style-type: none"> Majority of learners can read quickly 	<ul style="list-style-type: none"> Reading from screen has its limitations
<ul style="list-style-type: none"> Learners can read at their own pace 	<ul style="list-style-type: none"> Learners might have visual impairment
<ul style="list-style-type: none"> Can be subtle and sophisticated 	<ul style="list-style-type: none"> Learners might have low levels of literacy/dyslexia
<ul style="list-style-type: none"> Is flexible and searchable 	<ul style="list-style-type: none"> Learners might have English as a second language
<ul style="list-style-type: none"> Needs simple skills and tools to produce 	<ul style="list-style-type: none"> Learners might require sound, graphics, animation and/or video in terms of the content
<ul style="list-style-type: none"> Requires low bandwidth 	
<ul style="list-style-type: none"> Easy to update 	

Neither can text cope well with things that need audio, graphics, animation or video in terms of understanding. In these cases it is advisable to climb the media ladder.

Text as used in e-learning

Menus

Menus are usually text lists, even if they are displayed as mindmaps or 3D manipulable nodes. This is for the very good reason that text is simple and easy to understand. Even icons in most e-learning programmes need text to be understood and to ensure users requiring screen reader technology can navigate content effectively. So on the whole the navigational structure of an e-learning programme is likely to be at least text heavy, if not wholly textual.

Presentation

Presented content is often text based as it can be precise and concise. Formal and conversational styles (using terms such as I, me, my, you, your and we) of text have

been compared by Moreno and Mayer (2000 and 2007) showing that the conversational style resulted in 20-46% better learning. Of course it would be a mistake to overdo this, or use over-friendly styles in contexts such as training on terminal diseases, but the personal touch, on the whole, seems to work.

Reeves and Nass have taken this much further showing that politeness, flattery, personality, arousal and many other features can help people adapt to computer mediated communication and learning.

Feedback

Text feedback is immediate and must be placed on the same screen as the question. Everyone is a sucker for praise, and insincere praise is better than no praise at all. Reeves and Nass, in one study, found that computers should praise people frequently, even when there is no reason to. Remember also that praise and blame are asymmetrical - we love to be praised and hate to be criticised, so give out criticism carefully and sparingly. Avoid negative feedback that

you wouldn't give in a real conversation. We seldom say 'incorrect', 'wrong' and 'no' in actual conversation, so it is best to use a more conversational style when expressing criticism in e-learning feedback.

Instructions and help

Instructions must be displayed as screen text. The user must be able to read and re-read instructions right up to the time they choose to act. Similarly with help.

Glossaries

A glossary is, by definition, a text-based phenomenon, as is a dictionary.

Recommendations for the use of text

Text has more going for it than many people imagine. Programmes often end up with more text than planned, simply because it works. It should not be written off as dull until its many advantages have been understood. Text can be read quickly, at the learner's own

pace, be subtle, sophisticated, flexible and searchable. It only needs simple skills and tools to produce, requires low bandwidth and is easy to update.

It is to be used in menus, in other navigational features such as text accompanying icons, presentation, captions, feedback, instructions, help, glossaries and in many other components in e-learning.

On the other hand there are significant audiences for whom text may cause problems. Text may be unsuitable for audiences that have low educational standards, low levels of literacy, visual impairment and/or hearing impairment, or are simply not used to reading large amounts of text.

Text on its own is rarely adequate for e-learning programmes. It usually has to be supplemented by audio, graphics, animation and video to make the learning palatable and improve the learning in itself.

Audio

Reasons for using audio in e-learning

Audio can be necessary for learning

Let's bring audio into the media mix, as it is usually considered when text is inadequate in terms of the audience or type of learning. Language courses, telephone skills training, e-learning about the various types of heart murmur, and music courses - to name but a few examples - are unlikely to be completely effective without some kind of audio. In such cases, audio must be present for learning to take place.

Text and audio together

Text and audio (text delivered as audio) are not simply different methods of delivering information. They are fundamentally different in the way they are produced and used and there are fundamental differences in terms of learning.

They are, in fact, processed in two different ways, through two different channels, one visual, the other aural.

An interesting question arises time and time again in e-learning. Is it better to have:

- Identical text and audio?
- Audio only?
- Text only?

Audio only

According to studies in Clark and Mayer (2007) and Moreno (2007), audio or text on their own are better than text and audio together. This is confirmed by another study by Kalyuga, Chandler and Sweller (1999) where the group with audio scored 64% better than the group with both text and audio. They claim that one or other is redundant and will overload the visual and aural channels.

Clark and Mayer (2007) argue that audio and graphics/animation can improve learning, since they use separate cognitive channels, as opposed to text and graphics/animation which both use the visual channel. This is an argument for using audio and graphics without screen text.

It is true that when animation and video are presented at pace, or when complex graphs requiring detailed explanation are shown, the pendulum swings in favour of audio (without text) which allows the user to concentrate on more complicated animation and graphics. (If both audio and text are used, it is advisable to allow the user to be able to turn the audio off and switch to a text only version.)

Reasons for not having audio mirror text

However, there's a complication. Frustration with the slow delivery of audio can disrupt learning and cause students to drop out. We have seen that reading is about twice as quick as speaking or hearing. Which

is another strong argument for not having audio accompany text in e-learning programmes.

