E-ÖĞRENME İÇERİĞİ ÜRETİMİNİN SANATTAN TEKNİK ALANA DÖNÜŞTÜRÜLMESİNE YÖNELİK BÜTÜNLEŞİK E-ÖĞRENME PROJELERİ SENARYOLAMA DİLİ

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Özet

E-öğrenme içerik üretimi geniş bir spektrumun içine düşen çok sayıda farklı teknoloji ve tasarım çalışmasından oluşmaktadır. Bu nedenle geniş ölçekli e-öğrenme projelerine yönelik içerik üretimi, sürekli değişen teknolojiler, yeni ortamlar, pedagojiler ve metodolojiler üzerinde yapılan geliştirme eylemlerini gerektirmektedir. Bu da bu tür projelerin senaryo inşası, öğretim tasarımı, ortaklar arasında iletişim ve kaynak yönetimi gibi eşgüdüm ve tasarım işlevlerinin hem zor ve muğlak hem de kişilerin birikimine, yeteneğine ve deneyimine dayalı olmasını ortaya çıkarmaktadır. Avrupa Birliği Komisyonu 7. Çerçeve Projeleri tarafından mali desteklenen bir proje dahilinde yapılmakta olan bu çalışmada, öncelikle içerik üretimini ayrıntılı olarak inceledikten sonra, e-öğrenme proje süreçleri dahilinde SLIPEL adında iletişim ve tasarım amaçlarına yönelik olarak ortaya çıkan, programlama dili grameri tarzındaki bir formel dil önerilmektedir.

Anahtar Kelimeler: E-Öğrenme, İçerik, İçerik Üretimi, Proje Yönetimi, Formal Diller

A Scenario Language for Integrated Projects of E-Learning Proposed With A View to Transform the Art of E-Learning Content Generation to a Technical Discipline

Abstract

E-learning content generation is a collection of activities that fall in a wide scope and a variety of technologies and design. As a result, generating content for large scale e-learning projects requires development in constantly changing

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technologies, new environments, pedagogies and methodologies. This makes coordination and design functions of the projects such as scenario building, instructional design, inter-party communication and resources management extremely difficult, inexact and based on individual background, talent and experience. In this study, which is conducted within a European Commission FP7 funded project, we examine the areas of content generation for e-learning and then propose a programming language style formal language, SLIPEL, for communication and design purposes within the project stages.

Key Words: E-Learning, Content, Content Generation, Project Management, Formal Language

1. Introduction

E-learning content generation is production of material for computer-based learning. Constraining this to only a few methodologies, technologies and good practices is a potential problem area both in terms of scope and also in the sense that soon suggested methodologies will be obsolete when newer technologies and tools appear. This is such a fast moving area that a state of the art analyses must include a view for the future and an innovative perspective. In such a dynamic environment where fast changes are taking places and best practices have not been long established, one cannot simply rely on what is in the field, but must foresee and allow for the forthcoming methodologies. Also there are diverse practices and methodologies in e-learning, all of which considered within the same scope, including collaborative communities, massively multiplayer online environments, webinars, simulators or linear narrative style e-learning.

As a result there appears a need for combining e-learning technologies, practices and the content within a seamless learning package. Yet, e-learning content development projects require different types of content generated in different methods, at different stages of a project or even during delivery. Because e-learning is not a science but a study and a practice, let alone having a common collaborative basis for content generation, it is often the case that even through a e-learning

development project, partners, solution providers and affiliates understand completely different concepts of content or delivery when they communicate.

In this study it is argued that a common language in content generation is required within an e-learning project. It is true that during the last decade, initiatives such as ADL or IMS (ADL 2009, IMS 2009) have brought fairly widespread industrial or even international standards, which define the content in detail. However these detailed standardisation initiatives have not introduced a simple communication medium for the various parties of a development project, such as customer organisations, multimedia producers, scenario writers or software developers. As a result, a language suggestion is included in this study to form a basis for e-learning content generation projects.

We therefore first analyse the concept of content with its various categories in the second section. Then we make a concise study of content generation methods and tools in the next one. This is followed in the fourth section by content generation within the context of end-to-end value chain. Finally we argue for a formal language, defined in the formal style of programming languages, which can be used within projects by scenario writers for common understanding and production.

2. E-Learning Content

To understand the e-learning content generation a general look into the term content itself might be necessary. Content, at its most basic definition, is information within computerised media. The term content is sometimes misunderstood because of semantic ambiguity. Allen (2003) includes the different meanings in four types. The information-based meaning entails that content is all the information, such as facts, concepts, and procedures to be learned. A detailed outline, for example, would summarize the components. An objective-based meaning entails that content is a collection of learning objectives specifying behavioural outcomes. Another media-based meaning is more technical in that content is all the text, graphics, videos and other multimedia components of and instructional application. Finally, according to an experience-based meaning content is the sum of all instructional components in a learning application, including the learning objectives, media, interactions and assessment activities.

According to IMS content can be considered either atomic or aggregate. An atomic resource is a stand-alone resource with no dependencies on other content. For example, a JPEG image would be considered an atomic resource. An aggregate

resource, however, is dependent on other content in that it consists not only of its own content but also embeds other pieces of content within itself via a reference or meta-data. For example, an HTML document referencing one or more JPEG images would be considered aggregate.

