

# Interactive digital board and memory strengthening

*Fernando D. Rubio Alcalá*  
*José Manuel Bautista Vallejo*  
University of Huelva

## SUMMARY:

*This article describes the methodological bases and learning efficacy of the computer application software Action Manager<sup>1</sup>. This pioneer teaching tool has been specifically designed for students' interaction in the English foreign language class. Memory strengthening, high motivation and attention are main elements in the program. In an experiment carried out in a primary education level context, students showed an optimal memory recall of the learning concepts in two memory tests for both working and long term memory.*

Key words: foreign language learning, new technologies, memory channels, motivation, attention, classroom language, communication in the foreign language classroom.

## 1. INTRODUCTION

New technologies applied to foreign language learning are being applied in many educational contexts. Among the different instruments available, the digital board<sup>2</sup> can be one of the most complete and innovative resources for teaching. With a computer, a projector and some other peripherals, different tasks can be carried out for teaching a foreign language in class, such as doing explanations supported by slides, showing web sites, watching films or documentaries, performing karaoke, using word processors for writing, etc. The use of this tool gives light for new methodological forms and may facilitate quick-learning tasks and at the same time raise students' interest and motivation.

However, the fast coming of these new resources can take us to a "pseudo" state of learning. Bear in mind, for instance, the study carried out by the USA Government in which no significant differences were appreciated in tests of mathematical and social knowledge in groups using Internet as a methodological base and other traditional methods (Bourge, 2002). Despite of this, and being the learning process so complex and the use of technologies quite recent, many aspects must be borne in mind before some instruments are deferred; for instance, some teachers may have never had training on the use of computers for language learning and may not be prepared to follow the appropriate procedures when using them, let alone using a digital board.

Broadly speaking, using a digital board have some evident advantages. On the one hand, the students' visual stimulus is enriched and their level of attention is raised. Also,

---

<sup>1</sup> Action Manager can be freely downloaded at [http://www.uhu.es/fernando\\_rubio](http://www.uhu.es/fernando_rubio)

<sup>2</sup> With the term "digital board" we are referring to a multimedia projection, and not necessarily a tactile board.

with appropriate speakers auditory perception can be boosted. On the other hand, students' interaction can be denied, that is, students become passive receivers of visual and auditory stimuli. Bearing in mind that there is a big number of kinaesthetic students in a classrooms (they are able to learn better when they receive information coming from movement and emotion), the use of digital board just as a strong visual and auditory support would not help fostering the learning process of those students.

For this reason, the digital board can be conceived not only as a visual and auditory support, but also as an interdirectional support, as it is shown in Figure 1, where the teacher can interact with the students, students with the teacher, students with students, and all of them according to the software used. In this way, the didactic function extends and the resource exploitation maximizes.

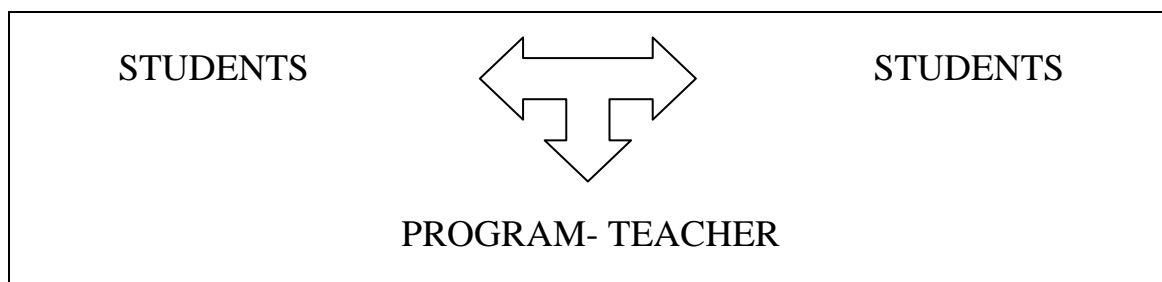


Figure 1: Tridirectional diagram of the digital board interactive use.

Using this interaction not only all learning perceptive styles are fostered, but also codification processes and memory fixation. Thus, the learner is able to recall the learning contents more efficiently when this type of interaction occurs, due to the fact that the five memory channels can be processed (semantic, procedural, emotional, episodic and automatic; Jensen, 1998; Sprenger, 1998). In fact, an accepted principle in the field of brain-based learning is focussed on the process of codification<sup>3</sup>, and it holds that the more elaborated this process is, the better memories are stored (Baddeley, 1999).