Simply repeating all the text as audio is not trivial. It requires a time-consuming, expensive process that necessitates specialist tools, production expertise and voiceover talent. It can also annoy experienced readers and learners, who want to go at their own pace rather than the pace of audio delivery.

Reasons for not having audio

Audio with text is less convincing where the true focus is on the text and not the graphics. In this case, as in reading a quote or section abstracted from an academic paper, audio may be no more than a distraction. It also assumes that the learner is attending to both simultaneously, whereas with text and graphics, the learner is relating, at their own pace, to text and graphics sequentially.

Text does not disappear from sight and mind, audio narration does; making greater demands

on working memory. It's a case of 'out of sight, out of mind'. This is one reason for keeping the spoken text on the screen. It acts as an insurance policy if the audio doesn't work. It can also give the learner the choice of using one or the other:

Text also ensures that the information can be read at the learner's own pace. Steps in a procedure will not benefit from a spoken treatment. The learners will want to look at and assimilate the entire procedure.

Instructions, for example, should be text and not audio as they need to remain on the screen until the task is attempted.

When you consider that the rate of assimilation of text can be twice that of audio, the argument for using audio is even less convincing, especially in e-learning with a text-and-graphics tutorial style, as opposed to animated sequences.

Delivery

Before embarking down the audio route, you also have to

know what you can and cannot do with audio delivery. You might encounter resistance in the IT department towards carrying sound as it involves sound cards, plug-ins and even the supply and maintenance of headphones.

Visual and hearing impairment

However, for some audiences, audio may be necessary for successful learning. An obvious example is the blind, for whom text, unless it is Braille, is simply not an option. Recorded audio equivalents can be useful. Other forms of visual impairment might mean accessibility through larger font sizes and screen background colouring, but again, audio is a useful medium. However, even here, accessibility may best be served with good text which is compatible with text-to-speech readers. These can voice text at a rapid rate: the ability of visually impaired learners to cope with amazingly fast delivery of voiced text sometimes astonishes those who have never seen them used. Strange as it may sound,

well written text may well be preferable for this audience.

Audio on its own is obviously not suitable for those with hearing impairments. Remember also that deaf children have huge problems in learning to read and *'only a tiny minority reach the eleven-year-old level when they leave school'* (Wood 2003). However, for this audience, text will be seen as a necessary condition for learning.

Low levels of literacy

This, of course, is a huge problem, not only in educational content but also in the adult workforce. In the US, surveys suggest that roughly 18 million adults have reading ages below nine years. In the UK, the Bullock Report uncovered a literacy disaster story, with at least two million adults unable to read beyond this level. These are worrying statistics and say a lot about how things have gone badly wrong in this area, but the bottom line is that many children and adults may have difficulty in handling text-only e-learning. Audio is a useful adjunct in that understanding

the spoken word is a skill learnt at an early age, and one possessed by an overwhelming majority of the population. Sadly, even in societies where huge amounts of resources are spent on education, this cannot be said of reading.

Dyslexia

Between 5 and 10 per cent of the population may have some form of dyslexia. Although this may be mild in many cases, it is another barrier to learning for those who, through this condition, may find it difficult to learn through text-heavy content.

English as a second language

As globalisation increases, demographics change and people become more mobile, workers often find themselves having to function in an environment where the language they use for both work and learning is not their mother tongue. Indeed, training is often seen by the learner as an opportunity to improve their ability in this other language. For this audience, a mixed media

strategy of both text and audio may be necessary, as learners may have different abilities in terms of comprehension of speech and the written word.

However, one must be very careful with sentence length, vocabulary and grammatical construction with this audience.

So there is no simple answer to the question of whether text and/or audio should be used in e-learning programmes. It depends on the audience. However, given constraints in budget, production skills and need, it would seem that text is still a basic and powerful medium that can be used in many learning contexts. Audio will continue to play an important role, though.

Audio and quality

Research at Stanford by Nass and Reeves has shown that users are more sensitive to the quality of audio than they are to that of video. This may sound surprising, but people are quite unforgiving when it comes to tinny audio with variable sound levels. Learners expect

consistently high quality at a consistent volume. Philips, the electronics manufacturer, also found that people perceived video picture quality to be better when higher quality sound accompanied the video.

Audio quality, unlike video, seems to affect the user's attention, memory and opinion about what is heard. Audio fidelity is therefore much more important than video fidelity, it would seem. They conclude that *'...for designers of multimedia, audio is a good place to invest. It appears to deliver more psychological bang for the buck.'*

Audio as used in e-learning

Audio is powerful. Radio continues to be a popular medium, driven by music, talk and - in the UK at least - a strong tradition of cultural and learning content delivered over the airwaves. In the UK, television had its roots in radio, and the Reithian public service ethos lives on in entities such as Radio 4 and the World Service. The web is also boosting the power of audio as bandwidth expands. Some would argue that the web has led to a radical reshaping of the music industry through download sites. So how can audio be used in e-learning?

Audio, like other media, does several things in e-learning. These include narration, voice lip-synched to animation or video, sound effects and music. In learning, unlike entertainment, narration is by far the most important of these functions.

Narration

The problem with extensive audio narration in e-learning is

that it sounds like written text. That's because it is written text. The writer sometimes had no idea that it was going to be voiced, so it comes out a little like someone reading a report. Designers must know that they are writing for voiced narration at the start.

