Preface

TEACHING, LEARNING AND RELEARNING WITH TECHNOLOGY IN ARCHAEOLOGY

One of the most obvious events of the last decade has been the explosion of the World Wide Web and its effect on learning with multimedia. In parallel, this decade has witnessed a fundamental shift on paradigms for learning and instruction that have altered our learning culture and learning styles. Learners are not passive beings, waiting to be taught basic skills by adults; these skills, rather, emerge as a function of adaptation to the real world (either present or past), where they pick up the ability to communicate with peers and solve problems. As such, learners gradually become natural speakers, scientists, writers, and problem solvers, utilising information that is offered via various technological means.

Therefore, within the context of the current technological status-quo, e-learning methodologies and techniques have been developed. E-learning is a very promising way of delivering training and is broadly used in tertiary education. In this introductory chapter, the benefits that e-learning offers over traditional methods of education are concisely presented, and its imperative for archaeology is rationalized. For this reason, special focus is given on the progress of information and communication technology (ICT) in shaping our information society, and on the degree to which e-learning has been incorporated in the citizens' everyday routines.

The rapid growth of ICT over the last few decades has opened up new possibilities for governments and individuals. Governments are increasingly using Wide Area Networks, the Internet, and mobile computing in their daily interactions with citizens and businesses. E-government applications are improving interactions with businesses by centralizing information sources into topical gateways, using Web-based expert tools to help businesses access rules and regulations, and developing applications to allow electronic tax filings. For citizens, they are attempting to make transactions, such as renewing licenses and certifications, paying taxes, and applying for benefits, less time consuming and easier to carry out.

Apart from government services, ICT has been also utilized in other sectors such as health, commerce, and of course, education. The increased use of ICT has actually been the motivation force for e-learning. By its name, e-learning can be understood as any type of learning delivered electronically. Clark and Mayer (2002) define e-learning as training delivered on a computer (including CD-ROM, Internet, or Intranet) that is designed to support individual learning or organizational performance goals.

E-learning can be synchronous or asynchronous, depending on the extent to which it is bound by place or time. E-learning is synchronous when two or more events occur at the same time. For example, when attending live training simulating a class or a workshop, e-learning is synchronous, because the event and the learning occur at the same time. In the opposite case, learning is asynchronous, for example when attending an online course and completing events at different times (Codone, 2001).

There are a number of other terms also used to describe this mode of teaching and learning, such as online learning, virtual learning, network, and Web-based learning. They all refer to educational pro-

cesses that utilize ICTs to mediate asynchronous, as well as synchronous learning and teaching activities. However, e-learning comprises a lot more than any of these terms. As the letter "e" in e-learning stands for the word "electronic," e-learning would incorporate all educational activities that are carried out by individuals or groups working online or off-line, and synchronously or asynchronously via networked or standalone computers and other electronic devices (Naidu, 2005).

E-LEARNING AND EFFECTIVE TECHNOLOGY INTEGRATION

E-learning, among others, is a tool for expanding and widening access to tertiary education. A key attribute of ICT is its ability to enable flexible access to information and resources. Flexible access refers to access and use of information and resources at a time, place, and pace that are suitable and convenient to individual learners rather than the teacher or the educational organization. Using ICTs, e-learning allows more people to participate in tertiary education: working students and adults, people living in remote areas, nonmobile students, and even foreign students can now access education. In a few words, e-learning has the ability to provide information to anyone, anytime, anywhere (Roblyer, 2003).

E-learning also promises to improve the quality of tertiary education and the effectiveness of learning. Due to the use of ICTs, e-learning gives easier and almost instant access to data and information in a digital form that allows manipulations that are sometimes not possible otherwise. E-learning can lead to innovative pedagogic methods, and new ways of learning and interacting, because of the easy sharing of these new practices among learners and teachers, as well as by easier comparisons between teaching materials and methods. E-learning can also be seen as a promising way to reduce the cost of tertiary education, which is critical for expanding and widening its access worldwide.

E-learning in its nature is rather autonomous, allowing learners to select the topics they want, control the pace at which they progress, and decide whether to bypass some lesson elements such as examples or practice exercises. The opposite takes place in traditional education, where the learning process is highly dependent on the reactions of the student-instructor relationship. Although more reliable, in turmoil the classic way of studying may lead to abrupt, chaotic and misleading professionally trajectories.

Figure 1. Differences between learning in the 20th and 21st century

Learning in the 20th century (Instructor oriented)	Learning in the 21st century (Student/group oriented)
Lecture	Support for autonomous learning
Autonomous learning and self-study	Group oriented learning
Taking classes / attending lectures	Collaborative study
Information transmission	Strengthening the learning potential
Instructor = hub of information	Instructor has a supportive role
Static content	Dynamic content
Homogeneity of learning sources	Variety of learning sources
Tests and exams	Applications and upgraded task performance

In Figure 1, the differences between learning in the 20th century (instructor-oriented) and learning in the 21st century (student/group-oriented) are presented, as encoded by Chute, Thompson, and Hancock (1999).

