Computers and Education
E-Learning, From Theory to Practice

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Preface</th>
<th>ix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgements</td>
<td>xi</td>
</tr>
<tr>
<td>1. A History of E-Learning: Echoes of the Pioneers</td>
<td>1</td>
</tr>
<tr>
<td>Paul Nicholson</td>
<td></td>
</tr>
<tr>
<td>2. eLRN: E-Learning Inside and Outside the Classroom: Supporting Collaborative Learning Communities using a Web Application Toolkit</td>
<td>13</td>
</tr>
<tr>
<td>Carl Robert Blesius, Pablo Moreno-Ger, Gustaf Neumann, Emmanuelle Raffenne, Jesús González Boticario, Carlos Delgado Kloos</td>
<td></td>
</tr>
<tr>
<td>3. Educational Modeling Languages: A Conceptual Introduction and a High-Level Classification</td>
<td>27</td>
</tr>
<tr>
<td>Martinez-Ortiz, I., Moreno-Ger, P., Sierra, J.L., Fernandez-Manjon, B.</td>
<td></td>
</tr>
<tr>
<td>Daniel Burgos, Colin Tattersall, Rob Koper</td>
<td></td>
</tr>
<tr>
<td>5. SchoolSenses@Internet: Children as Multisensory Geographic Information Creators</td>
<td>57</td>
</tr>
<tr>
<td>Maria José Marcelino, Cristina Azevedo Gomes, Maria João Silva, Cristina Gouveia, Alexandra Fonseca, Bruno Pestana, Carlos Brigas</td>
<td></td>
</tr>
<tr>
<td>Manuel Gértrudix Barrio, María Del Carmen Gálvez de la Cuesta, Sergio Álvarez García, Antonio Galisteo del Valle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Title</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7</td>
<td>Applying Semantic Techniques to Integrate Electronic Course Catalogues</td>
</tr>
<tr>
<td>8</td>
<td>Tele-Education of the Instruction Dynamic Scheduling Using a Web Simulator</td>
</tr>
<tr>
<td>9</td>
<td>Universalizing Chasqui Repositories with a Flexible Importation/Exportation System</td>
</tr>
<tr>
<td>10</td>
<td>An Approach for Modelling Interactive and Collaborative Aspects in CSCL Systems</td>
</tr>
<tr>
<td>11</td>
<td>SKC: Measuring the Users Interaction Intensity</td>
</tr>
<tr>
<td>14</td>
<td>Using Java and C# for Educational Simulators: The case of Simple-2</td>
</tr>
<tr>
<td>15</td>
<td>Iterative Design of Learning Processes</td>
</tr>
<tr>
<td>16</td>
<td>Design by Contract-Based Selection and Composition of Learning Objects</td>
</tr>
</tbody>
</table>
Table of Contents

17. Online Evaluation at Higher and Secondary Education: A Teaching and Learning Experience 193
   Joglar, N., Risco, J.L., Díaz, A., Colmenar, J.M.

18. Game Implementation: An Interesting Strategy to Teach Genetic Algorithms 205
   José M. Chaves-González, Noé Otero-Mateo, Miguel A. Vega-Rodríguez, Juan M. Sánchez-Pérez, Juan A. Gómez-Pulido

19. Instructional Theories to Model Educational Content: A Case Study 225
   Diego Bodas Sagi, Miguel Rodríguez-Artacho

Author Index 235

Subject Index 237
PREFACE

Computers have long been used in education and today their use is having an ever greater impact on society thanks to the increasing educational success of the Internet and easier access to it. This broad field, which may include any kind of learning process aided by Information and Communication Technologies, is usually referred to as e-learning. E-learning is commonly recognized as a powerful and valuable extension to traditional educational initiatives and Learning Management Systems (LMS) are key tools that support these new educational models. For this reason a significant amount of research and development on both technological and educational issues in e-learning has been taking place with striking results. The field is beginning to come of age and is making important advances in the development, reusability and interoperability of educational content fostered by maturing standards and specifications (e.g. IMS, ADL/SCORM).

Nevertheless, even if we take these advances into account, more research and application work is needed in order to produce more cases of success and to generalize e-learning in industry, universities and schools. Certain problems have been identified such as those regarding costs, the knowledge needed to effectively apply this approach, or the fact that in many cases traditional LMS sometimes lack the required flexibility and adaptability to implement innovative educational models that need to be addressed. There are other issues also open such as how to involve learners further in the instructional process, how to stimulate the collaborative creation of educational contents, how to ease the creation and reuse of contents for non-experts, how to make more open and collaborative environments, or how to put into practice the effective integration of mobile devices in educational settings.

This book attempts to reflect several different views and efforts of the computers in education use. The book collects a set of selected and improved papers presented in the 4th International Symposium on Educational Informatics (SIIE in Spanish) hold in Cáceres (Spain) on November of 2004. The book includes also contributions of well known researchers in the
Educational Informatics field. The book chapters present experiences not only from the research point of view but from a practical point of view as well.

