DESIGNING ELEARNING MODELS
The Agora Framework

José Rangel-García[1] and Jorge Buenabad-Chávez[2]
[1]*Edusistemas, D.F., Mexico City, Mexico*
[2]*Departamento de Computación, CINVESTAV-IPN, D.F., Mexico City, Mexico*

Keywords: eLearning, Modelling, Framework, Software Engineering, eLearning Engineering.

Abstract: This paper introduces the Agora Framework (AF), a modelling tool to help design, evaluate and deploy eLearning models. An eLearning model in AF resembles a business model, and consists of various blocks, each block addressing one main aspect of the eLearning *business*, such as: learners (consumers), eLearning types (products) to be delivered, pedagogical basis for course design, hardware and software resources, among others. We describe how to use AF in designing an eLearning model, and outline the role that AF may play within an eLearning engineering.

1 INTRODUCTION

The benefits of eLearning go without saying. Most potential users and deployers of eLearning are willing to adopt it for academic or training purposes. eLearning is now being deployed in various ways, from simply sharing files in a web server to serious games online, or from a single course to academic programmes with official value. The simplest types of eLearning are obviouly easy to deploy and practically risk-free, but complex types may become a rather difficult and costly project, and even unsuccessful.

Currently, most deployers of relatively complex types of eLearning are large institutions who can afford to take the risk. This is in contrast to the wide adoption, proportionally, of web systems across small, medium and large enterprises and institutions. That is, small and medium institutions, e.g., private schools, have not yet adopted eLearning systems as widely as they have adopted web systems, despite the fact that both kinds of systems can be deployed with free open software and have many aspects in common: web (HTML) pages, multimedia content, hierarchical menus, and on-line content delivery, among others. We realise that not all of eLearning takes place through the Internet and Web technologies, but most of it does nowadays; and we assume this from now on.

The main reason for the less widely adoption of eLearning systems is that they are a relatively new class of web systems. As such, they have *unique* aspects that need to be addressed with new, tailor-made best practices, methods and tools, i.e., an eLearning engineering. The basic principles of an eLearning engineering will be those of software engineering:

- Clearly defined goals and requirements
- Systematic development of the (eLearning) system in phases
- Careful planning of these phases
- Continuous audit of the entire development process

There is a lot of published work that is related to eLearning engineering, but most of this work is addressed to a particular aspect of eLearning. The term *eLearning engineering* is still rarely used, and where used (eLearning Engineering, 2012; Lischka and Karagiannis, 2004; Toval et al., 2011), no comprehensive view of the subject is discussed. A comprehensive view of eLearning engineering is clearly essential for the wide adoption of eLearning; in order for small and medium, and even large, deployers of eLearning to better assess, decide and cope with the issues they will face in adopting eLearning.

New disciplines do not emerge overnight, even in the fast-paced field of ICT. eLearning engineering, as a scientific discipline towards engineering-type development of eLearning systems, will take time to mature. It is likely to develop in a similar way Web Engineering developed. Web engineering (Pressman and Lowe, 2008; G. Kappel and Retschitzegger, 2006)

Rangel-Garcia J. and Buenabad-Chávez J..
DESIGNING ELEARNING MODELS - The Agora Framework.
DOI: 10.5220/0003956902650270
In *Proceedings of the 4th International Conference on Computer Supported Education* (CSEDU-2012), pages 265-270
ISBN: 978-989-8565-06-8

was developed for the purpose of efficiently addressing the particular issues of web systems. It borrows heavily from the long-standing knowledge of software engineering (Bell, 2005). As software engineering, web engineering advocates best practices, methods and tools to develop a feasibility study, requirements engineering, planning, ..., and project management, but tuned for web systems development. For instance, central to web systems is the display of information (textual and/or multimeda), and thus web engineering includes methods and tools to organise, display and update the information. In particular, Pressman and Lowe (Pressman and Lowe, 2008) advocate the use of *agile methods* for web systems development; characteristics of agile methods include: incremental delivery of software functionality, customer involvement throughout the development process, and embracing change.

From our experience in developing eLearning systems, we suggest that the main stumbling block to adopt them is the great difficulty to specify "clearly defined goals and requirements". One factor for this is the many concepts and issues involved. eLearning systems are a combination of education, computing, text and multimedia content, technology, software development, and platforms. The development of eLearning systems should therefore be perceived as a multidisciplinary approach requiring knowledge and expertise from different areas. Another factor is the lack of a method and tools to specify clearly defined goals and requirements.

