In the last decade, crucial advances in computers, in digital memory, in internet resources, in audio and visual transmission, in virtual imaging, and in wireless communication have created intriguing new possibilities for the use of technology in the teaching of English. In the same way, school syllabus are unanimous about the need to design and implement strategies that lead the learner to search, to enquire, to build his knowledge, to develop competences, to use new technologies, and above all to become autonomous. As a result, the use of interactive resources in teaching and learning processes turns out to be essential, so that learners can lead a successful path in this new information society. Bearing in mind the above assumptions, this research will explore the advantages and disadvantages of electronic interactive textbooks versus traditional textbooks in student’s learning. It investigates Portuguese EFL textbooks in order to check the level of interactivity. In other words, textbooks will be classified according to the way the communication is maintained between the textbook and the learner. One is able to determine which textbooks are adequate and which offer the levels of interactivity required by a textbook of the 21st century, in order to support learners with different background knowledge and skills.

1. Introduction

In the last decade, dramatic advances in computers, in digital memory, in internet resources, in audio and visual transmission, in virtual imaging, and in wireless communication have created new possibilities for the use of technology in the teaching of English. Web publishing, digital archives, digital video, electronic conferencing, blogging, wikis, podcasting, virtual reality worlds are easy-to-explore / accessible-to-all potential new tools for teaching and learning English (Webb, Allen, 2007). The use of information and communication technologies (ICTs) transformed traditional teaching and learning models and practices in the past decade. This evolution has resulted from the emergence of the information society and has greatly impacted on the global economic and socio-cultural development (Vieira, 2005; Ka0hiigi, E. K. et al., 2008).

According to the European Union’s aims for 2010 (Treaty of Lisbon):

• We should experience a shift from PC centeredness to ambient intelligence. The ICT
environment should become personalised for all users. There should be full multimedia, with an almost 100% online community.

- Innovations in learning should be focused on personalised and adaptive learning, dynamic mentoring systems and integrating experienced based learning into the classroom.
- Learning resources should be digital and adaptable to individual needs and preferences. E-learning platforms should support collaborative learning. There should be a shift from courseware to performanceware focused on professional learning for work.
- ICTs should be an integrated part of the learning process. Access to mobile learning should be enhanced through mobile interfaces.

The use of these new technologies requires, however, new literacies that enable to exploit their potentials effectively (Leu, D.J. et al., 2004). In fact, the new literacies of the ICTs include the skills, strategies, and dispositions necessary to successfully use and adapt to rapidly changing information contexts that continuously emerge in our world and influence all areas of our personal and professional lives. In the same way, recent trends in education focus on the need to shift from a teaching paradigm to a learning paradigm (Ponte, 2003; Brown, T., 2005). Such a shift changes the emphasis not only from teaching to learning, but also from teacher-directed to self-directed learning and from passive to interactive learning. Teachers become instructional designers creating learning experiences and environments, and students work without the teacher being present for every structured learning activity. According to Brown (2005), contemporary educational paradigms focus not only on the production of knowledge, but are beginning to focus more and more on the effective application/integration/manipulation/etc. of existing information and knowledge.

Therefore, school syllabus are unanimous about the need to design and implement strategies that lead the learner to search, to enquire, to build his knowledge, to develop competences, to use new technologies, and above all to become autonomous. As a result, the use of interactive resources in teaching and learning processes turns out to be essential, so that learners can lead a successful path in this new information society.

Bearing in mind the above assumptions, this research will explore the advantages and disadvantages of electronic interactive textbooks versus traditional textbooks in student’s learning.

2. Conceptualizing the learning process

Many approaches to learning over the years tend to agree that learning is a process through which learners achieve their learning goals by carrying out a number of learning activities and participating in interactions to reflect their understanding (Sun et al., 2004). Thus, learning seems to result from a change in students’ perception of reality related to the problem area under study (Rekkedal and Dye, 2007). Learning is then concerned with the way people acquire new knowledge and skills and the way in which existing knowledge
and skills are modified to solve problems (Shuell, 1986). It consists of the active role played by the learner to process the information for use (Barnard, 2006).

Furthermore, it has become increasingly apparent that the amount of knowledge students possess has a substantial impact on their learning processes (Chi et al., 1982) and learning styles. Students learn in differing ways. They pay attention to different aspects of their environment, they solve problems in a different manner, they relate to others in distinctive partners and they process information in unique ways. Thus, the manner in which information is presented to them affects their ability to learn. Consequently, the learning style must be differentiated, although according to Dunn et al., 1998, teachers tend to teach in the style in which they prefer to learn or were taught and prefer to work with students who exhibit the same learning style preferences they do.