The great mistake is to allow narration to be written as the written and not the spoken word. In general, literary terms need to be excluded and sentences kept short. There's always a tendency to overscript narrative. Scripts need to be read aloud to see if they make sense to the ear and whether their sentences can be read without great inhalations by the voiceover artist.

Professional narration, then, needs a good voiceover artist, who can deliver the correct intonation at the right pace. This is an art. Good voiceover artists are in demand for their voices and their ability to do this quickly in the studio. They can also correct weak scripts if the script is sent to them early.

For some applications, certain voices might carry the wrong sort of 'baggage'. A badly cast voice is worse than no voice at all. Also, multiple voices can over-complicate an interface.

Spoken word

Language courses usually have to get pronunciation across. They can even involve the recording of the learner's voice in the course, for comparison with a native speaker - and even for acoustic analysis.

Where skills involve the comprehension of the spoken word, such as with call centre training or public speaking, spoken word audio might well be a component of the learning.

Learning can also benefit in effectiveness from the voices of experts - such as academics, consultants or even senior members of management. It has been shown that learners actually learn more if they feel that the learning is being delivered by someone whose expertise and authority they respect.

Feedback

Another strong feature of the narrative flow of programmes is feedback in the form of formative or summative assessment. Audio feedback can be quite powerful, psychologically. It can be used to reinforce positive feedback, even when there is no core narration in the presentation material.

Be careful when presenting negative experiences, however. Negative events grab attention and wake up the processing system. In fact, experiences that come after negative events are better remembered, so put a negative event first, or up front in a programme, to wake learners up.

Sound effects

Sound effects have reached astonishing levels of sophistication in computer games, where they form an integral part of the whole experience, especially feedback.

In general they have the role of enhancing visuals. In a study at the University of Toronto two groups

were shown a car crash, one with the real sound of the crash, the other with specially created 'slam' sound effects: 90% of the latter group thought that the oncoming car was speeding as opposed to 20% of the first group.

This is fine in games and entertainment, but one major word of warning. Sound effects, such as beeps accompanying input, were found to drive learners mad and have now disappeared from e-learning. Similarly with positive sounds for getting things right, and negative sounds for wrong answers.

Moreno and Mayer (2000) compared an instructive, narrated animation on hydraulics, with and without environmental sound effects. Those who saw the version without sound effects scored higher than those who heard the sound version. When background music was added the results for that group were even worse.

There are, of course, acceptable contexts for sound effects, such as quizzes, specially designed games, and educational programmes for children.

The actual sounds of animals, machines and heart murmurs are sometimes a necessary part of the learning experience. In other words, they need to be heard in order to learn.

Music

In the early days of computer-based learning, especially with interactive video in the 1980s, title sequences in learning programmes often contained music, as the model was video and television. With web based e-learning, websites became the model and these music-driven title sequences became rare, as home pages are generally required to be informative rather than impressionistic.

Music's primary function is mood. It can set the emotional tone for a programme or piece within a programme. Fun tunes in early educational programmes can stimulate young learners. Music may be fine as a method of arousal at the start of an e-learning programme, but background music is counterproductive. Research points towards NOT having background music in e-

learning programmes as it results in sensory overload, reducing the effectiveness of the learning. Matt Lobel (2008) highlights how taste in music is subjective and can be intrusive to the learning experience.

Moreno and Mayer (2003) put this to the test with an instructive, narrated animation on hydraulics. The animation was shown with and without background music. Those who saw the version without music scored 20-67% higher than those who heard the music version.

Recommendations for use of audio

Audio can be a necessary component in learning when sounds themselves are the object of the learning e.g. recognising and analysing stethoscope sounds, taking inbound calls in a call centre, listening to music or submarine sonar.

However, audio is more often considered when the audience is seen as needing a supplement or alternative to text, due to visual impairment, low levels of literacy, dyslexia or English being a second

language – or simply where the target audience is not receptive to text.

On the issue of using text and audio together it is better to use narrated audio for animated sequences, but text only for sequences under the user's control. If you do use both, give the user the choice of switching the audio off.

Narration and feedback are the two commonest uses of audio in e-learning. Audio here adds the human touch, and can be used to reinforce correct answers, keeping negative feedback as text.

Music and sound effects may be suitable in educational material for children, and sound effects can be useful in entertainment styles of presentation such as quizzes or games. Otherwise, avoid background music and effects and sounds that accompany right or wrong feedback.

Audio also demands high quality. It is unacceptable to produce cheap, tinny audio at variable volume. This needs good process and reasonable production values. It can also be expensive to update and localise.

Table 2: Use of audio - pros and cons.

Pros	Cons
Audio has several advantages in terms of learning and learners:	Audio has several disadvantages in terms of learning and learners:
<ul style="list-style-type: none"> • Most learners can hear (many have problems reading) 	<ul style="list-style-type: none"> • Learners do not listen at their own pace
<ul style="list-style-type: none"> • Good for learners with visual impairments 	<ul style="list-style-type: none"> • Needs good skills and tools to produce
<ul style="list-style-type: none"> • Good for learners with low levels of literacy / dyslexia 	<ul style="list-style-type: none"> • Can be moderately expensive
<ul style="list-style-type: none"> • Good for learners with English as a second language 	<ul style="list-style-type: none"> • Requires specific plug-ins
<ul style="list-style-type: none"> • Learning may require sound 	<ul style="list-style-type: none"> • Difficult and moderately expensive to update
	<ul style="list-style-type: none"> • Language versioning difficult and expensive

Graphics

Reasons for using graphics in e-learning

Photographs, graphics, charts and diagrams are undoubtedly useful in learning, often adding meaning through the strength of the image. E-learning therefore gives us the opportunity to use a wealth of relevant imagery in learning. Imagery also appeals to learners who find large amounts of text indigestible, as it lightens the learning load.

