Multimedia Software for eLearning: An Old Topic Seen in a New Light

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Abstract

Based on a short revision of the history of eLearning, an overview of current and upcoming concepts is given. The eLearning categories introduced are used as a guideline to derive major challenges with respect to multimedia (eLearning) software engineering, and may be used to devise a strategy for the introduction of sustainable eLearning in organizations.

1. History and its remnants

The roots of eLearning go back at least to the mid 1960es i.e. four decades. In a simplified summary, each era was marked by hopes and deceptions as follows.

The first decade (about 65-75) was marked by behavioristic approaches i.e. sequences of content presentation followed by tests and, correspondingly, re-iteration or continuation in the presentation flow. Limits of early host computers with simple monitors contributed to the disappointing results of this *dictatorship era*. Nevertheless, late multimedia-augmented remnants of this era like CBTs and WBTs – coined as **eTutorials** below – represent the only commercially successful eLearning category today.

The second decade (~75-85) brought a vast amount of model-based learning systems such as intelligent tutoring systems, role games and simulations, Microworlds and plan-based programming or help systems, summarized as **eWorlds** below. Poor reusability and cost benefit ratio prevented commercial success. Overstated promises, nourished by the AI and cognitivist communities (in the computer science and didactics/pedagogy camps, respectively), accelerated the rise and fall of hope for models that would suit the 'brains' of all learners including all possible misconceptions – due this 'one suits all' attitude, the second decade can be coined as *communism era*. eWorlds concepts were advanced since, but the key problems mentioned remain unsatisfactory.

Disappointing results with ambitious eWorlds resulted in overly modest pedagogic goals in the third era: instead of being guided, the learners were supposed to explore subject domains on their own. Constructivist research, much improved explicit representation of semantic structures (using the upcoming hypertext concepts) and improved presentation (as multimedia) all contributed to new – again exaggerated – hope for big success. But the era of explorative learning was way too much the *era of anarchy*.

Alas, the current decade (about 1995-2005) can be coined as *New Age* since old recipes are mixed with (once more exaggerated) new promises. The computer science camp jumped on the 'virtual reality (VR)' bandwaggon just in time: serious budget problems in the private and public sector increase the temptation to believe that 'virtual universities' may be created where entire teaching departments can be replicated by means of keystrokes. At least the pedagogy/didactics camp tuned to modest expectations, despite two interesting advancements: firstly, an eLearning concept was shaped which we will call **eProjects:** support for discourse centered and project centered learning styles, applying computer and Internet based tools for project organization, cooperative work, etc. Secondly, adaptive hypertext was improved towards higher reusability and lower development cost for eTutorials and eWorlds; XML is likely to advance this field further.

2. eLearning categories revised

Many taxonomies and classifications for eLearning exist, such as the distinction into local and remote, synchronous and asynchronous, isolated and cooperative learning. The categorization used below (cf. fig. 1) is not just another one, but was developed in order to justify strategies for MSE research and for sustainable eLearning.

Fig. 1 shows a fundamental distinction between computer-based improvements of existing, on-campus teaching/learning styles – called **augmented learning** – and the introduction of remote and possibly asynchronous eLearning which is not possible in classical schools and universities – coined as **distance learning**. A look at the first category reveals that **eLectures** i.e. on-campus concepts like electronic classrooms were omitted in chapter one. Current projects headed by the author concentrate on scaling up up from classroom size to lecture hall size venues (cf. Digital Lecture Halls [4]), and on tight integration of notebook students i.e. learners equipped with mobile terminals of all kinds ('learners-in-the-loop').

Fig. 1 also points at the fact that eTutorials, eWorlds and eProjects can not only be applied in asynchronous and/or remote learning setups, but may be introduced in lectures and other on-campus teaching forms. Together with (multimedia) recordings of eLectures, they contrib-

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ute to a seamless transition between classical (but augmented) on-campus teaching and novel off-campus approaches.

The third fundamental category called **ambient learning** denotes an innovative field of eLearning that becomes possible with the pervasive, disappearing computing appliances considered as computers of the 21st century. Given such appliances, one may automatically retrieve much of the actual context [3] of users at work (or leisure). Based on this work context, not only just-in-time but *just-as-needed* learning (i.e. information provision) may be supported. Novel terminal devices, such as the location aware *talking assistant* for hands-/eyes-free operation developed by the author's team [1], support presentation of and final navigation through the subject matter.

Ambient learning is a key to considerable innovation in manufacturing, services, and office automation. It may penetrate many areas of business and private life, thus the term **eLife**. In order to link this innovation with educational institutions, University labs must be transformed into **eLabs**. There is already a trend to link labs – the point were future work places are experienced in vitro – live to the Internet. Future concepts must go further and model ambient learning as described above.

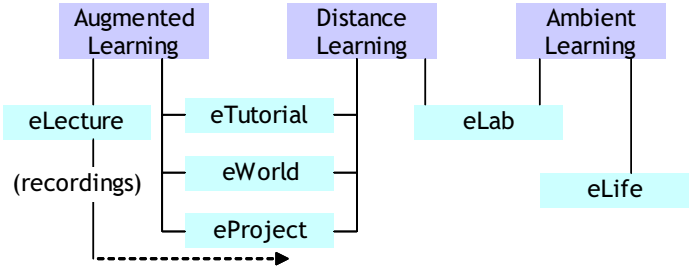

Fig. 1: eLearning categories

3. The Role of MSE

Multimedia Software Engineering (MSE) is the most important *enabling technology* across all three fundamental learning categories introduced, not just for CBT / WBT. MSE research topics around *augmented learning* comprise, e.g.: automated capturing / cutting / representation of multiple-perspective eLecture recordings for optimal telepresence; improved 'slides' (handwritten, software-based, hand-annotated by teachers and learners); replacements of classical multiple sliding blackboards (present in every lecture hall) for augmented learning setups; appropriate augmentation / replacement of standard mobile devices (laptops, PDA, cell phone, …) and seamless integration into local/remote networks; and many more.

As to *distance learning*, MSE has been successfully integrated with authoring tools, mainly for eTutorials (CBT/WBT) and to a certain extent for eWorlds. Further challenges include: reusability way beyond current standardization efforts for learning objects; adaptivity with respect to user preferences, learning context, and device capabilities; affordability and manageability of corresponding multiple-content authoring; multi-tier learning systems comprising well separated, reusable layers for raw media, subject matter semantics, instructional transactions, instructional strategies, etc.

With *ambient learning,* MSE faces challenges that apply to all application domains of MSE on the threshold to the era of ubiquitous computing [2]. E.g., structured delivery of, and navigation through media spaces must be supported for media like audio at least as intuitively as for (hyper-)text today; context-aware multimedia applications must be reflected in software engineering and, in particular, MSE; multimodal interaction, too, must be reflected in MSE, e.g., by introducing an abstract logical interaction layer between application core and physical interaction, and by integrating HCI with all MSE life cycle phases.

4. Strategic Impact and Conclusion

As briefly sketched in the above chapter, the categories from fig. 1 may be used to derive MSE challenges and research issues. They may also serve as a guideline for strategies towards *sustainable, affordable* eLearning. Cornerstones of the latter are: the 'breadth-first' introduction of advanced *augmented learning* concepts, setting low entry thresholds for the mass of teachers and learners (as opposed to the restriction to few enthusiastic project partners in usual eLearning projects); gradual inclusion of eTutorials, eWorlds, and eProjects into augmented learning, for seamless extension to distance learning; focus on reusability and alliances for cost reduction; eLearning as a corporate strategy as opposed to project driven funding.

5. References

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