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Chapter 1

A HISTORY OF E-LEARNING

Echoes of the pioneers

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Abstract: In many contemporary sectors, E-learning is often regarded as a ‘new’ form of learning that uses the affordances of the Internet to deliver customized, often interactive, learning materials and programs to diverse local and distant communities of practice. This view, however, is historically disconnected from its antecedent instantiations, failing to recognize the extensive links between developing educational theories and practices that had shaped the use of E-learning over the past 40 years. In addition, the historic divide between Education and Training has led to both the concurrent development of different notions, foci, and labels for technology-enhanced learning in different contexts and situations, and different conceptual origins arising in acquisitive and participatory learning metaphors.

Key words: E-learning; history; theory; practice.

1. PARALLEL HISTORIES AND TERMINOLOGY

With the historian it is an article of faith that knowledge of the past is a key to understanding the present (Stampp in Szasz, 2006). In the history of E-learning, it is important to note that there is no single evolutionary tree and no single agreed definition of E-Learning: since the 1960s, E-learning has evolved in different ways in Business, Education, the Training sector, and the Military (for a military perspective see Fletcher & Rockway, 1986), and currently means quite different things in different sectors. In the school sector, ‘E-Leaning’ refers to the use of both software-based and online learning, whereas in Business, Higher-Education, the Military and Training sectors, it refers solely to a range of on-line practices. (Campbell, 2004)
The history of E-learning across all sectors is best summed up as: ‘Opportunities multiply as they are seized.’ (Sun Tzu, 410bc) as for the past 40 years, educators and trainers at all levels of Education, Business, Training and the Military made use of computers in different ways to support and enhance teaching and learning. (Charp, 1997; Molnar, 1997) Consequently, the contemporary use of the term ‘E-learning’ has different meanings in different contexts (Campbell, 2004). In the Higher Education, Business, and Training sectors it relates particularly to Internet-based flexible delivery of content and programs that focus on sustaining particular communities of practice. E-learning in business and training can be characterised as being driven by notions of improved productivity and cost reduction, especially in an increasingly globalised business environment, with a focus on content delivery and online course management. These sectors initially employed the limited learning models extant at the time, but have since moved to incorporate a diverse range of learning models and foci. (Nicholson, 2004) Campbell (2004, p1) argues that:

‘Broadly, in industry settings, E-learning reflects an emphasis on informal and non-formal, just-in-time learning where the emphasis is on collaborative productivity. Whilst, in higher education settings, best-practice online learning emphasises the development of metacognitive skills, where the emphasis is on reflective and collaborative learning.’

In the context of the wider education community, the use of the term E-learning has historically had wider connotations that embrace a diverse range of practices, technologies, and theoretical positions. It is not only focused on online contexts, and includes the full range of computer-based learning platforms and delivery methods, genres, formats and media such as multimedia, educational programming, simulations, games and the use of new media on fixed and mobile platforms across all discipline areas. It is often characterised by active learner-centred pedagogies. (e.g., Harel, 1991; McDougall & Betts, 1997)

The growth of E-learning in Business and Higher Education, and its marketing as a ‘killer-app’ (Friedman, 1999), has led to concerns about the influence of quality assurance driven models on the structure and quality of these programs (e.g., King, 2002; McGorry, 2003). Related concerns about its ability to deliver meaningful pedagogically structured learning experiences, or to have a clearly identifiable learning paradigm have also been raised (Gillham, 2002; Stone Wiske, Sick et al., 2001; Suthers, Hundhausen et al., 2003). Recently, driven by such concerns, its focus has expanded to accommodate the incorporation of learner engagement and social-learning models (e.g., Mortera-Gutiérrez, 2006; Schroeder & Spannagel, 2006). Since its inception, technological advances in computers
and networks facilitated advances in E-learning as educators seized on new features in an attempt to adapt them to their needs, to accommodate new educational theories, or looked for the promise of enhanced functionality. Curiously, many of these were foreseen by the pioneers of E-learning.

2. ORIGINS

The origins of E-learning as currently practiced in Business, Higher Education and the Military stem from the insightful work of Patrick Suppes at Stanford and Don Bitzer at the University of Illinois. While others such as Porter (1959) and Uttal (1962) were also active early in this field (Fletcher, 2002), only Suppes and Bitzer clearly situated the use of technology within a broader educational agenda (e.g., Suppes, 1964, 1966, 1986).