E-learning content can be structuralised based on four aspects according to Bender (2003): thematic, chronologic, source or chapters. Although they take education purposes into account they also have parallels in industrial training. Thematic division is organizing material according to theme or topic. This format might work well for many courses in the humanities, social sciences, education and health-related fields. Chronological division of structure works well for a course in any discipline that has as its basis a historical emphasis. The alternative structure for a literature course could be to divide according to the books to be read and analyzed. Divided by chapters in a book might be effective for any course that follows the basic structure of a textbook. If the textbook has a many chapters, it might be advantageous to bundle a few chapters together in each lecture.

Another term often used for a specific aggregate content type, learning object or LO, is a part of the learning package that cannot be further divided into parts. Learning objects are digital self-contained and reusable entities with a clear educational purpose with the components of content, learning activities and elements of context. It must have an external structure of information, also known as metadata, to facilitate their identification, storage and retrieval.

2.1. Synchronicity of e-learning content

It is often been the case that e-learning content entails asynchronous e-learning content that has been specifically designed and produced for e-learning usage but there is also the synchronous form. It would therefore be appropriate to make a differentiation according to synchronicity and purpose. Synchronous learning points to simultaneous learners and tutors being in physically different locations such as in audio-visual conferences, online virtual classes or live broadcasts. Example functionalities of synchronous online learning include group work, role playing, virtual office, online lecturing, Web site demonstration or community building. Synchronous online conversations could assist students to work in groups saving them from having to change locations. In synchronous role-playing, students use their group's online synchronous conversation area to stage their virtual play. Synchronous learning is also used in demonstration of a Web site or community

building around a software or project. Another frequent employment of synchronous learning is in the form of virtual office hours.

In asynchronous learning, training materials and learning activities should be prepared and stored before performed. Students decide by themselves when the training materials will be delivered therefore this type is also called on-demand e-learning or self-paced e-learning. The content includes text, sound and voice narrations, simplified graphical presentations, streamed videos, animations, simulations, educational games, assessment systems and interactions supported by feed-back. When we are talking about asynchronous e-learning content we must be careful not to label all types of online resources as e-learning content. Internet makes it possible to access all sorts of information such as online knowledge and online documents but these do not necessarily constitute e-learning content. Browsing through search engine results is not asynchronous e-learning content as content has to be designed in a way that will enable the learner practice, interact and assess knowledge.

2.2. Chronological perspectives on e-learning content

E-learning content can be categorised according to various aspects such as technology, media, subject areas or time of widespread usage. Secker (2004) suggests separate eras in e-learning: Instructor-led Training Era before 1983, Multimedia Era between 1984 and 1993, First Wave E-Learning between 1994 and 1999 and Second Wave E-Learning after 2000. Earlier, up to the turn of the millennium, when the Internet was not widespread enough, e-learning content was mostly delivered in CDs if it is not the traditional broadcast media such as television or the Teletext. Content was often educational films, producing of which is still a widespread method of e-learning, but it is usually not interactive and brings delivery problems.

The e-book has been the simplest of e-learning content and is still widely used in traditional distance education courses, content being an electronic version of printed material, such as PDF, PostScript or the earlier TeX/LaTeX or PowerPoint and its related presentation-only formats or simple hypertext documents. Although converting existing documents to a Web format still falls within e-learning, as opposed to still many academics viewing it as the norm, it is a small subset of possibilities in content.

What we may call traditional or Good Old Fashioned E-Learning (GOFEL) is the interactive linear narration, what most people understand from both synchronous, such as webinars, and asynchronous, such as Flash narrations, Web-based e-learning today. This is in fact a PowerPoint presentation with voice-overs delivered in the more Web-friendly formats. To illuminate the presentation, often little graphics and small animations are included and sometimes questions and interactive tests are supplied to proceed to the next slide. Yet the content is basically linear-flowing PowerPoint style. There are widespread PowerPoint-to-Flash converter tools to assist e-learning material creators. Webinars are the synchronous and more interactive modern form of such content, but the interactivity is open to question and in essence it is still a PowerPoint presentation delivered from distance.

2.3. Simulations and games

The Society for the Advancement of Games and Simulation in Education and Training defines the terms simulation and games as teaching and learning methods in which participants are directly involving in making decisions and learning from outcomes of these. It adds that their active, learner centred nature means that they are memorable and highly motivating, enabling exploration of the complex nature of the real-world and interdisciplinary, interacting subjects as well as the more basic needs of understanding, doing and skill practice. Conrad (2004) adds that simulations create opportunities to build substantial synergy between learning to think in relevant theoretical frameworks and learning to deal with the complexity of actual settings.

Simulations are not limited only to games expanding to include virtual reality applications. In civil or military aviation training (Stewart 2008), where e-learning standards have roots, simulations are widely used. In certain countries motor vehicle driving licences are obtained through simulator training success. The first person shooter games genre, a favourite pastime of contemporary youth, is an offspring of American military training simulation practices. Simulators can also be applied to non real-time professional areas, such as business strategy games widely used in Management Schools. Restricted reality is a half-simulation half-reality training environment where learners use actual software, equipment and functional systems for training purposes but with slight changes, restrictions, crippled power or functionality, or sometimes the actual system with test data. For example a software system can be supplied for training purposes, instead of the actual software, that will

not affect the company processes. Interactive software screen-based training simulation is a soft form where software user interface usage is simulated for a specific function.

Edutainment is a widespread term that is first used for educational games in e-learning industry. There are countless types of interactive computer games used in the service of e-learning. British Education Communications and Technology Agency examines games in categories such as management games, real time, role playing, simulation games or world-building games.