To a degree, with a flood of photographs and images from posters, newspapers and magazines, we live in an age where seeing, not reading, is believing. But one has to be careful. It's said that a picture speaks a thousand words, but photographs, graphs and diagrams must speak the right words. If images are merely decorative, oversimplistic or overcomplicated they can be counterproductive in learning. More attention needs to be paid to conveying meaning and

understanding through graphics in learning. Images should not speak a thousand words, they should speak only as many words as the learner needs.

Branded art direction can set the tone and context for the learning. This, along with navigational graphics and icons, will be seen on nearly every screen and have a high impact on the user's perception of the programme. It must therefore be handled with care.

In terms of presentation, photographic images can bring a range of real people into the learning experience, flowcharts can clarify complex processes, graphs can illustrate complex data and diagrams can show processes and hidden views. Cartoons can simplify and be fun.

The web is full of exciting imagery and leading-edge graphics, but we must take a measured approach to the use of these resources in e-learning.

Text and graphics

Combining text and graphics is common in e-learning as relevant graphics are perceived to add extra dimensions to e-learning. This is one advantage e-learning has over the classroom, where images are not as common and knowledge is imparted largely through speech and text.

There is evidence that the integration of text and graphics improves learning, compared to the use of text alone (Moreno 2007). Richard Mayer's research (1989-2001) in ten separate studies compared text-only content with text-and-graphics/animation. There was an improvement of between 55 and 121% in those who learnt from the mixed media approach. A mean gain of 89% was produced across all ten studies.

This should come as no surprise in abstract learning like mathematics where children need to ground abstract concepts in real examples and images (Wood 1998). Many children fail to grasp basic maths as too little time is spent bridging between concrete examples and

images and mathematical symbol systems.

Don't decorate

Decorative graphics do little to help learning and may actually distract. Graphics must be relevant, not merely illustrative. The danger is to fall into the trap of what is sometimes called the 'Lord Privy Seal' syndrome, where the phrase is illustrated by an image of a Lord, followed by one of a WC, then one of a grey seal! Graphics need to do more than mirror the text, matching images to nouns. Graphics need to enlighten and expand understanding. Lazy scripting, where the writer simply adds vaguely related graphics as an afterthought, results in dull page-turning. In learning, graphics need to contribute to the learning, not simply hang around as decoration.

Relate text to graphics

Moreno (2007), Mayer, Steinhoff Bower (1995) and Moreno and Mayer (1999), in five separate studies, compared graphics with text close to the graphics, and graphics with text below the graphics, at the foot of the

screen. In all five studies, the co-located text and graphics resulted in improved problem-solving of between 43-89%.

Integrated text and graphics will be fundamental to interface design. For example, icons may need careful graphic design to make them clear and meaningful along with an accompanying word, or words, to clarify this meaning. The icons may also have to be carefully positioned on the screen to match user expectations and clustered according to type. The separation of related text and graphics through scrolling, or placing them on different windows, is also to be avoided.

E-learning has also introduced heavy doses of rollover text which is displaced away from the item over which the cursor rolls. Indeed the incidence of pop-up or rollover text is one of the primary causes of dislocation between text and graphics. Research confirms that this is to be avoided in learning programmes.

Graphics as used in e-learning

Art direction

Branding is often the main driver behind the art direction of an organisation's e-learning programme. Colours, trademarks, font types and sizes - even types of images - may be fixed at the start in brand guidelines. These are often well designed by a professional agency and are worth following (above and beyond what is strictly required) as they are likely to reflect the agreed ethos of the organisation.

On the negative side, however, brand guidelines often contain print-only specifications that are not suitable for the screen. A good benchmark is often the organisation's website, as the issue of branding has often been discussed and agreed in this context.

The art direction will also set the tone for the learning experience. The colours, layout, imagery, font, font sizes, etc. will all form a tonal palette that will speak

volumes about the course. This can vary from a wild, fun-type interface for certain educational programmes for young children to clean, professional, crisp direction for a serious management training programme. Lots of thought needs to go into this as it will appear on every screen.

It is also wise to avoid branding that overwhelms the learning. There must be room on the screen for navigational elements, titles, text, graphics and sometimes video. If your branding template takes up to 30-40% of the screen you'll have real problems in getting the learning content displayed.

Navigation

Many of the problems learners have with e-learning relate not to comprehending the content but to task failures. They find it difficult to do what they intended. They get lost, stuck and frustrated at their inability to navigate the programme.

Good interface design, which is a different skill to graphic design, is essential. You must

be skilled at this task and able to understand how the users will interpret and use your navigational structure and graphic cues.

Icons that represent abstract concepts may need accompanying words. The position and order of icons on the screen is also important. Their design should be sensitive to the fact that we read from left to right and top to bottom. They also need to be clustered according to function.

Ultimately, if your navigational design has not been user tested before, you must try it out on real users. User-centric design will eliminate many of the most common errors.