Sun et al. (2003) identify three learning styles to support students in their learning process:

<table>
<thead>
<tr>
<th>Learning Style</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual learners</td>
<td>Students who learn best through seeing things such as images, demonstrations, facial expressions, and body language of the instructor to fully understand the content of the lesson;</td>
</tr>
<tr>
<td>Auditory learners</td>
<td>Students who learn best by hearing things through verbal lectures, discussions, talking things through and listening to what others have to say.</td>
</tr>
<tr>
<td>Tactile/Kinaesthetic learners</td>
<td>Students who learn best through experiencing, reflecting, interacting, and doing things. These learners prefer to actively explore the physical world around them and would benefit from manipulating real objects and/or acting on them in a simulated environment.</td>
</tr>
</tbody>
</table>

According to the same author, however, students need to utilize the different learning styles interchangeably during the learning process so that they can have an effective learning experience.

2.1 Learning theories

Literature reviews suggest that learning theories can be related to three widespread models: cognitivist, constructivist, and socially situated model of learning.

The **cognitive learning theory** emphasizes the learner’s schema as an organized knowledge structure (Bruner, 1990; Gagne, Yekovich, & Yekovich, 1993). Unlike behaviorism, cognitivism recognizes that the human mind is not simply a passive recipient of knowledge. Rather, the learner interprets knowledge and gives meaning to it. They demonstrate how a student perceives, processes, interprets, stores, and retrieves information and are mainly concerned with the changes in a student's understanding that results from learning. The student is involved in the learning process, so the teachers have to present organized information in a way the student can relate to. Shuell (1986) emphasizes that a cognitive approach stresses learning as an active, constructive, and goal oriented process that is dependent upon the mental activities of the learner.
The constructivist learning theory views knowledge as a constructed entity made by each and every learner through a learning process. Constructivism frames learning less as the product of active construction whereby the learners construct their own knowledge based upon prior knowledge (Duffy, Lowyck, & Jonassen, 1993; Piaget, 1971; Steffe & Gale, 1995). Constructivist learning requires learners to demonstrate their skills by constructing their own knowledge when solving real-world problems. The constructivist model calls for learner-centered instruction, because learners are assumed to learn better when they are forced to explore and discover things themselves. The learner actively constructs or builds new ideas using previous knowledge and experience attained. During the learning process, the teacher takes on a facilitator role focusing on making corrections, fostering new understandings, and creating social disclosure. The learners take on the responsibility of learning by actively participating in the learning activities placed at the centre of the learning process.

The socially situated learning theory can be seen as a correction to constructivism, in which learning is disconnected from the social context (Hadjerrouit, 2008). Whereas in the constructivist paradigm learning is assumed to occur as an individual learner interacts with study material, this perspective regards learning as socially situated and knowledge as socially distributed (Vygotsky, 1978; Wengler, 1998). Learning occurs as learners exercise, test, and improve their knowledge through discussion, dialogue, communication, collaboration, information sharing, and interaction with others. Vygotsky (1978) argued that the way learners construct knowledge, think, reason, and reflect on is uniquely shaped by their relationships with others. He argued that the guidance given by more capable others, allows the learner to engage in levels of activity that could not be managed alone. Thus, learning theories explain the learning process through which learners are able to acquire knowledge, but there is no single learning theory that can fully explain all types of learning. Consequently, several theories coexist and complement each other during a learning process. It should be kept in mind, though, that the attainment of the learning concepts varies from one learner to another and the learning methods dictate the level of knowledge to be attained. Although the literature on learning theories points to the fundamental philosophical differences between them (Lin & Hsieh, 2001), in practice, a blend of learning theories is being used. Indeed, educators tend to believe that what works in a learning situation is a subtle combination of learning theories (Karagiorgi & Symeou, 2005).

Along the same line of argument, Mayes and Fowler (1999) proposed a three-stage model of learning cycle, in which they identified three types of learning – conceptualization, construction, and dialogue. The essential characteristic of the learning cycle is that it describes a continuous cycle, or feedback loop, of gradual understanding. Accordingly,
learning develops in three phases, beginning with conceptualization, progressing through construction to dialogue. Conceptualization is characterized by the process of interaction between the learners’ pre-existing framework and teacher’s knowledge. The construction phase refers to the process of building and combining concepts through their use in the performance of meaningful tasks. The dialogue phase refers to the testing of conceptualizations and the creation of new concepts during conversation with both fellow learners and teachers. Dialogue emerges through collaborative learning.

The three stages of the learning cycle include elements that are closely related to learning theories. Conceptualization is associated with the cognitive learning theory as it focuses on concepts and their relationships. The construction phase is related to the constructivist learning theory as it aims at the construction of new knowledge and its use in the performance of task-based activities. The dialogue phase is based on the socially situated learning theory as it is concerned with dialogue, group collaboration, and discussion.