A recent interest in cooperative online gaming and Internet-based gaming communities indicates the potential for using online computer gaming as a method of implementing cooperative learning theories (Lobel 2005). At the opposite end of the games spectrum from the single stand-alone game is the massive multiplayer online game (MMOG). The division between a standard multiplayer game and an MMOG is several orders of magnitude. MMOGs have the capability for thousands of players to play the same instance of a game simultaneously and played exclusively online. Environments like Second Life or Keneva are often described as social communities but they are also viewed as massively multiplayer online role playing games. They are increasingly used for educational and training purposes, some US and UK universities and German government's prestigious Goethe Institute providing education online in fictional locations but with real educational content.

2.3.1. Collaborative content

Online communities are a key factor in the development of the Internet based society and business models. In online communities, users interact with each other, share information and cooperate, forming specialised groups where it is expected that users interact with each other as well as the tutors and work together towards the common goal of learning. From a pedagogic point of view, Piaget's argument that effective communication and discussion was only possible where there is symmetric power between the two sides of communication holds in the online learning communities, where students have similar power to understand and solve problems (Conrad 2004).

The emergence and prominence of the Web communities is thus considered as the new pedagogy of learning (Muske, Goetting & Vukonick 2001). It is therefore imperative that an approach is based on the online learning community principles.

The Web 2.0 concept based on Internet communities encourages significantly more interaction between users, a feature that many theorists argue is vital in e-learning. Interaction encourages deeper and more active learning engagement, builds communities of learning (Wenger 2000) and enables feedback from tutors to students (Fahy 2003). In recent studies, associations have been reported between tutor–student interaction in online learning and raised levels of student motivation (Shea 2003, Levy 2007).

A growing spectrum of applications is enumerated as several emerging technologies and applications under the Web 2.0 platform (Barsky 2006) including wikis, blogs, RSS and the user comment functionality found in various Web sites. Aprt from the webinar discussed above other content forms include instant messaging, or chat, providing real time communication in a text or audiovisual environment, forums on interests and discussion points, wikis, developing collaborative Web pages, and blogs, being increasingly commonplace Web diaries in business environments. Other community actions include whiteboard discussions, voting for issues, uploading multimedia content, commenting on content or other people's actions or evaluating content or other people's actions. All these forms of collaboration result with content generated in decentralised fashion.

3. Generating e-learning content

E-learning content production resembles a film production, where the producer is responsible for the final product, including project team member contracts, legal issues, cash flow and production premises. The product requires understanding from the team leaders, corresponding to film directors, in various seemingly unrelated areas: learning, creative arts, popular culture, script writing, computing, pedagogy, trends, industrial requirements, etc. E-learning material production encompasses so many different elements and ever-changing parameters that, despite efforts in tackling it with an engineering-only perspective, it remains more of an art than a science. It is therefore as important to choose the right team with a right team leader as choosing methodologies, systems or standards.

The production of an online course is regarded as team work where it is crucial to establish a realistic schedule. Boukhliq (2005) suggests should the course need to be written in whole, it is necessary to foresee at least 12 months between the launching of the project and the beginning of the diffusion. Indeed, the writing

process, the correction and the formatting of any printout didactic material is often done at the pace of around one learning unit per month. The professor then develops a budget and identifies allocation requirements and constraints that impact budget, schedule and resource requirements.

At this point it might be of value to insert a comment on the e-learning production cycle. E-learning design is firstly based on pedagogy and then the content matter. But it is often the case that the e-learning designer is not at liberty to choose any material type he or she finds fit. Often the content type, environment and other constraints are imposed on the designer. This means that the designer, during the overall design of the environment, has to take into account the resulting content sometimes even before the pedagogic approaches. Therefore in e-learning, the finalizing of the e-learning content type constitutes the beginning of the content generation, with the employment of the design and pedagogic methodology following them.

It is also important, during the e-learning content generation process, to make sure all available knowledge on the field relevant for the learning content is derived. It is often the case that the knowledge is tacit, implicit or commonsense for the expert. Often the raw content is given in PowerPoint slides from experts and developers are expected to build an e-learning content on it. Knowledge engineering then becomes harder while considerable time and effort may have to be allocated. Many meetings and interviews may have to be conducted as well as review of notes and traditional training material. The results need to be verified and sometimes by more than one expert. Representation languages such as the Universal Modelling Language, or UML, an entity-relationship representation language that is used in knowledge gathering or software design, is not a universal standard or widespread practice in e-learning content generation.

E-Learning scenario writing is an integral area of content generation. The equivalent of film scripts in production must be done for e-learning platforms, and knowledge cannot be given as long texts of instruction, as is in much e-learning content. For example in game based learning the game environment must first be designed, must be modified to offer learning, and different game scenarios and rules can then be embedded, the multimedia and interaction-based scenario creating a cognitively familiar medium (Bates 2004).

3.1. Multimedia content generation

There are different categories of content generation and these categories constantly change according to the technologic advances. Although Horton (2000) suggests categories as multimedia editing, graphics, animation, audio, video, virtual world creation, screen capturing, screen recording, content conversion and software simulation, it can also be categorised as multimedia content, course authoring, simulations and games, collaborative content, content management and course delivery stage.