Photorealism

There are times in learning when 'making it real' is a good thing. In soft skills, transfer of knowledge and skills is helped by images of real people. Managers don't work in cartoon offices with cartoon people. Their problems centre around real people. The same is true of tasks

that involve real places and processes; it's sometimes much easier to relate to an image that accurately reflects the real world than to a graphic representation.

Digital photography has made this approach practical and cost-effective. A photoshoot over a half or full day can often produce images that would have taken days or weeks in graphics. However, it is easy to underestimate how difficult it is to produce really high quality photographs that are well lit and consistent in colour grading. No amount of clean-up work in a graphics package can compensate for poor photography.

Diagrams

Schematic diagrams come into their own with technical subjects dealing with plant, engines and objects. You can do cutaways, highlight, label and generally illustrate not only the appearance of the object but also its insides. Processes may also be represented by such diagrams as mindmaps, flowcharts and process diagrams.

Charts and graphs

Entire books have been written on this one type of graphic representation. At one level charts, histograms, line graphs, pie charts etc. have to be mathematically accurate, and the appropriate chart has to be chosen for the data set. In learning programmes, it is often appropriate to build these graphs up step by step to aid understanding. Accompanying text and audio can help the learner understand the data.

Beyond this, Tuft and others such as Saul Wurman, one of the US's leading information architects, have taken charts and graphs to a new level, using combinations of traditional charts and images. Wurman's books have sold millions of copies, as they are graphics-heavy with little text.

Software screens

When the learning concerns how to use a piece of software, accurate screen shots are needed along with exact replicas of the cursor behaviour; drop down menus and dialogue

boxes. These can be screen-grabbed but graphic fidelity has to be retained.

Cartoons

Cartoons can be appropriate in education and sometimes in training, as they present subjects in a light-hearted and digestible manner.

For the same reason however, they can be totally inappropriate when dealing with sensitive subjects such as life-threatening medical matters or subtle topics such as equal opportunities and diversity. In people issues, especially soft skills, cartoons will lack the realism that learners expect.

Recommendations for use of graphics

Research suggests that text supplemented by graphics significantly improves learning. However, if used improperly, this combination can end up superfluous and counterproductive.

Art direction and navigational graphics are key components in interface design, as they set the tone for the entire learning experience. They are likely to be on the screen for most, if not all of the time and need to be designed with particular care. However, they should not dominate the screen at the expense of the learning.

Graphic style needs to match the type of learner and the type of learning content. Photorealism is recommended for programmes that involve people skills i.e. real people, real processes in real environments, and for subjects of a serious and professional nature.

Diagrams, charts and graphs are powerful methods of displaying concepts, processes, objects and data. They need to be accurate, relevant and designed with care.

Cartoon styles may be suitable for children's programmes but they rarely reflect the professional world of work. 'Foxy the cunning customer' may seem like a good idea, but

is more likely to look simplistic and dated.

Graphics need careful handling. They should be relevant not decorative and be integrated with the appropriate text or sound. Noun-driven graphics that simply accompany text are

to be avoided. Don't decorate.

Graphics and text need to be in close proximity. Avoid rollover text that appears in a window at another place on the screen away from the graphics. Relate relevant text to graphics.

Table 3: Use of graphics - pros and cons.

Pros	Cons
The general advantages of pictorial representation for learning include:	Graphics also have some drawbacks, however:
<ul style="list-style-type: none"> No literacy skills required to interpret 	<ul style="list-style-type: none"> Need complex skills and tools to produce
<ul style="list-style-type: none"> High impact, reducing text load 	<ul style="list-style-type: none"> Can be expensive
<ul style="list-style-type: none"> Majority of learners like the visual appeal of graphics 	<ul style="list-style-type: none"> Can be difficult and expensive to update
<ul style="list-style-type: none"> Graphics set tone in art direction and navigation 	<ul style="list-style-type: none"> Bitmap language versioning difficult and expensive
<ul style="list-style-type: none"> Representation of data / concepts that are tricky in text 	
<ul style="list-style-type: none"> Can relate parts to the whole 	
<ul style="list-style-type: none"> Simplify, highlight and illustrate concepts / Processes 	
<ul style="list-style-type: none"> Cheap image libraries available 	

Animation

Reasons for using animation in e-learning

The ubiquity of Flash has perhaps led to an over-dominance of 'cartoon-like' animation, when simple graphics or video would have been more appropriate. However, Flash or GIF animation can do a magnificent job in explaining moving processes or in unfolding and building an image up to form a whole. It can also provide an engaging flow for learners who need some extra motivation, for example young children, or adults with low levels of literacy and attention.

An engaging flow can turn into a long animated sequence that loses its effectiveness in learning. Working memory can only hold so much information, and animated sequences in learning need to limit the amount of information or steps in a process. For example, if an animated sequence shows a piece of software being used

with an animated cursor; menus dropping down and choices being made it is unlikely that the learner will be able to handle more than six or seven steps at a time. In fact, it may be better to limit the number of steps to three or four.

We have also moved beyond peripheral animated features such as digital clocks, tickers and spinning logos. Jakob Nielsen showed that users hate this stuff, often putting their hands over the offending item in order to read the text. These should be avoided, unless they are an integral part of the learning experience. A clock, unless it is showing elapsed time in a simulation or exercise should not be a permanent feature on the screen. Even worse are animated logos and other moving graphic features. These really do distract learners.