This paper proposes the Agora Framework (AF) to address the two factors just mentioned. AF is a tool and a method to help generate e-learning models. An eLearning model does not correspond to a high-level design of an eLearning system. Rather, it is similar to a business model (Osterwalder and Pigneur, 2010), comprising the main elements involved in delivering a particular type of eLearning. An eLearning model includes a cost structure, goals, learners (consumers), eLearning types (products) and resources, among others. In defining an eLearning model, stake holders implicitly arrive at "clearly defined goals and requirements".

AF is based on the ideas about business model generation in (Osterwalder and Pigneur, 2010). The rationale behind its design is that content in eLearning systems (i.e., course content) is a product on and by itself, as opposed to only information about a product or service as is the case in other web systems.

Section 2 describes the elements AF. Section 3 describes how AF should be used. Section 4 outlines its role within a tentative eLearning engineering. We conclude in Section 5.

2 THE AGORA FRAMEWORK

The Agora Framework (AF) is a diagram composed of nine blocks/elements/modules, which represent the main components of an eLearning model (business) whose purpose is to deliver (sell) eLearning. The nine blocks are shown in Figure1.

As a diagram, the AF has the purpose of helping to: i) visualise all the elements involved in running an eLearning model; ii) classify possible embodiment options for each element, e.g., a particular type of eLearning to be delivered; and iii) reason about each element and its relationship to other elements, i.e., how different options of one element affect the options of other elements, e.g., how different resource configurations affect cost. We mention below the main issues for each element of AF, about which information must be gathered and analised in order to make informed decisions in designing an elearning model.

Learners Segments

Students are the core (the clients) of an eLearning model. Satisfying their learning needs is the purpose of any eLearning system. To better analyse such needs, it is convenient to classify the students into segments according to some criteria, such as: common needs, per (external) company/institution, basic skills, etc. An eLearning model can define as many segments as needed, but must define them precisely in order to facilitate the analysis of their needs, current level of relevant knowledge, skills, attitudes, prejudices, and skills related to ICT.

As a guiding principle, a group of students should conform a segment if their learning needs require a particular configuration of any of the blocks in the AF, thus giving rise to a particular eLearning model.

Once learners segments are defined, and their needs well understood, the eLearning model can be designed considering those needs.

e-Learning Types

We define an eLearning type as a particular organisation/configuration of all Agora elements *selected to fulfill the learning objectives* of a particular learners segment. An eLearning type must be designed and developed. It may be innovative, using new methods and technologies; or it may be typical, using known technologies but with new or more features and attributes. The guiding principle during design is that design makes the difference. eLearning may be as

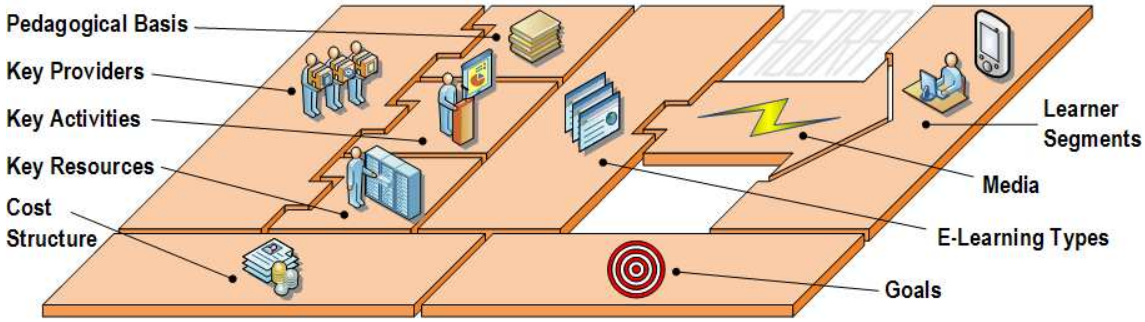

Figure 1: The Agora Framework.

good as the best in-the-classroom (face-to-face) learning, or as bad as the worst in-the-clasroom learning.

A good design of an eLearning type starts with a good instructional design (Dick, 1996; Clark and Mayer, 2008; Horton, 2006). The instructional design advocates selecting, organising and specifying the learning experiences needed to teach something to someone. In addition, the instructional design:

- drives and supports decision making in the selection of content and everything related to learning material and technologies to use, e.g., learning management system (LMS).
- drives the development of content and media selection.
- determines budget decisions.