Howard (2004) argues that it is never enough to simply save text as HTML and assume one has developed an online course. People tire of reading on a computer or television screen and will end up printing it out. If the only objective is to deliver static text, one might as well send a printed manual rather than using expensive telecommunication technologies. A well-planned electronic course design often begins with storyboards to create a computer screen display, good use of colour and clip art or pictures, and perhaps animated graphics to enhance understanding.

3.2. Generating graphics content

Graphical images are the basic and perhaps the most widely used components of e-learning material since the start of the World Wide Web and the possibility to publish graphics easily alongside text. Graphics are used in a variety of functions. Often in traditional linear e-learning material, graphics are used to highlight a point or just to make some cognitively intelligible design next to the material, i.e. if the training material explains that in high temperatures a machine has to be switched off, there may be a burning sun picture next to that. In this kind of auxiliary graphics usage, ready-made graphical images may be sufficient in the development stage. This type of simple conceptual graphics is called clip art and can be provided by various sources. In closed room PowerPoint presentations it is a common trend to use pictures from the Web without permission but in e-learning such action may have legal consequences if the picture copy rights are not tackled.

Making graphics a fundamental part of learning, not only as an auxiliary function, is harder and requires not only graphical design effort but also learning design input. To show the machine parts, for example, not with photographs but with simplified easy to understand graphics requires talent and effort in both areas. Graphical designers are employed in e-learning material creation teams when such

an approach is used. There are a number of software that e-learning graphics are created with, including Canvas, Fireworks, Flash, FreeHand, Illustrator, Photoshop, CorelDraw, PaintShopPro, Bryce, Poser, GIMP, Animation Master, Inkscape, Microsoft Paint, PowerPoint, Visio, AutoCAD, AC3D, Strata 3D or Cool 3D.

3.3. Generating audio content

Voice narratives, background music and special sound effects alongside training concepts or as a result of user interaction are widely used in e-learning content. They are almost always a certain integral part of a whole learning object alongside text, graphics and animations. For using ready-made special sounds there are libraries as in the graphics material and this is also known as clip audio. Special sound effects or simple background music can be derived from various sources including Ultimate Sound Archive, Microsoft Design Gallery Live, Royalty-Free Music, Loops for Acid, Soundeffects Shop, Audacity or the Hollywood Edge. The same legal copyright issues exist with sound as proprietary music cannot be just copied and used as background in commercial or widely circulated products. However, for education and training purposes permissions are more easily granted.

A key issue is to have consistency in sound effects all along the learning object or perhaps the whole package. A wrong answer, for instance, has to be announced with the same or similar sound effect to consolidate the message in the learner's mind and not generate confusion. This issue is important also in other design parts, graphics, fonts, background colours or Web page design.

Sound recording for narrations and voiceovers is more labour intensive. To do that the team needs to ideally hire a professional sound studio with recording tools, one or more voice artists, a sound-proof chamber and a sound editor. As hiring studio time is by the hour, the e-learning material creation team must prepare all written documents in an easily readable way. Increasingly, as technology is more refined, non-professionals take up the voiceovers themselves with the help of high quality microphones and sound capturing software. As a small set of examples we may list Audition, Peak, Multitrack Studio, SONAR, Sonicfire, Acid Pro, Sound Forge and Camtasia, the last also being a widely used authoring software.

3.4. Generating animation content

Animations are moving images and can be as simple as a blinking GIF arrow or as complex as a three dimensional journey in the human body. For simple thematic and generic animations clips are available from Flash Kit or Microsoft Design Gallery

Live as well as many free animation sources over the Web. Preparing custom made interactive animations is increasingly a key issue in e-learning material generation as learners become more demanding in animation capabilities and animation creation is a time-consuming, difficult and creative endeavour. But they are known to be effective in learning if they are well designed to fit the learning process.

To create purpose-built animations, e-learning teams choose outsourcing or in-house specialised teams, depending on the size and output. Whether the process is outsourced or in-house made there needs to be a very close interaction between the learning designers, scenario builders and the animation team. Sometimes they may be sophisticated, expensive, attention grabbing animations but not tackling the learning objectives sufficiently. In-house building animation teams in e-learning often use Flash, Director, Fireworks, 3D Canvas Pro, 3D Studio Max, Bryce, Poser, Animation Master, PowerPoint, Strata 3D Pro, Cool 3D or the GIF Animator.

3.5. Generating video content

There are three types of most widely used video film elements in e-learning content according to a generation point of view. Narrative shootings in studios, classrooms or offices are the oldest known style from the days of Open University while in-practice videos such as showing factories, software teams, fire fighters and open air shots are often more instructive. These do not require a studio but need professional cameras, light, directing and preparation. Finally there are desktop movies on software usage which is entirely on computer screen, which also require planning and directing. Of course, all these three types can be edited and mixed in a single video afterwards. To generate the video after editing the footage widely used software include Premiere, FinalCut, QuickTime, Avid Express, Movie Maker, Pinnacle Studio, Vegas Video, Strata DV, Camtasia and VideoStudio.

Boukhliq (2005) suggests in usage of video using only when appropriate, storing multimedia elements in standard formats, minimizing the size of audio files by compressing them, keeping video files as small as possible by reducing the frames per second or limiting the number of colors and finally including information about file size in links and letting the users determine how long they are willing to wait for the movie to transfer.