2.2 Learning methods

Learning methods are referred to as ways through which instructors deliver instructions and learners access these instructions. Several learning methods have been described in literature, including traditional learning, e-Learning, blended learning, mobile learning, and personalized learning which have been accompanying the advancements in technology and the paradigm shift from traditional learning to personalized learning methods with varied implementation.

Traditional learning refers to face-to-face sessions. The learning method is teacher centered, where the teacher provides the learning information to the students. Assessments depend on study notes given to students by the teacher. According to Chickering and Gamson (1987) students must do more than just listen to what is said in class, such as read, write, discuss, or be engaged in solving problems constructively.

E-Learning, on the other hand, refers to the use of ICTs to transform and support the learning process ubiquitously. For instance, Meyen et al (2002) define e-Learning as the acquisition and use of knowledge which is distributed and facilitated by electronic means. Such electronic means may include internet, intranet, extranet, CD-ROM, video tape, DVD, TV, and personal organizers. E-Learning can be carried out in several ways which include computer based, asynchronous, and synchronous learning (AEN, 2002). This facilitates an environment where the students take ownership of their learning.

Blended learning makes use of a combination of various learning methods that include face-to-face classroom activities, live e-Learning, and self-paced learning (Valiathan 2002). This learning method encompasses a variety of tools for maximizing the learner’s learning potential, taking into account the assumption that the use of a variety of methods, through
which learners can acquire knowledge and improve their learning potentials (Dean et al., 2001; Lubega and Williams, 2003).

*Mobile learning* is defined as learning or delivery of content that is facilitated by the use of portable technologies such as mobile phone, PDAs, or iPods (Wagner, 2007). The global penetration and the use of mobile technologies have created new avenues in teaching (Armatas et al., 2005). Currently, mobile learning presents vast benefits that facilitate e-Learning. However, mobile learning methods are still in their infancy and have not been fully adopted as a learning method (Kinshuk et al., 2003).

*Personalized learning* is a learning approach that facilitates and supports individualized learning. Each learner has a learning path that caters for learners' learning needs and interests in a productive and meaningful way (Graven and MacKinnon, 2005).

### 3. ICT and foreign language learning

The changing conceptions of learning and the rapid technological advances have been accompanied by changes in language teaching and learning. Language classrooms are increasingly turning into blended learning environments that focus on active learning. In other words, teachers tend to use multiple teaching and guiding methods by combining face-to-face sessions with online activities and using a mix of technology-based materials. The growing use of ICT in language learning environments has changed the face of language teaching and learning in a beneficial way. According to Jonassen (1999), who defines technology-enhanced meaningful learning as active, authentic and cooperative, the main benefits of ICT to language learning are mainly three:

First, **ICT—and the Internet** in particular provides language learners with the opportunity to use the language that they are learning in meaningful ways in **authentic contexts**. The Internet provides an easy and fast access to the use of current and authentic materials, which is motivating for the language learner (online newspapers, webcasts, podcasts, newsroom video clips or even video sharing websites such as, say, YouTube). Another motivating language learning opportunity using ICT is provided by chat rooms and virtual environments such as Second Life where the language learner can practice not only the written use of the language, but also practice speaking and pronunciation, without the fear of making mistakes.

A second important benefit derived from the use of ICT in a language classroom is based on the opportunities it affords for **cooperation and collaboration** with one's peers. Language teachers all over the world are introducing ICT-enhanced language learning projects, including simulations, between their students and groups in other countries, thus widening the language learning perspective into that of learning about the cultural context of the language being used today, using ICT they can 'skype' or chat online, where they can not only write to each other in real-time, but also see each other and speak to each
other online. Students are thus able to write, read, speak, listen, and react to a conversation using ICT as part of the language learning process. These beneficial ICT-enhanced language learning activities call for the teacher to organize and monitor them, although in a blended language learning class the overall role of the teacher has changed from the traditional authoritative role to that of a facilitator.

A third major benefit of the use of ICT in blended language learning classrooms is the opportunity that ICT-based tools give to language teachers so that they can tutor their learners more effectively. With the help of ICT-based tools and the constantly growing number of available educational resources language teachers are able to give individual and personalized guidance to the learners. The use of several media—audio, video, authentic contexts, and real-world experiences help language learners with different learning styles to assimilate the content according to their needs.

According to the author, in a blended learning environment that uses ICT tools, it is easier for the language teacher/tutor to use different approaches with students and accommodate different learning styles and the different needs of fast, slow, or handicapped language learners.