Media

The media in the classroom used to be only symbols in the blackboard and the voice of the teacher. Today we must design the media: the adequate mixture of text, graphs, voice, music, sound effects, animation and video. Then, we must design a sequence of them and synchronise it with the delivery medium, such as Internet, intranet/extranet (LAN/WAN), audio- and video-tape, satellite, interactive TV, CD-ROM, etc.

What media is best? Research comparing different media suggests that it is not the media what brings learning about, but the instructional methods (Clark and Mayer, 2008). That is, if the instructional methods are essentially the same, the media does not matter. However, each media offers unique capabilities to deliver content, and new innovative ways of delivering content should be explored to capitalise on those capabilities (Wigdor and Wixon, 2011).

Designers should also consider technologies with which students are familiar and feel comfortable, such as mobile phones, PDAs, social software, email, etc.

Goals

The *Goals* block contains the goals of the eLearning model, i.e.: what is to be accomplished by the organisation that is developing the eLearning model. Needless to say how important it is to clearly define such goals. A simple way to proceed is as follows:

1. Establish the goal of, what is most important for, the sponsoring organisation. Is it profit, public service, reputation, or ROI?

2. Describe how the project will contribute directly to achieve the goal of the organisation. If you cannot convincinly and honestly describe/argue how the project will contribute to achieve the organisation goal, *abandon* the project; the organisation will not be interested and will not support you. Otherwise you will have resources and support. Pass to next step.

3. Define learning objectives. Describe how students will be changed through the eLearning system to be developed. Learning objectives may have prerequisites, which in turn may become objectives in themselves having prerequisites, and so on. You should identify the basic skills of potential students.

Examples of organisation goals for eLearning models are the following:

- Reducing cost of education in 50% in one year.
- Making a profit of $ 200,000.00 out of selling courses.
- Training and certifying 150 plant operators.
- Increasing material covered in a course in 10%.
- Deploying a platform to administer courses and improve information exchange between teachers and students.

Pedagogical Basis

This block contains the pedagogical principles that should drive the design of learning content, and this has an effect on all the other blocks in the framework.

A good pedagogical design ensures that no inconsistencies exist between the curriculum being taught, the teaching methods used, and the evaluation procedures adopted. One should first clearly define the learning results to achieve; then select the learning activities that will offer students a good opportunity to achieve the learning results; and finally, design the evaluation assignments that will genuinely show that learning results have been achieved.

Key Resources

Every eLearning model requires resources to achieve the eLearning results expected. Resources may be physical, content, human, owned by the organisation, rented, or provided by third parties.

Physical resources: classrooms, technological infrastructure, computers, networks, learning management systems, application software, software tools, etc.

Content resources: text, images, audio, videos, etc. These resources are not easy to develop, and are costly. *They are the product to sell*.

Human resources. In eLearning models, human and content resources are closely related, and both are key factors in one of the most difficult problems to solve: *content production*. Teachers may lack the skills or the tools, or may not know how to use technology with pedagogical principles, to generate effective content.

We describe below how two courses of different complexity are typically developed and the most likely outcome with regard to quality and resource usage.

a) Course of low complexity. A teacher creates and formats herself content: text, figures, questionnaires and assignments. She also assembles the content, e.g., within an LMS.

b) Course of high complexity, requiring more people:

- Teachers contribute knowledge and basic material.
- Tecno-pedagogues design teaching material according to pedagogic and didactic principles and around available technological tools.
- Producers use various applications to create the teaching material: text, images, audio, video, animations, questionnaires, assignments, etc. Then assemble the content within an LMS.

Typically, in case (a) the content produced is of low quality, and the eLearning resources are underused. Also, the content is usually boring to students. The teacher may become overloaded during development. In case (b), eLearning resources are better used, but the cost and time spent is a lot more; many organisations cannot afford the cost.

Using AF, these issues will be brought to light, and in case (a) it will help determine the amount of training required by teachers, and in case (b) to find alternatives to reduce cost.

Key Activities

Key activities are designed to make learning happening. People learn through pondering, investigating, analysing, evaluating, organising, synthesising, discussing, testing, deciding and applying ideas. Learning activities should promote these kind of mental processes. Learning activities can be classified thus:

Absorption. The purpose of this type of activity is to convey knowledge to the student, typically reading text, watching a video or listening a narrative. The student is mentally active but not physically.

Action. In this type of activity the student learns while doing something: playing, answering questions, or following a procedure. The student practises, explores and discovers.