3.6. Course authoring

While some of the e-learning content development tools require advanced knowledge of programming, increasingly most of them do not require advanced technical knowledge. The term authoring refers to content generation with a computer based system that allows a general non-specialised group to create content for e-learning. There are certain tools that enable production of learning object elements separately and later integration of them to prepare a complete content for e-learning. The terms e-learning content management and authoring terms are sometimes employed interchangeably in discussing online e-learning content development. The functionality of such software usually consists of creating navigation, creating interaction, integrating prepared elements such as text, animation, sound, etc., creating and using templates, support for reusable learning objects, integrating learning objects and preparing test and assessment tools. Common authoring tools, varying in expert knowledge requirements, include Flash, Authorware, RoboDemo, Captivate, Breeze, DreamWeaver, Quest, Sculptoris, e-Learning in a Box, DazzlerMax, Outstart Trainer, Web Course Builder, Simple Learning Creator, ToolBook Assistant and Instructor, Lectora Publisher, Enlight Adaptive Learning Suite and Articulate.

Some tools are specifically developed to generate software help manuals and interactive help tools. They include RoboHelp, AuthorIT, Doc-To-Help and Flare. With Flash development environment it is possible to build interactive online e-learning courses that run on Flash players, either manually from scratch or by compiling ready to use third party material. Macromedia Breeze, another widely used tool, is a complete development platform composed of three modules: Presentation, Training and Live. It is widely used for turning existing presentation slides into online learning content. There are also the tools to convert for other file types including Canvas, QuickTime, DeBabelizer, Batch Converter and Adobe Acrobat, which is a general purpose file format converter to the widely used PDF format.

Format conversion is widely used for e-books or traditional linear e-learning environments. The most widely used content conversion source format is PowerPoint and to implement conversion to e-learning animations some widely used tools are Breeze, Presenter, Impatica, HotFoot, Producer or PowerConverter. Microsoft Word is also a content source and to convert Word to e-learning Web formats software such as HTML Transit, Filtrix, Logictran RTF Converter, WordConverterExe and WordToWeb are being used. In addition, there is a variety of

commercial tools for multimedia merging, which include PresenterOne, Authorware, Director, Flash, Producer, GRiNS, Toolbook Instructor, LiveStage Pro, Utilities Snapz Pro, CaptureEze Pro, HyperCam and HyperSnap-DX, Camtasia and SnagIt.

3.7. Game, simulation and virtual world generation

Game and simulation development require programming and good planning. The trade-off in e-learning between material creation cost and learning power here exists fundamentally. Developing simulations and games is hard and more professional. They require much more resources compared to traditional linear environments even with ready development platforms including PuzzleMaker, Hot Potatoes, Quandary, WebAuthor, Gameshow Pro or ExamBuddy.com.

Two of the most widely used game and simulation programming environments are VisualStudio .NET from Microsoft and Sun ONE Studio from Sun Microsystems. A general purpose programming language used in 3D game generation is C++, with 3D graphics component OpenGL. Java too is a general purpose programming language. Typical science simulations are developed in Java, but the ease and familiarity of the developer community with HTML and Ajax is a disadvantage leading to decreased employment of Java. Ajax is fundamentally HTML and JavaScript with the addition of HTTP requests at the JavaScript level that enables the client-side browser-based application to communicate with an information centre, such as an application server. Flash has an object-oriented, increasingly effective programming language called ActionScript and together with graphics-based operations forms a rapid development platform as opposed to HTML/JavaScript technologies.

As for specific simulation tools used in e-learning, Captivate and AgentSheets are general purpose simulation development environments. For software simulations there are Captivate, Turbo Demo, Firefly, Virtual Professor, ViewletBuilder, RapidBuilder and ScreenPoint from Enocta, Turkey.

There is a variety of commercial software programs for the creation of three dimensional virtual worlds including Director, 3D Canvas Pro, AutoCAD, TrueSpace, VRML Pad, SiteSculptor, Cosmo Worlds and Dune. One recent method for 3D applications, also used in 2D games, is using special scenarios of the software to develop cases and sharing them with the online community. For example in a world domination strategy game it is possible to develop a game that teaches a certain era and historic event through game playing when a community member uses tools

available to form such scenarios. In 3D this is also exploited producing a separate art form, Machinima, with own festivals and competitions, where entire films are produced using the available design tools provided by game software.

4. Content management and value chain

Content management is the general term for preparing content in a supply chain management fashion, starting from raw data, processed information normalised and rationalised, standardised content, quality control and distribution. In fact all of the activities in the enveloping subsection include content management functions. However here, we can mention content management systems (CMS) for the development and preparation of content. AuthorIT, Microsoft CMS, Manila, UserLand Frontier and OmniUpdateare are only few of the hundreds of CMS software that are being used in generating real time Web systems for general purpose.

The environment where learning is to be conducted is called e-learning environment, and is essential because the virtual closed system will be composed of it during the process. It has to be familiar, easy to use and understandable. The environment can be a separation from reality like a distant planet, or an ancient era, or it may be more realistic like a typical company and competitive environment (Campbell 2004).

4.1. The Web as a publishing environment

The most widespread and default platform for e-learning is the browser. Web browsers Internet Explorer, Firefox, Netscape Navigator, Opera, AOL Browser, Safari, Google Chrome, Lynx, MSN TV browser, Xiino or Amaya offer standardised environment for running e-learning content. Web browsers do not have all the same functionalities and external software such as Flash players may have to be downloaded onto the browser software. For delivery on the Web there has to be a Web Server, with a function of Web content distribution and information reception. IIS, Apache, Lotus Domino, Sun ONE and AOL are established Web servers. For streaming multimedia material, video or audio content, media players are also needed. QuickTime, Windows Media Player, WinAmp and RealPlayer provide media player functions. To publish them, media servers are needed. Some such servers are QuickTime Streaming, VideoCharger, Windows Media Services, Helix, SGI Media Server and Torrent OSA. There are also proprietary format players for formats such

as PDF, SWF, PPT, DOC, etc. such as Acrobat Player, Authorware Player, Flash Player, Shockwave Player, and Microsoft PowerPoint and Word Viewers.

