

DEVELOPING EFFECTIVE ONLINE MATERIALS

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Summary

Very often, upon the initial excitement by the opportunities the technology offers and the possibilities of crafting rich media educational content, teachers ‘forget’ about the pedagogical aspects when developing interactive online materials with HotPotatoes in Moodle.

The presentation explores the effectiveness and the educational value of blending content, visual design and usability when learning and teaching theories are taken into account.

The presenter demonstrates good and bad practices throughout the talk emphasizing the pedagogically informed decisions about structuring content, visual design and usability.

Introduction

Touch-less technology was sci-fi in 2001. In 2009 Opera starts developing widgets. In 2010 Microsoft’s Kinect implements gesture, motion, facial, voice, emotion recognition in XBOX 360. By 2011 it is on the market.

Think about kids growing up with this technology: by the time they start school at the age of 7, they will have had their brains totally rewired. They will have had, for at least 5 years before school, full control of their 3D reality manipulation gadgets.

Schools, including Universities, are slow to adopt radical changes. And it is not a money issue but us, the teachers.

To avoid a situation that drives learners away from education, we need:

- to start thinking about content in more engaging ways
- to implement research findings
- to re-think the roles of students and teachers

Learners (aged 7 – 37) already have difficulties in school:

- Concentration
- Immersion/distraction
- Surfing books
- Staccato reading
- Working on paper
- Checking ‘incoming’
- Copy, Paste, Ctrl+F, Esc, F1 in real life
- Travel problems
- Hard to stop

The aforementioned will not be a problem for the ‘new learner’ by the time he gets into University.

Right now, we’ve got to deal with the learners in transition, using the tools and skills we have at hand in order to catch up with them. Therefore we must consider instructional theories and new research findings.

So I want to talk about pedagogy, about visual design and about usability. **My contention is that presentation of content is as important as content itself.**

I’ll first discuss different teaching and learning theories and how they can inform certain technological decisions; how they can inform decisions about visual design and layout. Then I’ll discuss usability in the light of these pedagogical theories, giving examples from practice.

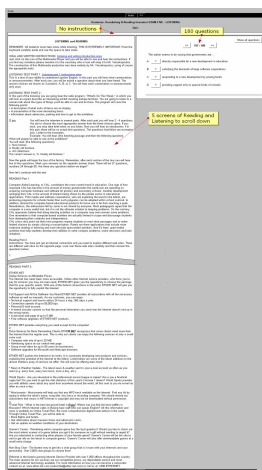
In the light of a few good and bad examples I’ll discuss how these hinder or enhance learning and learner performance.

At a recent conference I attended, most presenters who were touching upon eLearning also mentioned digital natives and digital immigrants, the latter being the teachers. Indeed, today’s generation is saturated with technology; the influx of information, the ease and speed of access from virtually any point in the world has rewired their brains to perceive the world, and learning in that respect, in a different way. Many teachers adopting the

technology embark on creating rich media educational content. However, given the possibilities technology offers, they ‘forget’ about the learners. Turning our eyes to research and pedagogical theories will help us offer better and more effective learning support.

The first thing to consider is the cognitive abilities of these learners to make sense of online content. Their online behaviour and habits will provide an insight into how they are used to approaching learning.

The capacity of the brain to process information has been defined in G. Miller’s *Information Processing Theory* postulating that the short term memory can hold 7 ± 2 or between five and nine chunks of information. Consider this example:



180 quiz questions, including vocabulary, 3 reading and 2 listening pieces on a single page that scrolls down 5 screens for 15-year-olds.

The fact that we could include a wealth of information does not mean that we should do so! The information should be divided in meaningful chunks so that we enhance its processing by the short term memory, as the theory and practice suggest.

Another negative feature is the text-based approach to the learning – there are no pictorial clues whatsoever despite the fact that “we are talking multimedia here”. R. Mayer (1998) in his *Cognitive Theory of Multimedia Learning*, drawing from the work of Paivio (1986), postulates that “providing coherent verbal, pictorial information, guiding the learners to select relevant words and images, reduces the load for a single processing channel”. What can be entailed from this theory and from Paivio’s *Dual Coding Theory* is that auditory and visual perception should complement each other to enhance learning.

Still another deterrent in the above example is the cognitive load, as postulated in J. Sweller’s *Cognitive Load Theory of Multimedia Learning* (1988). Every kind of knowledge has its intrinsic difficulty (e.g. the sum $2+2$ has its intrinsic difficulty). It also has its *extrinsic* difficulty determined by the way we try to teach that knowledge, by the

way we represent that knowledge; and its *germane* difficulty, which is the recommended difficulty; it reflects the effort needed to construct a cognitive scheme for this knowledge.