Connection. This type of activity drives students to relate what they are learning to their previous knowledge; it facilitates applying knowledge later when needed.

Key Providers

It is not always possible for an organisation to acquire all the resources or carry out all the activities involved in an eLearning model. Working with third parties, e.g., outsourcing, costs can be substantially reduced.

eLearning service providers offer a range services including: serious games, consultancy, ad hoc course development, hosting of LMS, real-time eLearning solutions, among many others.

Cost Structure

The Cost Structure block will describe the most important costs related to the development and management of the eLearning model. Each block of AF involves a cost, which may be of one of the following kinds:

Fixed Costs: constant costs independently of the level of operation of the eLearning system, i.e., number of students using the system.

Variable Costs:.variable costs on account of the level of operation of the eLearning system.

Economy of Scale: cost advantages derived as the

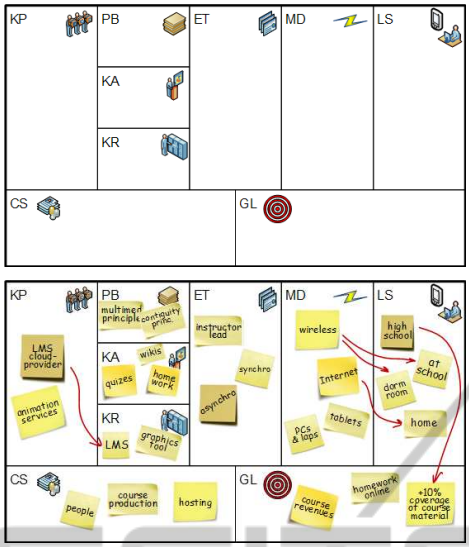

Figure 2: AF before use and in use.

output/use of the eLearning system grows. E.g. hosting larger eLearning systems cost proportionally less than smaller systems.

The cost of an eLearning model should not be more nor less than is required to accomplish the learning objective, i.e.: that the students do what they are expected to do. In practice, the optimum cost is achieved gradually through successive approximations.

However, during the design of the eLearning model, relevant cost information should be collected and analysed so as to have a good estimate from start.

3 USING AGORA FRAMEWORK

As mentioned earlier, AF has the purpose of helping to: i) visualise all the elements involved in running an eLearning model; ii) classify options within each element; and iii) reason about the relationships between elements. Figure 2 shows AF before use and in use. Legends in the figure correspond to: Learner Segments (LS), e-Learning Types (ET), Media (MD), Goals (GL), Pedagogical Basis (PD), Key Resources (KR), Key Activities (KA), Key Providers (KP), and Cost Structure (CS). AF should be drawn on a blackboard or printed large and pinned to a wall.

However, before using AF, the following activities should be made:

- Gather and analise information about each element of AF (LS, ET, ... CS), particularly current solutions, methods and tools, etc.
- Organise various meetings inviting relevant people, e.g., teachers, experts in education, cloud computing solutions, eLearning platforms, etc.

The use of AF consists in discussing, analysing and classifying the information gathered onto each element of AF[1], as shown in Figure 2. These discussing and classifying in itself generates various eLearning models. The best one, under some criteria and constraints, will eventually be chosen.

Note that meetings should carry on until the particular aspects of each element of AF are well defined and understood by the people most closely related. For instance, it should be very clear how teachers will participate in course content generation, and if teachers themselves need training.

It is also worth noting that, if each element of AF is *sufficiently* defined, then the chosen eLearning model would comprise most of the information typically found in a Requirements Engineering document. This information would only need to be organised and extended as required. A Requirements Engineering document tipically consist of: 1. Functional Requirements, 2. Data Requirements 3. Performance Requirements 4. Constraints 5. Guidelines (Bell, 2005).

A feasibility study usually precedes the requirements engineering process in order to establish whether or not the project is worth proceeding. This is typically established through a cost-benefit analysis: "the cost of providing the system vs the money saved or created by using the system – the benefit" (Bell, 2005). Using AF, a feasibility study is implicitly carried out throughout the definition of the eLearning model, as this includes a cost structure (CS).

4 PUTTING IT ALL TOGETHER

In this section we outline an entire process to design and deploy an eLearning model, and where AF fits within this process. We believe something similar to this process will be part of an eLearning engineering. As a reference, we first list the typical phases found (suggested) in a software engineering process (Bell, 2005); web engineering process are similar (Pressman and Lowe, 2008):

Feasibility Study; Requirements Engineering; Planning; User Interface Design; Architectural Design; Detailed Design; Programming; System Integration; Validation and Verification (testing); Production (deployment); Documentation; Maintenance. Project management runs along the entire process after the Planning phase.