Studies on cognitive processing and the use of new technologies in the context of learning are scarce and this new area of research needs more dedication. In some contexts the use of new technologies has become a snobbish attraction or an instrument to raise motivation. In this article, it is shown that the interactive digital board not only motivates and gains students' attention, but it also contributes to make learning more efficient.

This paper explains the methodological basis and functioning of the software Action Manager<sup>®4</sup> (AM from now onwards), which has been the pioneer program of the interactive use of a digital board in the field of learning foreign languages<sup>5</sup> (Rubio 2002). To investigate the learning efficiency of the program, a study was carried out during the school year 2002-03. It intended to ascertain to what extend students were

<sup>3</sup> Schacter (1999:69) defines the concept of codification as "the processing of turning into memories of what people see, hear, think or feel".

<sup>4</sup> This research was facilitated by a Fellowship from the Action of Projects of Educational Innovation for the Improvement of Teaching Practice at the University of Huelva (2001-02). Please, see Rubio and Fonseca (2003) for an extended version of this paper.

<sup>5</sup> It has been specifically designed for learning actions and vocabulary to promote communication in the foreign language classroom.

able to recall words of the program in short and long term memory. After having four memory tests, results showed that the use of the interactive digital board with the AM program caused a deep mark in both memory processes.

## 2. ACTION MANAGER AND THE INTERACTIVE DIGITAL BOARD

### 2.1. DESCRIPTION

AM is a software program designed in FLASH where the players or students have to achieve the highest mark (see Figure 2 for a layout example). It is a typical card game where couples of cards must be found. The student, or a team, has to flip over two cards, in turns, until finding a couple. Next, when students find a pair they have to perform the same action as the one shown in the cards and repeat the word with the same pronunciation and intonation; otherwise, the cards will be turned back over again. Students will keep playing following the same dynamicity until they complete a total of eight couples of cards. Students always see the score they have achieved. The AM application allows up to six teams of students participating.



Figure 2: Example of an Action Manager screen.

Six out of the nine screens consist of animations carried out by a nice antihero character (see Figure 3), and three screens include people via video and picture format.

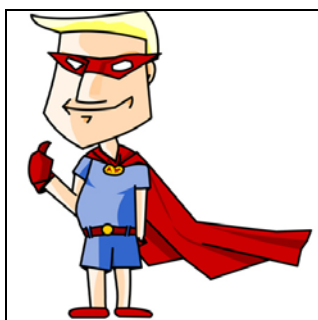


Figure 3: Action Manager animation carácter.

Although the program offers three different levels for the game depending on the knowledge of the player (elementary, intermediate and advanced), the program is thought for all learners because it deals with isolated words. Due to the informal character of the program, it may be more appropriate to use with children or with adult groups where there is a strong sense of confidence and security.

The linguistic elements to be learned belong to classroom language, which are vocabulary for actions, sounds, gestures, positions, orders, objects and feelings that can be helpful to promote real and more frequent communication in class: “*use as much of the target language as possible*” Cameron (2001:209). The AM application has 72 words, out of which 56 words are verbs, 8 nouns and 8 adjectives:

Screen 1: yawn, stretch, hiccup, snore, sigh, scream, clap your hands, hiss. Screen 2: whistle, whisper, clear your throat, grumble, nod, shake your head, beckon to your teacher, stick out your tongue. Screen 3: scratch your head, blow a kiss, wave your hand, lick your lips, shiver, pick your nose, caress your hair, fidget. Screen 4: sneeze, cough, snap your finger, wink an eye, laugh, put up your hand, be silent, wait. Screen 5: throw it in the bin, take out your dictionary, sharpen your pencil, go to the bathroom, turn on the lights, lend your ruler, turn around, speak louder. Screen 6: dangle your legs, fold your arms, stand up and sway back and forth, stand on tiptoe, pinch your cheek, shake hands with your partner, cross your legs, recline on your chair. Screen 7: stand up, sit down, look at your teacher, open your mouth, close your eyes, touch your head, read your book, take a pencil. Screen 8: rubber, stapler, scissors, notebook, board, ruler, glue, ballpen. Screen 9: happy, sleepy, scared, surprised, angry, crazy, in love, thoughtful.

### 3. THE INTERACTIVE DIGITAL BOARD AND MEMORY CHANNELS

Sprenger (1998) explains that people remember what they have learned using five memory channels that store information in different organs in the brain with different cognitive processes. These are the semantic, episodic, procedural, automatic and emotional channels.