4.2. Learning content management systems (LCMS)

Learning content management systems (LCMS) are specifically designed CMS software for e-learning. They enable storing, managing, delivering and updating learning content. Furthermore they enable developing and building content, learning objects, from different sources and subcontent. Therefore LCMS are also project and production management tools from raw knowledge notes to the complete e-learning material. Such software include CentreLearn, ForceTen LCMS, ePath Learning ASAP, GeMS, OnDemand Knowledge Pathways, Lumenix, On-Demand Learning Suite, LearnCenter, iPerformance, FlexTrain, Evolution, Centra, SmartBuilder, Total LCMS, Techniq LCMS, Olé Online Learning Environment, Vuepoint Content Creator and LCMS, TopClass LCMS, KnowledgeBridge LCMS and Enlight Adaptive Learning Suite.

4.3. Learning management systems (LMS)

Learning Management Systems (LMS) or e-learning management systems (E-LMS) are software that enable, monitor, manage and report the interaction between the learner and the content or learner and the tutor. A standards-compatible LMS can keep track of who has taken which learning object or course, how much they have worked on the content, what marks they scored in assessments and report the results for general assessment of performance. Some of the most important LMS include Open Source Asynchronous LMS, such as Atutor, Dokeos, Moodle and Sakai, Commercial Asynchronous LMS, such as IBM Lotus LMS, Oracle LMS, SABA Learning Suite or SAP Enterprise Learning. We can also count the Virtual School LMS such as BlackBoard and WebCT as well as eCollege, Enhanced Distance Learning Environment, Jenzabar, E-Education, .LRN, Integrated Virtual Learning Environment, Serf, or TopClass. There are also Open Source Synchronous LMS such as Dimdim or OpenMeetings and Commercial Synchronous LMS such as Adobe Connect Professional or Saba Centra.

There is independent software for e-learning assessment apart from the ready functionalities of the LMS. Such additional advanced software available in an e-learning environment are CourseBuilder, Quizmaker, Brainbench, ePath Learning ASSESS, ExamsOnline, Test Generator, Hot Potatoes, RandomTest Generator Pro,

HostedTest, Quiz Rocket, Vue Testing Services, Prometric, Perception, SmartCertify and Unit-Exam.Com.

4.4. Collaborative content generation through communities

Web 2.0 is the general term for online community membership collaboration for generation of content. Although user generated content makes e-learning producer's job easier, Web 2.0 community environment creation is not that easy. It is not only as a result of initial design and production but also through effective management of the community. When the community is grown sufficiently and lively enough, then users communicate with each other, help each other and add content on the system that otherwise would have been added by the e-learning material creator. Wikis, collectively prepared Web sites, are one such function and one of the most renowned examples that were developed as a result of collaboration is Wikipedia.

Another community function is blogging. Blog content is supporting, user generated content for e-learning for learners to share experiences and help each other. Sometimes the instructor can also provide blog content. Apart from ready and free blog services provided by many online services we can count on the following software to set up a local blog environment: DiaryLand, Blog Studio, Multicity, Pitas.com, TongueWag, Blogger, MoveableType, TypePad, Free Open Diary, Manila and Radio UserLand.

Online voting is a commonly used functionality not only to learn users' decisions and positions but also to see instant feed-back and subject comprehension. Poll Pro, The Survey System, Zoomerang, Multicity and PollMonkey are some state of the art software used today for this purpose.

Whiteboards are jointly used, interactive, two or many sided tools for sharing information freely over the net. This functionality can be enabled using GE Sketch Board, Lawrence-Berkeley National Lab White Board and Groupboard.

Collaborative learning aids can also be instantly generated real time through application sharing, joint work remotely on a single computer application. Apart from Breeze, we can also count GoToMeeting, Elluminate, Microsoft Exchange Conferencing Server and WebEx Meeting Center for this type of activity.

Conferencing is a synchronous task that is used in various ways, most importantly in classroom activities, office hours, project based group meetings or Webinars. There are many audio conferencing tools but to name a few we can count

Skype, Skypecasts, vat, MS Exchange and Robust Audio Tool while video conferencing can be set up with Breeze, Elluminate, vic and Exchange.

Chat or instant messaging has the same function as audio conferencing, only with text. Sometimes they are simultaneously used. Some tools that are to be employed in this function are ChatSpace Community Server, DigiChat, Skype, Lucid Chat, Exchange, Multicity, Dbabble, Chat Blazer and VollanoChat.

Online meeting tools are multimedia environments that provide both of the above functionalities plus video and others as well for synchronous meetings like Webinars. The following are established packages that are used by e-learning facilitators: Breeze, FirstClass, MeetingPlace, GoToMeeting, OfficeClip, iLinc, Elluminate, eRoom, Facilitate.com with the same name, Lotus Domino server and Notes, QuickPlace, Sametime, Interwise Connect, iCohere, Exchange Server, LiveMeeting, Microsoft Office Groove, Windows Messenger, GroupWise, Centra Conference, Centra eMeeting, Centra Symposium, Enterprise Forum, Bridgit Data-Conferencing, Groupboard, Web Crossing and WebEx Meeting and Training Centers.