Animations and audio

Mayer (2002), Klein and Koroghlianian (2004) and Fisk (2008), have shown how animations need narrations, and has explored instructive animations in terms of media mix. It would seem that animations benefit from audio narration in a way that is less true for still image graphics and text.

Animation as used in e-learning

Animated processes

Things unfolding across time clearly benefit from animation. Processes such as liquids and gases flowing in hydraulics and pneumatics, or the orbit of the earth around the sun, are good examples of the use of animation to improve upon static graphics. This is useful for both physical and conceptual processes.

Animated graphs

Graphs such as histograms, pie charts and line diagrams can

also benefit from an animated build to show how the different components arise in stages over time, for example, several phases in a sales cycle. However, simple cuts may be just as effective.

Character animation

A more controversial area is animated characters. Cartoon animation, even crudely lip-synched, flat 2D characters, need not be bad (witness *The Simpsons*). However, in e-learning, with limited budgets and different objectives, this can be dangerous. Full character animation can be very expensive and needs a skilled animator. It is best avoided unless you have adequate resources. It is often better (and cheaper) to opt for stills with text/audio or video. This may, in fact, give you more realism.

Lip-synch can also be a problem. This can be achieved with relatively few mouth movements, presented randomly as the character speaks. The brain does an amazing job of reading lip-synch into these random movements, but you still have to

deal with the pauses between sentences. Actual lip-synch is better, but more difficult to achieve.

High quality character animation is notoriously difficult to achieve and best avoided, although there are tools for the creation of animated figures, should you decide to take this route.

Recommendations for use of animations

Animation is an engaging medium, with high appeal to children. It is also a high impact medium in learning for adults and if the content demands images that show processes, flow, builds or movement, it can be a powerful aid to understanding.

However, animation can also be harmful to learning. Avoid long animated sequences as the learner will have difficulty in remembering the entire process. Non-essential animation has also been shown to be counterproductive in learning. In particular avoid spinning logos, icons, tickers and clocks. Studies

by Dawling, Tickle, Stark, Rowe and Godat (2010), support the idea that complex animation does not always yield improved learning outcomes.

Flash has given this medium a huge boost and wonderful things can be achieved in animation using relatively cheap tools. Processes in science and technical training often benefit from animation as do some charts, graphs and diagrams. However, simple cuts may also suffice.

Cartoon animation is obviously of use in children's learning but must be used with care in adult learning, where realism may be a better option. Good character animation is expensive.

It is also clear that animation benefits from audio narration rather than text captioning.

Don't forget that animation can be an expensive medium that requires plug-ins. It also requires specialist tools and skills and is difficult to update and localise. It must therefore be considered with care.

Table 4: Use of animation - pros and cons.

Pros	Cons
Animation is a powerful medium that has several advantages (similar to those of video) in terms of learning:	Animation also has several disadvantages:
No skills required to watch (unlike reading text)	Learners do not view at their own pace
High impact	Animation sometimes seen as superfluous
Many learners (young learners especially) like the visual appeal of animation	Long sequences cannot be remembered
Movement, conceptual or otherwise, can be shown	Peripheral animation can annoy
	Needs complex skills and tools to produce
	Can be expensive
	Requires specific plug-ins
	Difficult and expensive to update
	Language versioning can be difficult and expensive

Video

Reasons for using video in e-learning

Many real things in the real world move – people, machines, natural processes and so on. If the learning benefits from a realistic sequence showing these things move, then video is the ideal medium. It is particularly strong in dealing with people and the subtleties of speech, behaviour, body language and interpersonal skills.

Close-ups, cuts, pans and other camera and editing techniques can also help to illustrate the learning; establishing the context, highlighting detail, cutting from one person to another, and so on. One can also play with time, collapsing real time down into a shortened, edited sequence.

Video is primarily emotive in effect. Its power lies in the presentation of moving images which stimulate the viewer's attitudes. As such it tends to

work best for soft skills such as management training, sales training etc. It is rarely a cost-effective training medium for procedural or technical subjects.

Video can be harmful to learning

In terms of learning, TV, film and video sharing sites are not always the best guide to the use of video. Their aim is to entertain, not teach, and they induce the suspension of disbelief, which can destroy any hope you have of learning and retaining that learning. Swept along in the cognitive flow, you may fail to integrate the new information into your existing knowledge structures. It washes over and through the viewer, inducing emotional and impressionistic responses. This has been confirmed by neurological research which shows that television slows brain activity. Before watching we are in an attentive, conscious, alert state. Within

30 seconds one can measure a change from dominant beta waves to dominant alpha waves, a slower, unfocussed state. Interestingly, this contrasts with reading, where one remains in a beta wave state, allowing us to be more active and to process information analytically.

In fact, non-essential video may actually be harmful to learning. Mayer, Heiser and Lonn (2001) tested this by putting an exciting narrated video scene (storm bending trees with an ambulance arriving for someone who has been injured) in front of an instructive animation explaining how lightning works. Learners who did NOT see the video clip did 30% better than those who did.

In practice, in learning terms, video can certainly aid learning. But it would seem that this is better achieved in short bursts and using specific techniques, rather than the longer sessions we experience on television and in films. In e-learning, video is best used in an episodic manner, complementing other media in the learning experience.

For example, point-of-view (POV) video, with someone looking directly at you from the screen, whether it's a coach, subject expert or interviewee, is often a powerful means of getting learning across. The 'talking head' is something we can also interact with, especially if we are doing the questioning or interviewing.