3.1. Teachers’ perceptions and beliefs about ICT for language learning

Cuban (2001) has continuously maintained that teachers will use technology only if they perceive it to facilitate instruction. Studies in this direction have concluded that if teachers perceive technology as adding value to curriculum goals, motivating learners, or augmenting learning they are more willing to teach with technology (Doering, Hughes & Huffman, 2003; Ertmer, Addison, Lane, Ross & Woods, 1999; Russell et al., 2003). Likewise, in the ODLAC institutional surveys (2008), teachers’ attitudes as well as perceptions of the benefits of ICT for language learning, teachers’ beliefs about teaching methods, electronic communication with students, perceptions of their role as a teacher, and their confidence with using technology can influence the ways in which they use technology in their teaching.

3.2. Learners’ perceptions of ICT use for language learning

The use of ICT in language learning not only involves pedagogical changes for teachers but also involves environmental and pedagogical changes for learners who are traditionally used to face-to-face teaching in classrooms.

Although an increasing number of learners have access to online technologies and use ICT for personal interactions, they find it challenging to use ICT in an educational context. Although many online language courses include spoken elements and oral interactions with the teacher, learners are often unsure how such elements would work and whether they could actually learn using ICT resources in the physical absence of the teacher. Often
students are more willing to listen to audio materials, watch video materials, and take self-tests online as a supplement to face-to-face interaction and communication in a language course.

Learners’ prior experiences with language learning and with learning with ICT, their technical skills, and their personal learning preferences can play a role in their perceptions of teaching and learning in general and with ICT in particular. It is common for learners to feel isolated from their instructor and peers while using ICT, while in other cases, learners who hesitate to speak in front of peers are more comfortable writing their opinions online (Kumar, 2007). In order to help language learners deal with the challenge of using ICT to study, there should be study support systems which include guidance about self-study and discipline when using ICT to learn a language from a distance, access to library resources, and activities for collaboration and communication with peers.

Lynch and Roecker (2007) identify three delivery trends in formal education and corporate education. The first trend is the freedom to learn at a time that is convenient for the learner. The second trend is the emphasis on personal choice. Learners want to make choices at the module level instead of the course level as all topics in a course may not be interesting or needed at that particular time in the learner’s life. For instance, many learners will demand just-in-time learning applications. Finally, the third trend focuses on peer support in learning. Most learners seem to want contact with their peers and opportunities for such contact need to be provided.

According to Kershaw (1996) people who use the new technologies must be provided with training, technology access, and encouragement to use the technology in their day-to-day work. He particularly stressed that “there must be a clear focus on the people who use the technology, not on the technology itself” (p. 14). Furthermore, he emphasized the slowness of institutional change by pointing out that the transformational process can be expected to take between five and ten years, and that it is easy to slip back into old ways if an institution begins to lose its focus on change.

4. Textbook and learning

Textbooks in one form or another have been a part of education since the written tradition began, as textbooks are an integral part of most education systems serving as bridges between teachers and students. Zevin (2000) stated that teachers depend on the textbook as their main source of ideas without much enrichment or supplementation from other sources. The author also stated that they are used as part of a nearly closed system of assignments, reading, questions, homework and tests that provide security but little imagination.

4.1. The role of textbooks in language classroom
The textbook plays an important role in English Language Teaching (ELT), particularly in the English as a Foreign Language (EFL) classroom where it provides the primary form of linguistic input (Kim & Hall, 2002).

In fact, English language instruction has many important components but the essential constituents to many ESL/EFL classrooms and programs are still the textbooks and instruction materials that are often used by language instructors. As Hutchinson and Torres (1994) suggest:

"The textbook is an almost universal element of [English language] teaching. Millions of copies are sold every year, and numerous aid projects have been set up to produce them in [various] countries…No teaching-learning situation, it seems, is complete until it has its relevant textbook. " (p.315).

Thus, textbooks are regarded as a key component. In some situations they serve as the basis for much of the language inputs learners receive and the language practice that occurs in the classroom. They may provide the basis for the content of the lessons, the balance of skills taught and the kinds of language practice the students take part in. For learners, textbook may provide the major source of contact they have with the language apart from the input they have from the teachers.

Other theorists such as Sheldon (1988) agree with this observation and suggest that textbooks not only "represent the visible heart of any ELT program" (p.237) but also offer considerable advantages - for both the student and the teacher - when they are being used in the ESL/EFL classroom.