Extrinsic cognitive load is the result of bad instructional design. Our bad or complex layout and visual design (e.g. too many integrated sources of information to attend the attention to and too many tasks to perform at once) can increase extrinsic cognitive load. ([Link to example](#)) Hence learners will split their attention; they will attend to performing the tasks rather than learning which will result in ineffectiveness of the elearning material and the elearning as a whole. On the other hand, chunking the information to present it appropriately, enhancing the germane difficulty and providing multiple variants of the same knowledge will result in reducing the cognitive load, freeing memory to process the information, thus resulting in better and more effective learning.

We as teachers can structure the content in such a way that the input we provide can turn into intake. Several researchers have offered insights into this. Professor Merrill's Component Display Theory is a mental-model consisting of two major components: knowledge structures (schema) and processes for using this knowledge (mental operations). A major concern of instructional design is the representation and organization of subject matter content to facilitate learning. He claims that the careful analysis of subject matter content (knowledge) can facilitate both the external representation of knowledge for purposes of instruction (knowledge objects) and the internal representation and use of knowledge by learners (mental-models). If a student is **taught a concise knowledge representation for different kinds of instructional outcomes, the student can use this representation as a meta-mental-model to facilitate their acquisition** of specific mental-models.

While instructional designers tend to focus on delivery systems (especially technology) and to a lesser extent on instructional strategies and tactics, Merrill claims that the greatest impact on learning results from the representation and organization of the knowledge to be learned. Merrill's Elaboration Principle was further developed by his doctoral student C. Reigeluth (1999) into Elaboration Theory which helps users "select and sequence content in a way that will optimize the attainment of learning goals". Regarding scope and sequence of instructional content, the theory is composed primarily of two parts, epitomizing and elaborating. *Epitomizing* means finding **the simplest version of the task**

that is to be taught that is still representative of the entire task. ([Link to example](#))

Elaborating means **teaching students increasingly complex versions of the task.** ([Links to examples](#)) The idea of incrementing the difficulty of instruction has been discussed in other ways, such as Bruner's (1960) "spiral curriculum," Ausubel's (1968) "progressive differentiation," and Burton, et al.'s (1984) "increasingly complex microworlds." Reigeluth (1999) described epitomizing and elaborating as follows.

Epitomizing utilizes

1. a whole version of the task rather than a simpler component skill;
2. a simple version of the task;
3. a real-world version of the task (usually); and
4. a fairly representative (typical or common) version of the task.

Elaborations should be

1. another whole version of the task;
2. a slightly more complex version of the task;
3. equally authentic (or more so); and
4. equally or slightly less representative (typical or common) of the whole task.

The level of processing of information is at the core of the research Craik and Lockhart (1972). They found that retention is easier when the level of processing has been performed at deeper levels, rather than the time spent on a task.

The last consideration in my Cognitivism review is Vessey's *Cognitive Fit Theory* (1991), which studied the relationship between the task and the task format. The research findings were that the choice of a suitable task representation leads to the activation and use of similar cognitive processes, hence eliminating the need for transformation of the cognitive schemes to infer information from the task representation. Therefore, solving a problem is more or less effective depending on the representation of the information in the task.

What all the above leads to say is that we, as instructional designers using HotPotatoes and QuizPort in Moodle, should consider the pedagogical theories to structure content; to design the layout in a way that does not make the learner struggle with the design, does not hinder the learner's understanding the task, nor flooding him/her with tons of information to process.

Moodle has been developed with the **Social Constructivist** understanding of the learning process (Bandura, Piaget, Vigotski, Bruner, Dewey). We shouldn't forget that the learners form **communities of practice** and that all learning takes place in a specific learning **situation/environment**. We should create materials and provide learning opportunities in an engaging way; for only one is actively engaged and involved, he could learn (Lave, 1990).

At the same time, the new learner – the digital native – is used to making sense of and learning in ill-structured domains (the multiple representations of the same information and different thematic perspectives on the information - **Cognitive flexibility**, Spiro).

In the new way of learning in a complex and complicated (technological) world we should adopt Papert's **Social Constructionist** approach and abandon the old Instructionist view. The learner has the skills of 'navigating' the technological world and is better at making sense and making better use of this world. We teachers should cooperate with the students to create for them the opportunities for learning purposefully, to provide the environment for them to create and share knowledge in a meaningful way.

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Appendix: PowerPoint Presentation slides: Developing_effective_online_materials.pps

Talk given at the 1st International HotPot MiniMoodle Moot Conference, Paris, France, 23 August, 2011