2.1 Patrick Suppes

In the 1960s, there were few educational applications of computers in universities, with most performing routine computational tasks. It was thought that the high cost of technology would prevent its ubiquitous uptake as an educational tool. In 1966 Suppes argued that ‘… in the future it would be possible for all students to have access to the service of a personal tutor in the same way that ancient royals were once served by individual tutors, but that this time the tutors would be in the form of a computer.’ (Suppes, 1966). He argued that the single most powerful argument for the use of computers in education is individualized instruction and the dialogue that it supports. This was not an idle conjecture, but was based on Bloom’s research that demonstrated that one-on-one tutoring improved student achievement by two standard deviations over group instruction – the equivalent of improving the performance of 50th percentile students to that of 98th percentile. (Bloom, 1984) Individual tutorials, Suppes argued, were also a core aspect of the university and computers would embrace and extend this through the use of virtual learning environments.

Driven by a belief in the educational potential of computers, Suppes founded the Computer Curriculum Corporation at Stanford as part of his ongoing inquiry into the nature, benefits and effectiveness of computer-enhanced learning. In accordance with prevailing psychological paradigms, he developed a Computer Managed Instruction system and used it widely in his courses. Suppes also provided elementary school children with individual CMI tutorials in mathematics to supplement teacher instruction. The results were inconclusive but led to suggestions for improved practices.
Suppes work and teaching was confined to structured fields and views of knowledge, with ‘drill and practice’ approaches being typical for such fields. He was concerned with both producing better learning, and learning how to be a better teacher with computers.

Contemporary critiques of his approach often overlook the lack of viable alternative paradigms at that time, something that Suppes was aware of. For example, in 1971 he noted that there was (then) a shallow understanding of how to use CAI effectively, and that it would take a long time to develop the necessary deep theoretical understandings that would underpin better practises. His research found that CMI produced profound effects on learning, and identified changes in students’ understandings ranging from simple to complex. While his use of computers was essentially as a tool, he foresaw the potential for wider applications of computers in education. His research led to the following (amongst other) items for consideration:

- In 1971 the technology was not up to the tasks that he envisaged for it.
- The impediments to individual CAI were pedagogical not technological.
- CAI can track & follow each student, providing the potential for customised learning pathways.
- Richer learning theories were needed to inform design and practice.
- In the future, large numbers of students using CAI will be an important part of the mainstream university.
- There was a tendency to assess the product (of CAL) with simple studies using simple statistics when more complex measures might have led to more incisive conclusions.
- Students learning styles needed to be considered when developing CAL.
- How would more complex questions and responses be developed and handled as students increasingly engaged with higher-level content?

2.2 Don Bitzer: PLATO

In the early 1960s, Don Bitzer at the University of Illinois created PLATO, a timeshared computer system, to address concerns about student literacy. PLATO could be used to develop and deliver computer-based education, including literacy programs. It allowed educators and students to use high-resolution graphics terminals and an educational programming language, TUTOR, to create and interact with educational courseware and to communicate with other users by means of electronic notes – the forerunner of today’s conferencing systems (Bitzer, Braunfeld et al., 1962). Woolley (1994) argues that as well as PLATO’s advances in Computer Assisted Instruction, its communication features were equally innovative and were the foundations of today’s conference and messaging systems:
Two decades before the World Wide Web came on the scene, the PLATO system pioneered online forums and message boards, email, chat rooms, instant messaging, remote screen sharing, and multiplayer games, leading to the emergence of what was perhaps the world’s first online community.’ (Woolley, 1994)

When PLATO was eventually commercialised, it became the direct ancestor of today’s E-learning systems such as Blackboard™ and WebCT™. It’s interesting that what are widely touted as the key features of such systems are exactly those that Woolley identifies in PLATO! Like Suppes, Bitzer appears to have created the technology mainly as a tool, but also oversaw its operationalization in other dimensions.

3. FROM SIMPLICITY TO COMPLEXITY

When Dan Watt took the first computer terminal into a Boston school in 1969, he could hardly have envisaged the subsequent changes that would occur – in particular the shift from localized 1:1 computing to distributed many: many models that occurred with the rise of constructivist and social-constructivist theories in the 1990s, and the related notions of situated and distributed cognition. To accommodate these cognitive and social learning theories required a major epistemological shift to embrace active learners, and indeed active communities of practice (Wenger, McDermott et al.), that were both knowledge consumers and knowledge creators (e.g., Papanikolaou, Grigoriadou et al., 2002).

3.1 Paradigm shifts

The eclectic history of E-learning means that constructs and paradigms in and across fields of use have merged and developed as part of the following trends in a progressive and incremental manner rather than being a new ‘killer app’ or ‘a new way of learning’. The two interrelated trends examined briefly below (Figures 1 and 2 below) are the pedagogical focus of learning environments, and changes in the psychological foundations of learning. The size of the circles in those figures is meant to imply increased adoption or implementation over previous items, and is indicative only – they are not based on particular data. These meta-level characteristics of E-learning environments represent key lenses into what educators and developers were attempting to build and achieve with educational computing.

One of the most obvious trends in all areas of educational, business and training applications has been the increased scale of adoption of constructivist