Haycroft (1998), for example, suggests that one of the primary advantages of using textbooks is that they are psychologically essential for students since their progress and achievement can be measured concretely when we use them. Second, as Sheldon (1988) has pointed out, students often harbour expectations about using a textbook in their particular language classroom and program. Third, textbooks involve low lesson preparation time, whereas teacher-generated materials can be time, cost and quality defective. In this way, textbooks can reduce potential occupational overload and allow teachers the opportunity to spend their time undertaking more worthwhile pursuits (O'Neill, 1982; Sheldon, 1988). A fourth advantage identified by Cunningsworth (1995) is the potential which textbooks have for serving several additional roles in the ELT curriculum. He argues that they are an effective resource for self-directed learning, an effective resource for presentation material, a source of ideas and activities, a reference source for students, a syllabus where they reflect pre-determined learning objectives, and support for less experienced teachers who have yet to gain in confidence. Finally, Hutchinson and Torres (1994) have pointed out that textbooks may play a relevant role in innovation. They suggest that textbooks can support teachers through potentially disturbing and threatening change processes, demonstrate new and/or untried methodologies, introduce change gradually, and create scaffolding upon which teachers can build a more creative methodology of their own.
While many of the aforementioned theorists are quick to point out the extensive benefits of using ESL/EFL textbooks, there are many other researchers and practitioners who do not necessarily accept this view and retain some well-founded reservations on the subject. Allwright (1982), for instance, suggests that textbooks are too inflexible and generally reflect the pedagogic, psychological, and linguistic preferences of their authors. Subsequently, the educational methodology that a textbook promotes will influence the classroom setting by indirectly imposing external language objectives and learning constituents on students as well as potentially incongruent instructional paradigms on the teachers who use them. Moreover, the pedagogic principles that are often displayed in many textbooks may also be conflicting, contradictory or even out-dated depending on the capitalizing interests and exploitations of the sponsoring agent.

More recent authors have criticized textbooks for their inherent social and cultural biases. Researchers such as Porreca (1984), Florent and Walter (1989), Clarke and Clarke (1990), Carrell and Korwitz (1994), and Renner (1997) have demonstrated that many EFL/ESL textbooks still contain rampant examples of gender bias, sexism, and stereotyping. Other theorists such as Prodromou (1988) and Alptekin (1993) have focused on the use of the target language culture as a vehicle for teaching the language in textbooks and suggest that it is not really possible to teach a language without embedding it in its cultural base. They argue that such a process inevitably forces learners to express themselves within a culture of which they have scarcely any experience and this may result in alienation, stereotyping, or even reluctance or resistance to learning. Gray (2000), on the other hand, has defended the socio-cultural components of many textbooks. He suggests that English language textbooks are actually ambassadorial cultural artifacts and that students should not only critically engage their textbooks but also view them as more than mere linguistic objects. In this way, he argues, learners will improve their language skills by using their textbooks as useful instruments for provoking discussion, cultural debate, and a two-way flow of information.

Some proponents of authentic classroom language models have argued that the problems with many textbooks are not necessarily the fact that they are culturally or socially biased but that they are actually too artificial in their presentation of the target language. They argue that it is crucial to introduce learners to the fundamental characteristics of authentic real-life examples of both spoken and written discourse. They have demonstrated that many scripted textbook language models and dialogues are unnatural and inappropriate for communicative or cooperative language teaching because they do not adequately prepare students for the types of pronunciation (Brazil, Coulthard, and Johns, 1980; Levis, 1999), language structures, grammar, idioms, vocabulary and conversational rules, routines and strategies that they will have to use in the real-world (Cathcart, 1989; Yule et al., 1992).
Richardson (2001) summarises both advantages and disadvantages of the use of textbooks in teaching, depending on they are used and the contexts of their use (table 2).

<table>
<thead>
<tr>
<th>Textbook advantages</th>
<th>Textbook limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. They provide structure and a syllabus for the program.</td>
<td>1. They may contain inauthentic language.</td>
</tr>
<tr>
<td>2. They help to standardize instruction.</td>
<td>2. They may distort content.</td>
</tr>
<tr>
<td>3. They maintain quality.</td>
<td>3. They may not reflect students’ needs.</td>
</tr>
<tr>
<td>4. They provide a variety of learning resources</td>
<td>4. They are expensive.</td>
</tr>
<tr>
<td>5. They are efficient.</td>
<td>5. They may be confining, i.e., they inhibit teachers’ creativity</td>
</tr>
<tr>
<td>6. They provide effective language models and input.</td>
<td></td>
</tr>
<tr>
<td>7. They are visually appealing.</td>
<td></td>
</tr>
</tbody>
</table>

Collins (2001) states other limitations to the textbook pedagogy:

First, the standard textbook pedagogy places severe limitations on the classroom instructor, making him or her beholden to a particular approach and interpretation and organization of content. Instructors often find themselves compelled to fit their lecture to the textbook in order to make a clear connection for students between what is being read and what is stated in class. When exposed to this methodology, students are forced to learn the same thing in the same way. As professionals who know the content and who have their own interpretations and teaching methods, instructors find that having to conform to the approach of authors, exceptionally restrictive.