The **semantic memory** is processed in the hippocampus in the form of a catalogue for semantic categories<sup>6</sup>, as Sylwester points out (1995). Therefore, the vocabulary acquisition is ideal when the student has the option to relate a word with others of the same semantic field. For this reason, the linguistic elements present in AM belong to a related semantic field: gestures, sounds, positions, actions, orders and objects that normally occur in a class context. Since they are usual actions, the chances for repeating this vocabulary is guaranteed, and then memory recall is reinforced<sup>7</sup>. However, not any

---

<sup>6</sup> This explains that vocabulary learning is more effective when it is organized in the same topic lessons or semantic categories.

<sup>7</sup> Rundus (1971) conducted a research of a task on free memories and discovered that the more frequent an item was repeated the better the memory was.

type of reception reinforces memories; as Baddeley explains (1999:129) “the pure automatic repetition is not the best way to assimilate new information”. The type of repetition that best fits the acquisition of a word in the memory is that one where the person has to elaborate connections of meaning between the semantic category and the previous knowledge of the concept. Therefore, the semantic memory in order to remember depends basically on the processing levels (or codification), and not on structures or stores (Craick and Lockhart, 1972). This means that when codification on an item is elaborated, memory is empowered. Aparicio summarizes this process as it follows (1993: 226):

Codification can include simple activities of sensory character or others, everytime more complex, until it achieves those activities that needs all available interpretative resources. The main prediction of the theory is that the marks out of the <<deeper>> complex semantic analysis are memorized better.

In spite of this, the user has to be aware that the semantic codification which is processed with the use of AM is limited. This is due to the fact that although the learning of vocabulary is learned meaningfully, the literature on this field indicates that a stage of transference is necessary for foreign learning to occur. Also, “only a certain type of semantic codification provokes a deep activation in the memory” (Schacter, 1999: 71). This means that AM concepts should be integrated into other tasks<sup>8</sup> that integrate all skills in different learning situations. Doing this and using the AM actions as they happen naturally in communication, semantic codification would have more possibilities to be elaborated.

AM simply offers an introduction of concepts and an ideal predisposition for acquisition supported by other eventual activities in class. An example of orientation tasks applied to the AM application would be to carry out an activity where the student has to answer questions such as: “*what would you rather do in class? Stretch, sigh, yawn, scream...*”. Then, the student has to establish semantic connections between concepts and his personal schemata. Another possible activity would be: “*Order these words according to loudness: sneeze, scream, sigh, whistle, whisper...*”. On this occasion, the student would have to know the meaning of the concept and establish comparisons according to personal values. Now the student is establishing connections between his new and previous knowledge. As Schacter (1999:71) explains:

If we wish to increase the probability to remind an incident or to learn a piece of information, we have to be sure of making an elaborated codification thinking about the information and connecting with other things that we already know.

Playing AM, the semantic channel is activated when the student has to induce the meaning of vocabulary watching the actions and listening to the sound of the word with its characteristic intonation (words are not translated). In every couple of cards, one has the name written down on it, and the other one has just the animation; the sound is the same for the matching couple.

The **episodic memory** is also present in the learning process of AM. This type of memory is responsible for those memories based on experienced images or episodes, so the brain evokes a memory as a picture or film. A way to foster this type of memory is to carry out an activity where the student does something different to what he usually does, so much that his brain records it as significant within his experience. For this reason, the digital board, with its enlarged screen projection, and together with sound and animation, creates new visual and auditory experiences. In order to create a deeper

---

<sup>8</sup> This is known in Cognitive Psychology as *orientation task*.

effect in the episodic memory processing, with AM students can see some actions carried out by a coloured attractive animation. The literature that deals with episodic memory points out the lack of precision of this type of memory<sup>9</sup>. This happens because a person builds images and facts in a subjective way, being able to change the built image from the original one. For this reason, the episodic memory activation should go along with other memory activations, as it happens with semantic memory.

The third memory channel is activated to remember things related to movement sequences, that is why it is called **procedural memory**<sup>10</sup>. This memory is reinforced by the repetition of movement successions and it is fixed when it becomes a routine. In AM, there are 72 concepts to learn, 56 are actions that make students imitate movements and produce a dramatized sound. For instance, when students get the “*stretch*” couple, they have to stretch, produce the right sound (onomatopoeia) and then utter the word.