Video as used in e-learning

Drama

Drama sequences can show either positive or negative behaviour. For example, in assertiveness training one can show combinations of behaviours, to illustrate optimal strategies in assertiveness. Drama can be emotive and powerful in soft skills training such as dealing with customers, selling, interviewing, meeting skills and so on. However, it can be expensive and, if done badly, look rather weak and wooden.

Documentary

Commentary over picture is a powerful documentary technique. This is one of the strongest genres in traditional television, where a finely crafted documentary gets into a subject in depth, presenting different sides to a story and coming to a conclusion. The use of wonderful images and sparse, but well written commentary, may also deliver learning in a highly visual way. In e-learning this technique is more likely to be used to show a specific process or place rather than to create a full documentary.

Talking heads

Interviews can be done in third party perspective, where you the viewer are watching someone else interview the subject. Note how this compares, in learning, to a more direct first person perspective, where you are being spoken to by the subject. These talking heads are what one commonly sees on television programmes that need to impart information through presenters or newsreaders.

Specialists

The respected and authoritative views can not only bring credibility to the programme, they can also increase learning and retention. For this reason many e-learning programmes use a key subject matter expert, or someone with strong practical experience in the area, to anchor the theory and practice. This could be an academic, opinion leader, consultant or senior manager. People like identifiable personalities. The personalities in media should be consistent and strong, mixing personalities weakens the message.

Vox pops

Vox pops (interviews with real people) give realism. Real people give real opinions. For example, in an induction programme you may wish to show the views of some real, ordinary employees to get their views on what it is like to work in the organisation. Vox pops work because viewers can empathise with other people like themselves.

Coaches, tutors or guides

On TV, a presenter often provides structure to a programme. A well known TV presenter, especially, can also add weight to a programme. In learning programmes this is more likely to be someone who supports the learning. This type of talking head, often found in interactive learning programmes, is the coach, tutor or guide. They are a person who helps you through the learning experience, rather than imparting knowledge and skills. They may pop up to give you feedback on your overall progress in terms of what you've done, how well you've done and what you need to do next.

Research by Moreno et al (2003 and 2004) has shown that screen tutors, can improve learning by between 24 and 48%. Atkinson (2007) reported a similar effect when presenting explanations straight or through an on screen agent. Taking this one step further they showed no significant difference between a video and an animated cartoon agent, and

even just a voice - a human voice being superior to a mechanised voice. This stopped at text. Voice was better than just text. What also seems to matter is that the agent sounds conversational.

However, Microsoft's famous paperclip (Clippy) gives us reason enough to be wary of annoying cartoon characters popping up at every turn, even if they can speak!

One last point. Realism does matter and close-up shots are compelling. Indeed, attention and memory are enhanced when pictures are big and close, so use close-ups when using images of presenters, guides, tutors and coaches.

Interactive interviews

Point-of-view (POV) video gives immediacy and is particularly useful for skills transfer as the learner is put in the shoes of the other participant in the dialogue. This dialogue can be taken further if the learner is allowed to pose questions and interact with the video participant on the screen. This is used in

performance simulations, where you the interviewer or sales person actually select questions to ask the person on the screen. A number of video replies are shot and the person on the screen answers in response to your question. These interviews bring an extra dimension of interactivity and learner control to the experience.

In all cases where talking heads and POV video are used, it is strongly recommended that one uses close-ups - in learning, the immediacy of the image is important. This may seem obvious but in this type of dialogue, expression, often in the eyes, is an important component.

Trigger video

Significant improvements in learning can be achieved when video is used as an active, not passive, medium. This active technique can be described as 'trigger' video, where relevant video sequences are used to trigger discussion, reflection and choices.

Trigger video is suitable when the e-learning is used by groups of learners, perhaps

in a facilitated workshop. The facilitator poses a question to the group, designed to stimulate discussion and induce transformative changes in behaviour. This form of active projection, posing the question prior to the video, encourages fresh discussion around a range of options. No matter what conclusion the group comes to, consensus or conflict, the video is then played to reveal best practice.

Watching the video sequence first, followed by a discussion point, is better for reinforcing less contentious behaviour where consensus in the group is more likely. In this case it is the discussion that reinforces best practice after the video, with members of the group contributing their own personal experiences. This is also useful when a specific technique needs to be explained, then shown in video, after which it can be followed by a reinforcing discussion. This technique can be used for truly non-contentious practice.

Be aware that video is not good for the knowledge-based

portion of the workshops. It should not be used to deliver text and general knowledge about process. Video, like television, is a close-up medium which is good at showing people interacting with other people or dynamic processes, not background knowledge.

The facilitator has the role of setting up the session then posing questions, playing video sequences and moderating discussion. They should not spoonfeed the learners but prompt and guide group discussion towards best practice, using good questioning technique and video at the appropriate point. It is important to move the group towards consensus using the evidence to consolidate and underpin best practice.

Quality of video

Even though we live in a world of increasing fidelity in terms of cinema, television and animation in computer games, it is interesting to ask whether money and time spent on high quality video images in learning are worth it.

Reeves and Nass thought that because peripheral vision is largely ill-defined and we are used to dealing perceptually with low visual fidelity in twilight, fog and so on, we are likely to cope well with low fidelity visual images.