Second, the traditional textbook methodology is becoming increasingly superfluous to the courses and to the students using them, as social and technological changes have transformed the way students access and process information.

4.2. Traditional textbook versus electronic textbooks

Collins (2001) states textbooks have changed drastically over the years in response to technology and changing needs, and believes textbooks will continue to change as society redefines its needs and uses new technology to better achieve those needs. According to the author, the Internet now offers the potential of remaking textbooks completely. First, it will obviate the scarcity model on which publishing had been traditionally based, and replace it with a model in which the value of information increases as it becomes more accessible. Second, technology will result in the creation and validation of multiple forms of discourse that will enrich the educational experience. Third, because of the variety of skills and expertise needed to build interactive textbooks, the notion of authorship will change and more collaborative development models will become the norm.

In fact, the advance in the area of the information technology have opened up new possibilities for the use of the interactive media such as CD-ROM, in the learning and teaching situation. Textbooks are now available via computers. According to Schwarz, E. et al., (1996), a very big part of developed 'electronic textbooks' are no more than 'electronic copies' of printed textbooks: they offer the learner nothing more than access to the textbook.
content, sometimes with use of simple hypertext technology. Currently, printed textbooks exist on the market with electronic supplements. However, according to the same authors, a new concept has emerged. Technically, current electronic textbooks (ET) are much better than their grandparents: first ETs used expensive mainframes and represented only text. Multimedia technology, however, added the possibility to present sound, video, and animation, and, now, Internet and World Wide Web bring the possibility of distance access. One of the new features is a multimedia approach, which combines sound, text, stills and video with interactive learning (Plasschaert, 1997; Carvalho, 2002). These new electronic or multimedia textbooks appear similar to the conventional books, but differ in function. In addition to text and images, they contain the video and audio clips, which allow the learners to interact with the content and to be exposed to the target language and the culture. Learners explore the simulated environment with audio and visual input, which facilitates comprehension in listening and reading (Chun & Plass, 1997; Verdugo & Belmonte, 2007). Teachers, in turn, are able to easily retrieve the most recent and pertinent information for their students (Moore, Morales, & Carel, 1998).

The purposes of developing the multimedia textbook are to enhance student enthusiasm, by using more materials of multimedia and creating opportunities for interactive learning (Davis, et al., 1997). The features are intended to create a stimulus-rich environment in which the users can enjoy a variety of interactive experiences that will facilitate the learning process (Calhoun, 1997).

There are several studies comparing the effectiveness and efficiency of multimedia textbook (MMTB) and traditional methods. Even though the multimedia textbook fails to prove its effectiveness in the beginning stage, it became evident that computer-based instruction can be more fruitful as the technology develops. According to a research conducted during 1993, the instructional effectiveness of the multimedia textbook and the lecture are equal. In 1995 study, the instructional effectiveness of the MMTB is greater than that of the lecture (P < .05), and this measurement is the same as that of the printed textbook.

The instructional efficiency of the MMTB is equal to that of the lecture and of the printed textbook. The authors concluded that the MMTBs constitute an educationally alternative instructional method and have a promising future in education. In Lilienfield and Broering’s study, the effectiveness of an interactive multimedia computer program in improving the knowledge of users was determined. Through this, a marked and significant improvement in the immediate posttest, compared with the pre-test scores, was found. More importantly, the users who had used the computer program achieved a significantly higher grade. Moreover, multimedia textbooks can be quickly and inexpensively updated and repurposed for the lectures and the handouts, and are available on-line via computer networks for the
distance learning. The networked multimedia textbook approach, for the global distribution of multimedia information, brings the benefits of multimedia publishing on the Internet.

According to the subcommittee of the Computer Network Study Project Advisory Committee established under Senate Bill 294, 75th Texas Legislature (1999) there are major differences between a printed textbook and an electronic textbook. Electronic textbooks are made up of the same formatting and design elements as print textbooks, text formatting, symbolic text, graphics, and a navigation system. However, these formatting and design elements are enhanced because the information is presented making use of multimedia.