E-Mail-based forums are an important and actually the first ever collaborative online environment in the days of USENET. It is possible to run forums with software such as CoffeeLink News Server, Majordomo, Eve, LISTSERV, Exchange, Multicity, Dbabble, DNews Server, DiscussionApp and Enterprise Forum. Sometimes the learning environment may provide the e-mail service itself for the learners. In such circumstances widely used software are Agent, Exchange Server, MSN Hotmail, Outlook, Thunderbird, Eudora WorldMail Server, MailSite and SquirrelMail.

4.5. Generation value chain

Varlamis (2006) provides a conventional representation of the e-learning process flow. As shown in Figure 1, the process is divided into four major parts: design, production, deployment and assessment. Learning design requires both analysis of the knowledge and the recipient. Then learning production, which is focused on content, how it is produced, assembled and then packaged for delivery. Next is deployment which means teaching by means of e-learning and collaborative activities. Finally come assessment and evaluation.

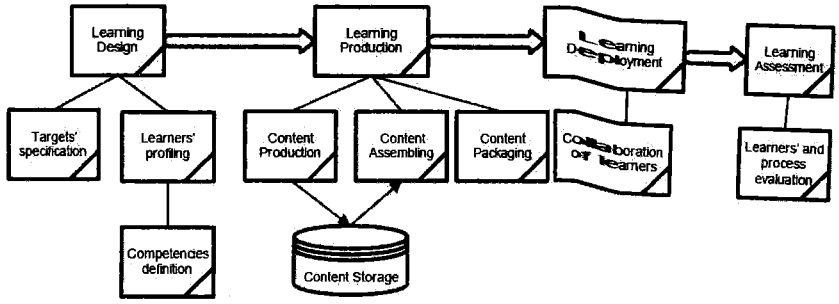

Figure 1: E-learning process flow

Note that in previous discussions, in the above representation or in most other representations of the e-learning activities, there is an implicit industrial engineering metaphor. Like any factory produced goods, row material is collected with an initial industrial production planning. Then according to the plan and product design, production is handled in specialised production centres. Once the product is completed, delivery or the logistics comes as in industrial production. And finally it is the assessment and feed-back from customers. This industrial metaphor is useful in management and organisation but the argument in the start of this section stands as e-learning content generation is a creative activity and cannot be seen as science, not even engineering at this stage.

The most essential part of the production effort is scenario writing, which requires knowledge in diverse areas including technology, communication, pedagogy, as well as understanding of the subject matter as it forms bridges between raw content analysis and more technical production stages. We have to then label the learning content designer as the key function in the process.

The process flow requires flow of content in and out and we have to be able to get raw content in at the right time. The input content, expert knowledge, starting materials are essential for continuous production. If the input content to the production room is not delivered on time the activities come to a halt. Therefore incoming information is one of the bottlenecks of e-learning material production. We have to therefore make sure in any project, continuing to sue the industrial engineering metaphor, that the flow of content development obeys planning time and projected quality.

5. Towards an e-learning content generation project language

Having examined e-learning content generation methods and tools, it has been seen that e-learning content generation is a collection of diverse activities that has been developed depending on advances in technology, pedagogy and experience of the industry and that the bottleneck of e-learning material creation is not the technologic development stage, where experts develop content by a multitude of software or where non-technical professionals can use authoring tools, but more at the instruction design stage. The design stage includes acquiring the expert knowledge in a field, analysing it and rendering it to an analytical and structured format, then developing a scenario for it and a suitable learning environment. The scenario development is especially crucial requiring deep understanding of the different fields of learning and technology, as well as the subject field and demanding creativity.

Yet what is as important is the communicative environment during the e-learning content generation project where instructional designers foresee content types being generated by the development teams in precise sequence, amount and context. In other words, apart from the detailed pedagogy or didactic knowledge included in the learning objects, an overall architectural, simple to understand representation of the content generation requirements that will be used in project planning and human and technological resources planning by developers is needed.

We therefore propose in this section a simple formal grammar that will be proposing a solution in the intra-project communication and planning of e-learning.

5.1. SLIPEL: scenario language for integrated projects of e-learning

We shall propose the grammar for a language for integrated projects of e-learning that are focused on the learning of the usage of software products, which we shall abbreviate as SLIPEL, in the simplified formal language of Computer Science, Backus-Naur Form, as follows:

Content: = <Product>.<Module>:(Element)$^{+}$

Element: = <Technique> | <Technique>.<Detail> |
<Technique>.<Detail>(ExpTime) | Element[–Element] |
Element-Element | [Element]$^{+}$

Here, Content means a set of learning objects for a specific functionality or module.

Element stands for an e-learning application, a technique or a learning object.
Technique denotes one of the selected techniques to be employed in an e-learning project.
Detail means the description of the learning object for reference reasons.
ExpTime is for the expected time that the user is to spend on the learning object and can be measured in minutes.
Of the other grammar elements, **[ ]** means optional, and $^{+}$ means one or many times.