[1] *Agora* is a greek word that means forum; by the term *Agora Framework* we mean: a framework to be used (to design eLearning models) in a forum-like way.

An eLearning Engineering: eLearning Model Design and Development

The eLearning model design and development process we propose has five phases: Prepare, Collect, Design, Develop, and Manage. The progression through these phases is rarely lineal. In particular, the Collect and Design phases tend to proceed in parallel. The last phase, Manage, is about continuously managing your deployed eLearning model.

1. **Prepare:** Describe the motivation behind the project. Establish a common language to describe, design and analyze and discuss eLearning models. Select the design team. Prepare the place for discussion.

2. **Collect:** Research the elements for the eLearning model design: learners, technology and environment. Collect information, interview experts, and identify needs and problems.

3. **Design:** Transform the information and ideas from the previous phase into eLearning models using the **Agora Framework**. After an intensive eLearning model inquiry, select the most satisfactory eLearning model. Create the eLearning model requirements document/s.

4. **Develope:** *Plan* for developing and deploying the project; *Develop* the required software; *Get* the needed hardware and software; *Hire* the required services, *Train* teachers and administrators; *Produce* the content for learning; *Perform* the prototype phase (if it was specified); *Deploy* the complete eLearning system.

5. **Manage:** The deployed eLearning model should be placed in a continuous feedback loop so that managers can identify and change the parts of the process that need improvement. A method such as the Deming cycle could be used:

PLAN: Design or revise eLearning process components to improve results.

DO: Implement the plan and measure its performance.

CHECK: Assess the measurements and report the results to decision makers.

ACT: Decide on changes needed to improve the process.

5 CONCLUSIONS

eLearning offers many benefits to users and deployers, but developing eLearning systems is currently difficult and costly (except for simple types of eLearning) because many new issues are involved and it is little understood how to proceed. An eLearning engineering is needed to guide the adoption of eLearning without too much risk. The purpose of the Agora Framework (AF) proposed here is to help achieve "clearly defined goals and requirements" of eLearning models. AF helps to think of and visualise the issues related to an eLearning project, and their relationship. We believe AF will help non-technical people to understand what is involved in an eLearning project. We have outlined its use and how it fits within a whole process of adopting eLearning. We are currently working on designing a methodology to generate requirements documents out of an eLearning Agora model.

REFERENCES

Bell, D. (2005). *Software Engineering for Students*. Prentice Hall, fourth edition.

Clark, R. and Mayer, R. (2008). *e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*. Pfeiffer, San Francisco, 2nd edition.

Dick, W. (1996). The dick and carey model: Will it survive the decade? In *ETR&D, Vol. 44, No. 3, ISSN 1042-1629*, pages 55–63. Association for Educational Communications and Technology (AECT).

eLearning Engineering (2012). Engineering e-learning. In *www.elearning-engineering.com*. Visited on 29 Jan, 2012.

G. Kappel, B. Proll, S. R. and Retschitzegger, W. (2006). *Web Engineering: The Discipline of Systematic Development of Web Applications*. John Wiley & Sons, San Francisco, new edition.

Horton, W. (2006). *e-Learning by Design*. Pfeiffer, San Francisco, new edition.

Lischka, J. and Karagiannis, D. (2004). A generic e-learning engineering framework embracing the semantic web. In *Artificial Intelligence: Methodology, Systems, and Applications, 11th International Conference, AIMSA 2004, Varna, Bulgaria, September 2-4, 2004, Proceedings*, pages 341–350. Springer.

Osterwalder, A. and Pigneur, Y. (2010). *Business Model Generation*. John Wiley & Sons, New Jersey, new edition.

Pressman, R. and Lowe, D. (2008). *Web Engineering: A Practitioner's Approach*. McGraw-Hill Higher Education, USA, new edition.

Toval, A., Toval, R., de Gea, J. M. C., Nicolass, J., and Fernandez-Aleman, J. L. (2011). Learning systems development using reusable standard-based requirements catalogs. In *2011 IEEE Global Engineering Education Conference (EDUCON): Learning Environments and Ecosystems in Engineering Education*, pages 907–912. IEEE.

Wigdor, D. and Wixon, D. (2011). *Brave NUI World: Designing Natural User Interfaces for Touch and Gesture*. Morgan Kaufmann.