<table>
<thead>
<tr>
<th>Text</th>
<th>Printed textbook</th>
<th>Electronic textbook</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>Words and punctuation that make up the document.</td>
<td>Text may be resized, or the font may be changed to meet the reader's needs.</td>
</tr>
<tr>
<td>Text formatting</td>
<td>All of the attributes of characters and words, such as bold, italics, underline, colored lettering, or size. The words are structured into meaningful units, such as sentences, paragraphs, pages, sections, and chapters, as well as tables and lists.</td>
<td>In addition to all of the attributes of printed textbooks, text formatting in electronic textbooks may include hyperlinks which can move the reader to other parts of the page or book (see Navigation System below).</td>
</tr>
<tr>
<td>Symbolic Text</td>
<td>All subject-specific, semantically rich symbol sets, related text, and positioning which provide information and meaning.</td>
<td>Symbolic text in electronic textbooks may be resized or reformatted to meet the reader's needs. The student may be able to move symbols or edit text to solve problems. The resulting solution could be dynamically graphed or displayed for additional student interaction.</td>
</tr>
<tr>
<td>Graphics</td>
<td>Photographs, maps, charts, graphs, illustrations, and diagrams. These may have text associated with them, as with captions, or contain text embedded within the graphic itself.</td>
<td>The electronic versions of graphics may allow the image to be expanded to fill the entire screen, or sections of the image could be expanded to show detail. Graphs and charts may dynamically change to reflect student interaction or manipulation of associated data.</td>
</tr>
<tr>
<td>Navigation System</td>
<td>Formatting and design elements include colour sidebars, a table of contents, different levels of headings (chapter, section, subsection), indices, and page numbers. These navigation systems help the student find specific information (text or graphic) in a printed textbook.</td>
<td>Electronic textbooks use techniques for finding specific information within them, such as navigational maps, tables of contents with hyperlinks, heading levels, indices, and page numbers. They may also include hyperlinks, expand and collapse features, search functions, and interactive controls for navigating and controlling the information presentation.</td>
</tr>
</tbody>
</table>

Electronic textbooks, however, may also include the following elements, which are not typical of print textbooks:

- **Hyperlink.** A hyperlink is a segment of text (word or phrase), or an inline image (an image displayed as part of a document) which refers to a location within the current document, or another document (i.e., text, sound, image or movie) elsewhere on the Web. The electronic textbook may also include a “search” feature to find a specific word or phrase anywhere in the book. These navigation systems help the student find specific information (text, graphic, movie, or activity) in the electronic textbook.
• **Expand and Collapse Features.** Electronic textbooks also have the ability to expand or collapse their structure. For example, it is possible to produce a document which would collapse down to its major titles and subtitles. This makes it much easier to see the overall structure and to navigate to a particular level in the structure. Once that point is reached, it is possible to expand the structure exposing all of the paragraphs at that point.

• **Search Features.** Search features provide users with the ability to search documents and to jump immediately to any occurrence of a particular word or phrase which is used.

• **Sound.** Examples of this auditory information include prompts or warning sounds, music, spoken words, and natural sounds.

• **Fixed Sequence Animation and Movies.** Electronic textbooks may contain moving graphics.

• **Interactive Elements.** Electronic textbooks may contain visual graphic animation or symbolic interaction that can be controlled and manipulated by the student.

• **Live Information.** Electronic textbooks may contain hyperlinks to the Web that would provide students access to live information.

• **Collaborative Environments.** An electronic textbook could be designed giving students the ability to collaborate, through the use of "chat rooms", e-mail, discussion forums, or videoconferences. Students would be able to study with peers or a team to write reports, share research data, or share an area of the screen where they can draw, write, calculate, or otherwise work together on the same piece of paper.

• **Three-Dimensional or Immersive Environments.** An electronic textbook may include a three-dimensional environment or experience (commonly referred to as virtual reality). These environments can be viewed, heard, felt and/or manipulated using various stereoscopic displays, three dimensional sound systems, interfaces and/or three dimensional controllers. Ideally these environments should simulate real world experiences without real world constraints.

### 4.3. Interactivity and the emergence of intelligent electronic textbooks

According to Sims (1994), interactivity is the element which turns an electronic textbook from a passive into an active learning medium (Sims, 1994). In interactive materials it is provided access to a programming environment with a program editor, an interpreter or compiler, and even a graphic program design tool. In such systems, all examples and problems are active teaching operations. The student can not only look at the example but also use the above tools to investigate it: to execute it, to change something, to execute it again, and so forth. The same tools can replace paper and pencil for developing and
testing problem solutions interactively. Another example of adding interactivity to textbooks is demonstrated by program testing and grading systems. (Benfordet et al., 1994). This kind of programmes not only provides on-line access to the text of lectures and programming problems, but also can process student programmes (i.e., problem solutions) and provide the student with important feedback. In particular, it can test the correctness of a student's problem solution, measure its quality with several metrics, and report the results to the student. Such interactive feedback gets the students much more involved in the learning process. Interestingly, students often try to improve even correct solutions trying to get a better mark.

Interactivity is intrinsic to successful, effective instructional practice as well as individual discovery. Thus, the author argues the implementation of interactivity can be perceived as an art because it requires a comprehensive range of skills, including an understanding of the learner, an appreciation of software engineering capabilities, the importance of rigorous instructional design and the application of appropriate graphical interfaces.