Depending on the use of ICTs and the level of reform, learning can be separated in four categories, as shown in Figure 2. Successful e-learning requires both the use of ICT and reform. Therefore, successful e-learning does not imply merely that the tools of the trade have to be used; it also means the Web-based training provider should analyze needs and carefully select the delivery methods (Driscoll, 2002).

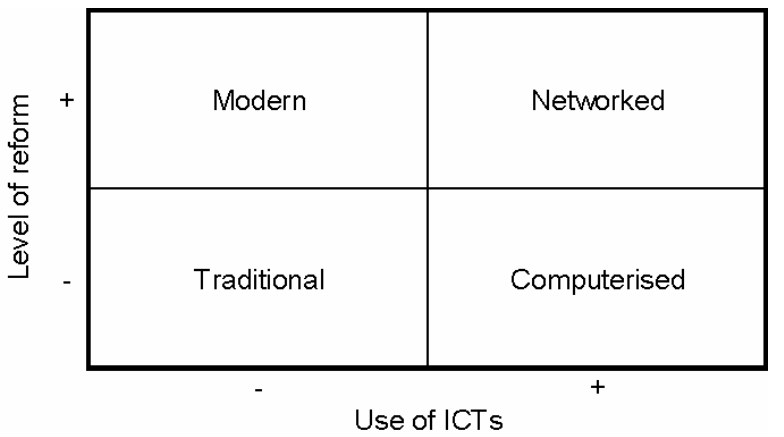
THE RANGE OF E-LEARNING IMPLEMENTATION IN THE KNOWLEDGE SOCIETY

The growing interest for e-learning seems to be coming from several directions. Organizations that have traditionally offered distance education programs see the incorporation of online learning in their repertoire as a logical extension of their distance education activities. The corporate sector, on the other hand, is interested in e-learning as a way of rationalizing the costs of their in-house staff training activities. For instance, multinational companies need to train their employees in new technologies. E-learning is of interest to residential campus-based educational organizations that see e-learning as a way of improving access to their programs. More rigorously, educational institutions see advantages in making their programs accessible via a range of distributed locations, including on campus, home, and other community learning or resource centers.

The increasing significance of ICTs has become a factor defining contemporary influence. We are experiencing a transformation in the nature of economic activity, with associated implications for the shape of society.

The generation and exploitation of knowledge is now the predominant factor in the creation of wealth. Knowledge has always been a factor of production, and a driver of economic and social development. However, technology-related developments have fundamentally transformed the degree to which knowledge is being integrated into economic activity, to the extent that we are witnessing a shift in the very basis of competitive advantage. Unlike capital and labour, information and knowledge have many of the characteristics of what economists call public goods. Once discovered and made public, knowledge

Figure 2. Types of learning depending on the level of reform and the use of ICTs



can be shared at zero marginal cost and its value is not depleted in consumption: it is nonrival. Indeed, the economic and social value of information and knowledge actually increases as it is shared with and used by others (Means, Haertel, & Moses, 2003).

The next society, the one that will succeed the current information society, will be a knowledge society. Knowledge will be its key resource, and knowledge workers will be the dominant group in its workforce. There will be an increased demand for a well-educated and skilled workforce across the whole economy. As access to information becomes easier and less expensive, it becomes more crucial that we have the skills and competencies relating to the selection and use of that information. There is a clear imperative for continuous education and training, and the establishment of incentives for firms and individuals to make the critical adjustment to a culture of lifelong learning. Workers at all levels in the 21st century knowledge society will need to be lifelong learners, adapting continuously to changed opportunities, work practices, business models and forms of economic and social organization. E-learning can offer lifelong, better, faster, and less expensive education for citizens and organizations.

A special interest group of e-learning is the one that enhances relearning. Because many competencies of the working force are technology-related, it is obvious that scientists need to revamp their outpaced knowledge base and potential. This is especially true in Archaeology. That archaeologists "collect data" and "feed them into a computer" are almost taken as givens within everyday conversation (Lock, 2003). However, the use of computer technology is not deteriorated to creating archaeological data repositories and warehouses. A new scientific field has emerged referred to as computer applications in archaeology (CAA).

Computer Applications in Archaeology, using as updated as possible ICTs, support archaeologists in managing, presenting, and utilizing the results of their work with the help of new technology. With such tools, observations from practical work are transformed to virtual reality (VR) reconstructions in such a photorealistic manner that sometimes it is hard to say where reality ends and virtual dreams begin. Clearly, with CAA the procedures of modeling the past perform a cognitive walk in new dimensions.

Amid this canopy studio, the e-learning potential in Archaeology emerges, promoting the increase and the dissemination of archaeological knowledge. Also, it becomes manifested as a cross domain activity, disseminating learning or relearning about technological factors that have changed significantly within the recent years. For example, it is rather unlikely for mid-aged archaeologist to be proficient on encoding mark-up languages like VRML or handling geographical information systems (GIS) for the very simple reason that these technologies were practically nonexistent some 10-15 years ago, when he was studying archaeology. Therefore, e-learning in archaeology does not involve only knowledge dissemination using ICTs for the subject domain only, but also computer aided instruction about the new technologies in focus.