5.2. An example training scenario in SLIPEL

To further explain SLIPEL we shall examine an example to demonstrate the communicative and project planning power of the grammar on an e-learning project to generate content for asynchronous learning of the usage of a software product. We shall choose some of the content types described in previous sections, including Wiki, Blog, Discussion Group or Forum, Content Evaluation, Community Polling, Simple Educational Games or Edutainment, Restricted Reality Simulation, Asynchronous Screen Training (AST), Multiplayer Online Business Game, Linear Narrations usually Flash or Web-based, E-Book, Screen Capturing, Instant Messaging Conference or Chat and Webinar. The content that has to be generated within the example e-learning project section are therefore in abbreviated format AST, E-book, Linear, RRSimul, Capt, Webinar, Edutain, Bizg, Chat, Wiki, Blog, Forum, Eval and Poll.

Let us examine the statement below:

> **SWX.EMailCampaign**: Linear.introMM(20) [-Ebook.MM(30) [-Wiki.MM(15)]]-Capt.MM(15)-AST.MM1(10)-RRSimul.MM1(20)-AST.MM2(10)-RRSimul.MM2(20) [-Forum.GW]

The above statement means that for the E-Mail Campaign functionality of Software X training content is to be composed of an approximately 20 minute-long introductory Linear Narration on Flash, followed by an optional E-Book content that may take half an hour to read but may also be used as a manual and if that is completed followed by an optional Wiki exercise by the learning group, then to be followed by a 15 minute long movie of the E-Mail Campaign functionality demonstration, an interactive Screen Training simulation on Flash to familiarise the learner with the user interface and the actual software, a key Restricted Reality

Simulation exercise, another pair of screen training and Simulation exercise and a finally an optional discussion forum. The expected total time of training for completing the prescribed online training sequence amounts to a minimum of 105 and a maximum of 150 minutes.

If we look deeper into the elements in the example statement, we may understand the possibilities SLIPEL propose for e-learning project communication:

SWX.EMailCampaign is a system analysis exercise, held by the instructional design partner of the project in the SW company headquarters with training specialists within a series of meetings and software analyses that are held on location but later in constant distance communication during development if needed.

Ebook.MM(30) – Existing help material, manuals and documents are studied by system analysts to produce the mail merge functionality manual to be prepared in Word Processor format by the instructional design team.

Linear.introMM(20) – After studying the functionality, the scenario team will develop a proposal for evaluation by SW Company, and the technologic content development partners. After mutual agreement the storyboard for the content will be prepared for development by the chief development partner, which is to produce approximately 20 minute, perhaps 40 slide long Flash-based tutorial with minimal interactivity but with some questions and an ActionScript-based interactive quiz prepared by the scenario team.

Capt.MM(15) – On site demonstration of the functionality will be either videotaped or written down in full detail. A storyboard and a background narration text will be prepared by the instructional designers for development by the development partners to prepare a 15 minute long screen capturing movie using actual SWX software with a narrative voice-over.

AST.MM1(10) and AST.MM2(10) – Storyboards for two separate exercises will be prepared with the graphical backgrounds for consideration of both the SW Company and the developer teams, and finalised for development by the chief developers, which uses existing software described in earlier sections to generate the application software training simulation.

RRSimul.MM1(20) and RRSimul.MM2(20) – A script of usage will be proposed to SW Company experts and an agreement will be reached. The expert user, probably again from the training staff of the customer company, will be required to demonstrate two sets of functionalities of mail campaigns by using the simulation environment and product software SWX. The results will be sent for the

consideration of technical teams. If they approve the exercise then the scenario part will be completed with no further development by the instructional design teams.

Wiki.MM(15) – The Wiki exercise will be development of an informative Web page by the training group, each group member producing a certain part. This may be a FAQ or a description of the functionalities. SW Company will approve the proposed script and an answer document will be prepared to evaluate trainee effort by the instructional design or scenario building partner.

Forum.GW – Topics and tree structure for the relevant field will be inserted in the overall online discussion group area with initial e-mail posts mutually agreed by the instructional designers and the customer SW Company.

Packaging – The development partner then is to package the content, if not an LMS functionality such as forums, according to the ADL initiative based industry standards.

As for the generation procedures step by step of the above example, firstly, technologic capacities and possibilities, especially of the key IIL options, will have to be decided. Then an overall pedagogic approach that will involve selection of techniques must be finalised. Based on these, content scenario lists will be proposed to customer SW Company with each line as in the above example

The list of content scenarios will have to be both capturing the needs and requirements of the SW Company and realistic enough for development within budgetary constraints. To make the two key sides converge, a top-down approach will have to be pursued during on-site system analysis meetings. However ideally, the content scenarios list must be prepared before visiting the SW Company. For this reason a specialised face-to-face meeting may have to be held between the SW Company representatives and the instructional design partners but also technologic development teams if they wish. Prior to such a meeting a concise explanation can be posted by the designers to the SW Company for their internal consultations.

6. Conclusion

In this study we have analysed e-learning content generation techniques and displayed that content generation is composed of various activities of development while the stress of e-learning material creation is at instruction design stage. The design stage includes turning tacit knowledge to analytical, developing a scenario, which is especially crucial for the content generation project. To cover the gaps in communication, design and planning within the integrated e-learning project, we then

proposed a formal BNF-based language to declare design and development results to all parties involved within the project. Finally we gave a detailed example in an e-learning project situation. Although the example looks imaginary, and intended to be so, it actually is based on an actual situation in the ELEVATE e-learning research project funded by the European Commission Framework 7 Projects Scheme, of which the author is currently the Innovations Manager. This paper is also based on research supported by the same body and within the same project.

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