Therefore, when developing multimedia applications, significant emphasis must be placed on the ways in which users can access, manipulate and navigate through the content material. Sims (1994) identifies a range of interactive concepts based on 11 concepts of interactivity which may be used as a guide to different modes of communication between computer and person. By applying these interactive concepts to multimedia courseware design, the various media elements can be integrated based on instructional decisions rather than visual appeal, allowing more effective communication and therefore potentially more educational effectiveness. An important aspect of the following classification of interactive concepts is that they are not mutually exclusive events, but elements which can be integrated to provide comprehensive and engaging instructional transactions.

<table>
<thead>
<tr>
<th>Interactive Concepts</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Object Interactivity</td>
<td>Refers to an application in which objects (buttons, people, things) are activated by using a mouse or other pointing device.</td>
</tr>
<tr>
<td>Linear Interactivity</td>
<td>Refers to applications in which the user is able to move (forwards or backwards) through a predetermined linear sequence of instructional material. Often termed electronic page-turning.</td>
</tr>
<tr>
<td>Hierarchical interactivity</td>
<td>The hierarchical (reactive navigation) class of interactivity can provide the learner with a predefined set of options from which a specific course of study may be selected. The most common example of this interaction is the menu, and in its basic format, learners will be directed to a linear interaction after selecting an item and returned to the original menu on completion of the sequence. This interaction is relatively simple in terms of development effort, especially if no conditions are attached to menu selection. However, if prerequisite and mastery conditions are required, the instructional strategies will require more careful specification.</td>
</tr>
<tr>
<td>Support Interactivity</td>
<td>Refers to the facility for the user to receive performance support, which may range from simple help messages to complex tutorial systems.</td>
</tr>
<tr>
<td>Update Interactivity</td>
<td>It relates to individual application components or events in which a dialogue is initiated between the learner and computer-generated content. The applications present or generate problems to which the learner must respond; the analysis of the response results in computer-generated update or feedback.</td>
</tr>
<tr>
<td>Construct</td>
<td>Is an extension to update interactivity, and requires the creation of an instructional</td>
</tr>
</tbody>
</table>
Interactivity as a means to access to significant learning is not only a simple navigation process (Caldas, 2003). On the contrary, it involves the drawing of interactive environments. Learning, therefore, depends mainly on the strategies used which should demand an adequate cognitive evolvement by the learner. Moreover, the addition of the cognitive capacities to the ability to master learning is positive as far as the development of learning and of interactivity is concerned. Therefore, it seems that the development of multimedia environments as a means to learning is an important challenge more in terms of design of environments through which the learner not only processes learning but also improves the development of cognitive strategies which enable to master, identify and select concepts and transfer acquired knowledge to new situations (Sims, 1994). In the same way this intelligent, integrated, interactive textbooks allow:

- **Self-paced learning**: Students can learn the material at their own pace. Simulations can be rerun multiple times to help students internalize the principles being demonstrated. Interactive problems can provide hints if required. And, of course, students can “flip” the pages when they want.

- **Multiple learning styles**: Students learn in various ways. Interactive textbooks show animations of concepts while they are being explained verbally. They also challenge kinesthetic learners with simulations that require a grasp of the concept as well as hand-eye coordination.

- **Self assessment for the student**: Each textbook provides many ways for a student to self assess. Sample problems show the student step-by-step solutions for a problem. Interactive checkpoint problems follow the same steps as sample problems, but supply hints when requested.
6. Conclusion

Printed textbooks have a long history in education and still retain several important advantages over electronic texts. Yet, the computer-based textbook is a new educational tool that promises to play a prominent role in the coming years. Classical instructional technologies, such as video, stills, audio files and computer programs with a textbook orientation, have been merged into one multimedia computer system and have created additional opportunities for learning. In fact, electronic texts also have their unique strengths in meeting the needs of learners: Electronic texts can incorporate simulations and other concrete examples, employ a style well-suited to a learner’s needs, and work in the opportunity to practice and elaborate upon what students have learned which is very appealing since interactive media provide teaching tools that appeal to diverse learning styles.

As students learn the basic concepts in a concrete form they will likely be able to learn effectively at a more abstract level, and certainly need to do so. Thus, for more advanced learners paper texts may retain their superiority over electronic texts for a considerable period of time.

We believe that the most important idea presented here is the notion that the textbook of the future will be a construction of the learner, drawing upon the data base and authoring linking and customizing tools provided. Instructional software will be of a different type: Instead of selecting, organizing and presenting content, software will provide tools that enable students to select, construct, organize and customize information from a variety of sources and representational modes, thus reinsuring that the times ahead in education will be exciting and challenging.

Referências