ORGANIZATION OF THE BOOK

This book is organized in 23 chapters clustered in four sections. The last section is comprised of eight chapters, coming from IGI's InfoSci-Online database; these are selected readings, already published, that enhance and promote understanding for the amalgam of computers applications in archaeology and e-learning tools. A brief description of each of the 23 chapters follows:

Section I, titled "E-learning Technologies, Strategies and Methodologies," is comprised of four chapters.

Chapter I describes the impact of technology on education, providing definitions on what e-learning is about, and mostly, what e-learning is *not* about, separating facts from speculation and the likely

from the unlikely. Also, it describes how e-learning has evolved along with the World Wide Web and its changing to a degree significant enough to warrant the recent neologism "E-learning 2.0."

Chapter II digs in the computer aspects of virtual worlds used for e-learning. It explains how a computer system can generate a 3-D virtual environment, with which the user can interact and receive real time feedback. Then it describes what virtual learning environments (VLEs) are, and explains how enhanced educational functionality can be achieved when the learner uses virtual worlds.

Chapter III expands the e-learning paradigm from a mere immersion to a virtual reality system to a complete open and distance learning (ODL) strategy. It also explains the format of the multimedia materials and the structure of teaching when instruction is delivered within a VLE.

Chapter IV continues even further, explaining how virtual learning communities may be created when education and learning are offered through a Web site. It also explains how cognitive walkthrough may be achieved by using elements and features of online education.

The concluding chapter for section I, **Chapter V**, it illuminates the process of evaluating e-learning outcomes. Evaluation is conducted on the pedagogic paradigm, on the learning process and on the teaching materials and learning tools. Some case studies present in practice how evaluation should be conducted.

Section II, titled "Spatial-Computational Technologies and Virtual Reality Reconstructions in Archaeology," describes spearhead technologies that form the main context of CAA.

Chapter VI is the link between traditional archaeology and CAA. It deciphers how from observation we may have a fruitful interpretation of archaeological data that lead the way for computer animated reconstructions.

Chapter VII describes how archaeological data, coming from multiple excavations, can be stored in a relational database management system and accessed via the Internet.

Chapter VIII is a primer to geographical information systems. Adopting a user-oriented approach (rather than a programmer's approach) it describes how geographic data and elements, like spatial queries, may be used within an e-learning context.

Chapter IX presents the rapid evolution of virtual reality technologies and expands the digitization process of archaeological data to reconstruction techniques and methodologies using high level deductive reasoning.

In **Chapter X**, two vertical applications are analyzed in depth. They refer to simulations and virtual reality reconstructions, using high-level programming tools. The first focuses on the emerging sector of on-the-fly creation of virtual museums, mining data from linked archaeological databases. The second is an avant-garde application is presented conveying the acoustic reproduction of ancient Greek singing in a parameterized composing environment.

Chapter XI describes the implementation of an expert system's architecture on predicates of archaeological content. By using a network of rules, associated with a confidence factor that is derived from the interpretation of archaeological data, the system may deduce some propositions that perform a modeling of archaeological excavations in terms of "social"-like predicates.

Chapter XII demonstrates the tools that help us cope with the inherent multilingualism of archaeological publications. Namely, machine translation systems promote a subfiled of computational linguistics that helps translate the bulk volume of texts that are kept in archaeological repositories. Of course, the system does not have 100% success and post-processing human intervention is needed, but it is encouraging that archaeologists have started using and developing such tools, boosting their productivity.

Section III is titled "Electronic Publishing and Copyright Protection over Archaeological Computer Networks."

The first chapter in this section, **Chapter XIII**, gives concisely the legal framework within which authoring in virtual environments is protected. It does not go into an in depth analysis, because jurisdictional segregation implies that each county's legal system has its own rules and particularities.

Chapter XIV presents in a systematic manner the electronic publication of a monument of the European cultural heritage. Methods of electronic data processing that fit in for medium to long lasting excavations are presented so that archaeologists can take them into account.

The last chapter of this section, **Chapter XV**, is devoted to clarifying how *blogs* and *forums* may host electronic publications in a manner that copyright protection is safeguarded. Emphasis is given on how automated multilingualism may be sustained, using machine translation tools.

The last section, section IV, is titled "Selected Readings." It is virtually an annex for the cross-border concepts that have been presented in the first three sections. It aims to enhance the scientific background of those seeking more insight on the technological and pedagogical aspects of CAA.

More specific, **Chapter XVI** examines cross-cultural e-learning problems and conflicts. In **Chapter XVII**, the pedagogical impact of multimedia is presented. The next chapter, **Chapter XVIII**, digs into artificial intelligence (AI) evolutionary techniques that may be used within the context of CAA. **Chapter XIX** focuses on the collaborative aspects of GIS, while **Chapter XX** examines contemporary issues on database design and the development of information systems (IS). Finally, **Chapters XXI**, **XXII**, and **XXIII** are devoted to 3D visualizations and their profound learning dimension. The last two chapters especially emphasize the role of virtual museums in offering new learning experiences to the general public.

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