The **automatic memory**<sup>11</sup>, as the concepts itself shows, is activated when memories are instantly evoked by a stimulus (image, music, gesture, etc.). The AM target is that students have to produce those learned concepts freely or automatically, that is, a student who is about to yawn and instantly thinks of the “*yawn*” term. The more repeated the concepts are, the better neuron connections take place; and therefore, a deeper evocation of the automatic memory is processed.

The fifth and the last type of memory mentioned by Sprenger (ibíd.) is the **emotional memory**. According to LeDoux (1996), it is the strongest memory lane of all types of memories. The emotional memory is activated when students in class have entertaining activities or enjoy a relaxing and ensuring atmosphere. To provide this, AM has been designed for a dynamic and amusing methodology. However, if the teams have a great sense of competition, they may have a stressing experience. It is the teacher’s task to create an appropriate atmosphere, not competitive nor too relaxed, because a moderate level of anxiety helps performing tasks (Rubio, 2004). The AM application offers teachers the chance to have from one up to six teams, and to avoid competition just one team to play (maybe against the teacher) would be in order.

The emotional memory, as well as the other four types of memory, has its own channel to process information, and the capacity for memory is deeply influenced by the way the information is shown. Thus, Sprenger (1998) explains that students may fail to answer right in an exam if required channels are not those used by students during the learning process. For instance, a written exam may evoke memory from different channels. The semantic memory can be stimulated by activities with gaps to be filled in or joining words in columns, or procedural memory by demanding students to write down the steps to follow in a certain action such as loading a car in a patrol station. It is important to bear in mind that undergoing a similar situation to the learned situation helps remembering better. Regarding the emotional memory, Baddeley (1999:335) points out that:

---

<sup>9</sup> See Damasio (1994) who points out that the episodic memory builds images from substratum or memory parts, that is, not as a whole picture, otherwise there would not be enough room to store episodic memories.

<sup>10</sup> Due to the dynamic and corporal character of this type of memory it is also called *muscular memory* (Jensen, 1998)

<sup>11</sup> Jensen (1998) calls this memory as *conditioned response memory* and Sprenger (1999) uses the term *stimulus-response memory*.

...everything experienced in a particular state of mind will tend to be remembered easier when that state of mind is restored, regardless of stimulus material is pleasant, unpleasant or neutral.

Therefore, if we intend to check if students have learned the AM linguistic elements, it would not be appropriate the traditional written exam because the stimuli and processing of memory channels are different.

Apart from having borne in mind the above mentioned five types of memory, it has been studied other forms of memory functioning such as auditory and visual memory. Specifically, Baddeley (1999:34) states that “the underlying auditory memory system has been developed to detect and use rhythmical and prosodic aspects in spoken language”. In order to achieve a better chance of auditory memory by playing AM, students listen to sounds and voices played in animations characterized by a rhythmical and prosodic variety. Thus, these sounds and voices are semantically related to the right action. For instance, the word “scream” starts with a scream and then it is pronounced screaming. This happens accordingly in every animation.

In a first step with the AM use, the auditory memory starts in the *working memory*<sup>12</sup> through the *phonological loop*<sup>13</sup>. Being AM a recurrent activity where linguistic elements can be repeated several times, codification processes are repeated so therefore those elements are learned better.

To sum up, if as Miller and others (1993:26-27) suggest, the learning is carried out due to several processes conjugation such as “sensation, perception, integration with previous memories, memory storage, taking decisions and creating answer”, the interactive digital board with the AM application can become a useful tool to foster students’ foreign language learning.

#### 4. ATTENTION

Memory and attention have a strong link, because they both need a quantity of cognitive energy to happen (Kahneman, 1973). Therefore, both processes work in a linear way: the more attention, the more chances to keep in mind the learning concepts. To get the students’ attention is one of the main goals of AM. This is easily accomplished with the use of the digital board. Attention is a mechanism of observation which maintenance depends on external and internal components (Roselló i Mir, 1998). The former, those extrinsic to the person, is defined by size, position, color, movement, novelty, repetition, intensity and complexity. Those stand out in AM, especially color, movement and novelty. Regarding the internal or intrinsic motivations, expectations and intentions take place. In any case, both components have to be present as Roselló i Mir (1998:33) explains:

We do not have to be ingenuous as to believe that this dichotomy between extrinsic and intrinsic stimulus represents two isolated and independent categories. The prosexigen valour of the external stimulus qualities can be modelled by cognitive and motivation elements, and these ones at the same time will be modelled by the former, becoming therefore the connection between both of them a kind of feedback dialectical loop.

---

<sup>12</sup> The *work memory* is a *short term memory*, though it is an old-fashion term.