They tested their hypothesis by measuring attention, memory and evaluation of the experience when viewing video. Interestingly, they could detect no difference between those who viewed low as opposed to high fidelity images.

Taking their experiments further they also discovered that the size and shape of the screen (and therefore image) mattered more than quality. Large screens and images were preferable to higher quality images and horizontal screens and images were preferred over higher quality. In other words, larger widescreen format monitors have more impact than quality of image.

Other evidence of our tolerance for low fidelity video comes in our acceptance of black and white movies. We quickly forget that chrominance is missing as

our perceptual system depends primarily on luminance.

Don't use video as wallpaper - use it for things that move. And don't be too ambitious when scripting video. Typically, it costs about £1000 per minute for broadcast quality video, and often more, so use it sparingly.

Recommendations for use of video in e-learning

Video is a powerful, high impact medium in learning and if the content demands images that show real things moving in real environments, it can be the medium of choice.

However, video can be harmful to learning. Video that is too long will induce suspension of disbelief. This state of 'suspension' also suspends learning. Avoid overlong scenes and sequences - video is best used in short bursts.

Non-essential video has been shown to be counterproductive in learning. It should not be used merely to raise interest.

Drama, although very expensive, can show interpersonal behaviour

and skills, useful in management training. Documentary is similarly expensive but is more likely to be used to show real people, places, processes and objects.

Talking heads are cheaper to produce and provide more bang per buck in e-learning. Presenters, specialists, consultants, opinion leaders, senior managers, vox pops of ordinary people.

On-screen video coaches, on-screen tutors and on-screen guides can all be shown as point-of-view video, talking straight out of the screen to the learner. These have been shown to increase learning but the research also shows that they need not use video. Simpler; photograph and text, photograph and audio and even audio on its own can suffice. What does matter is their conversational style.

This can be taken one step further in interactive interviews and performance simulations where the learner can actually interact with the on screen character; face-to-face.

Trigger video is appropriate for re-use in blended learning within the classroom.

On quality it would seem that learners gain as much from low as high quality video. Picture quality is not of prime importance in learning (this does not apply to audio). What does matter is image size and the use of close-ups as opposed to medium and long shots.

Video is an expensive, high bandwidth medium that requires specialist skills, equipment and editing. It is also difficult to update and localise. Make sure the effort is worth it. Your budget may better be spent on other media or improvements elsewhere in the programme.

Table 5: Use of video - pros and cons.

Pros	Cons
Video is a high quality medium that has several advantages:	Video is a high bandwidth medium:
<ul style="list-style-type: none"> • No literacy skills required to watch 	<ul style="list-style-type: none"> • Learners do not view at their own pace
<ul style="list-style-type: none"> • High impact 	<ul style="list-style-type: none"> • Induces a non-interactive brain state
<ul style="list-style-type: none"> • Majority of learners like the visual appeal of video 	<ul style="list-style-type: none"> • Needs complex skills and complex tools to produce
<ul style="list-style-type: none"> • Realism in people, places, processes and objects 	<ul style="list-style-type: none"> • Can be expensive
<ul style="list-style-type: none"> • Movement can be well presented 	<ul style="list-style-type: none"> • Language versioning difficult and expensive
<ul style="list-style-type: none"> • Good for attitudinal or impressionistic messages 	<ul style="list-style-type: none"> • Requires specific plug-ins
<ul style="list-style-type: none"> • Good for people skills and soft skills 	<ul style="list-style-type: none"> • Difficult and expensive to update

Future of media in learning

The future is text

Despite all the talk about other media destroying text as a medium it is likely to remain the dominant form of communication in e-learning for many years. It has so many advantages over other media in terms of user control, flexibility, searchability, production and distribution that it is unlikely to be displaced as the number one medium in e-learning for many decades.

What is likely to change is the way in which text is supplemented by rich media. Graphics, audio, animation and video are likely to become important supplements in learning, rather than rivals to text. Note that this does not mean that people are likely to use text as opposed to rich media in other areas such as entertainment, only that in learning, text will remain the dominant medium.

Cheaper production

Advances in the technology that creates sound, photographs and video have led to cheap, mass market products. High quality digital still and video cameras are cheaply available along with editing software. The cost of production has plummeted.

This is not to say that the skills involved are getting cheaper; although some of these skills are being outsourced to cheaper labour markets.

Free and cheap media resources

A good library of free and cheap photographs, graphics and animations can save enormous amounts of time and cost on designing and building e-learning.

There has been an explosion of sites that offer free and low cost text, images, animations and sound. It is now clear that the web, with its ethos of freely

distributed content will allow much more sharing and use of free resources.

User generated and virally distributed media

Just how the text, sound and images are organised may no longer be the sole domain of the e-learning designer. As users become increasingly influential in the creation and ordering of content, chunks of e-learning are likely to be accessed in a way that better suits the learner.

Users may determine their own learning journey, with opportunities to compile their own learning profile, choosing only the most relevant content to engage with, and, in some cases, even the presentation most suited to their learning style. And in this Web 2.0 world (where learning is no longer about one head one computer, but rather about many heads many computers) the user, having digested the e-learning, may comment, discuss, access others' understandings and recommend through

collaborative online communities.

This will undoubtedly make e-learning ever more personalised and virally distributed. And as mobile technology becomes more integrated too, the notion of e-learning being just-enough, just-in-time and just-for-me is likely to become even more of a truism.

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