<sup>13</sup> The *phonological loop* is a part of the work memory “which is used when we need to keep in mind a short piece of linguistic information for few seconds” (Schacter, 1999: 69).

Eysenck (1982) explains that motivational states can have a greater influence on attention processes. Here emotion is the ignition switch for attention and motivation to be raised:

If we realize that motivation and emotion are at least closely connected, and we have just studied that motivation and attention determine each other, then by an easy deductive process we can guess that an important link may exist between emotion and attention. (Roselló i Mir, 1998: 15).

Therefore, bearing in mind the explained characteristics about AM, intrinsic elements are present in the process, strengthening students' attention in the activity.

## 5. MOTIVATION

Motivation is a key element that is intended to be strengthened by the use of AM. The fact that new technologies take place in class makes students feel the learning process less monotonous and more enthusiastic. In addition, the competitive element in the game motivates even more the use up to the end of the game<sup>14</sup>. Motivation is a cognition and emotion drive. After many years of controversy about which is the most influencing element in learning, most researchers have adopted an eclectic position where emotion is considered to be essential for cognition to take place (Arnold, 2000). Christison (2000: 2) explains it as it follows:

Students' feelings and attitudes about language learning play a vital role in how successful they will ultimately be. Because it is not possible to separate emotions and cognition, teachers must be concerned with what students learn as well as with how and under what circumstances the learning takes place.

In short, AM has its own motivational elements so that teachers do not need to seek any other strategy to motivate students during the game. This is significant, due to the fact that sometimes teachers *encourage* students to learn, memorize or be motivated, but what it really influences the learning process is not the intention but the form of the cognitive process: "it is the codification operations and not the intuition to learn what determines the execution in the memory" (Aparicio, 1993:228). In short, AM raises the students' motivation by including several elements: use of new technologies, impressive or attracting images and sounds, dynamicity, competition in teams and targets to achieve (to get as much couples of cards as possible).

## 6. EXPERIMENT

To prove if the methodological framework of AM conducts to optimal learning, we carried out a study in which working and long term memory tests were applied. Other issues, such as students' beliefs about their motivation and level of attention were also measured.

### 6.1. OBJECTIVES

- To check if the instructions and procedures to follow during the game were appropriate.
- To analyse motivation, attention and memory fixation in short and long term memory.

---

<sup>14</sup> As we have mentioned before, competition may become a negative element in the game by creating high levels of anxiety and other negative emotions when facing an excessive rivalry and anguish for winning. For this reason and according to the age of the team, teachers must create a positive atmosphere for the game in order to avoid frustration.

## 6.2. SUBJECTS, DATA COLLECTION AND PROCEDURES

17 students from the sixth level (with nearly the same number of boys and girls) of a Primary Education school in Huelva, Spain, participated in the study. In a 60-minute session, the first 10 minutes were used to show eight actions to be learned. Then, the class was divided into two teams and played the game for 15 minutes. During the rest of the session, a questionnaire (about students' beliefs of attention and motivation) and the two memory tests (one with written support and another for free recall) were administered. 45 days later the memory tests were repeated following identical procedures in order to compare new results with previous ones. This would indicate the effect of the use of AM with respect to long-term memory recall.

## 6.3. RESULTS

About the motivational aspects of AM, 95% of students showed to have liked and enjoyed the game, as well as having understood the actions to be learned (note that meanings have to be induced, because they are only in English) and having paid attention during the game.

A comparative analysis of two memory tests was made with a range of 45 days. According to the results found in the first memory test, where students had to choose answers from a multiple-choice activity after the teacher performed the actions, students were able to remember most words. And if we compare the first test to the second test, where students had not had any exposition of the learning concepts in AM in the meantime, the number of correct answers is even greater in the second test, as it is shown in Figure 4:

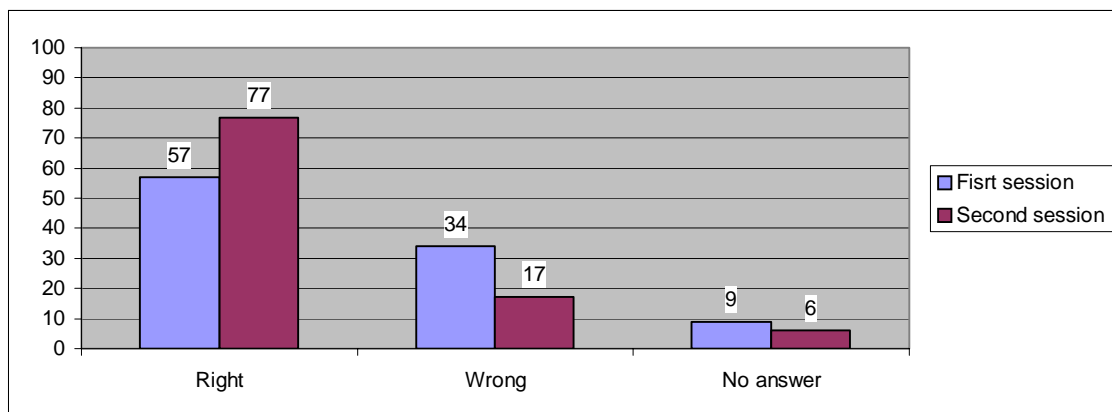


Figure 4: First and second memory test with visual support.

Similar results were found in the second memory test, where students wrote the actions that they saw performed without any type of written or auditory support (except for the onomatopoeia the action might contain). Obviously, this is a very difficult task:

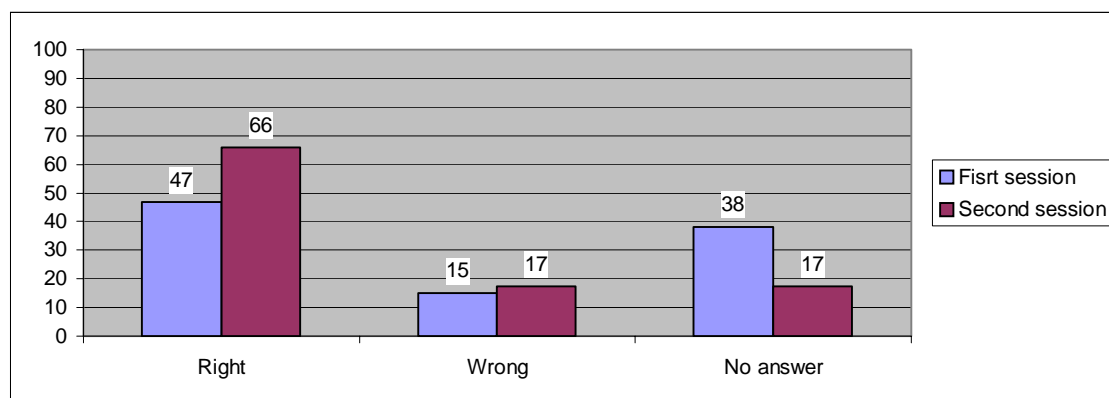


Figure 5: First and second memory test without visual or auditory support.

## CONCLUSION

This article has shown a connection between foreign language learning and the use of new technologies. Action Manager, throughout the use of the digital board, can be a useful tool to foster motivation in the foreign language classroom, and can also help in the acquisition of the concepts to be learned in the program. The learning of classroom language and meaningful communication is also promoted in order to enhance the natural use of language within the classroom. Both the methodological bases of AM, based mainly on the possible activation of the five memory channels and attention, and the study prove that the concepts to learn are prepared for long-term memory recall. However, it would be advisable to conduct further research with a bigger number of subjects and other contexts.

## BIBLIOGRAPHY

- Arnold, J. 2000. *La Dimensión Afectiva en el Aprendizaje del Inglés*. Cambridge: Cambridge University Press.
- Aparicio, J.J. El progreso en la teoría de la memoria: De los modelos multialmacén a la teoría de los niveles de profundidad de procesamiento. In J.I. Navarro Guzmán (Ed.), *Aprendizaje y Memoria Humana. Aspectos Básicos y Evolutivos*. Madrid: Mc-Graw-Hill.
- Baddeley, A. 1999. *Memoria Humana. Teoría y Práctica*. Madrid: McGraw-Hill.
- Bell, M.A. 2002. Why use an interactive whiteboard? A baker's dozen reasons! *Teachers.Net Gazette*, 3 (1), January. <http://teachers.net/gazette/JAN02/mabell.html> (22 January 2003).
- Bourge, C. 2002. No hypelinks to test success. Insight on the news. In [<http://www.brainconnection.com>].
- Cameron, L. 2001. *Teaching Languages to Young Learners*. Cambridge: Cambridge University Press.
- Christison, M.A. 1999. Applications of brain-based research for second language teaching and learning: Part 2. *TESOL Matters*, 9/ 3. In [<http://www.tesol.org/pubs/articles/1999/tm9906-04.html>].
- Craik, F.I.M. and Lockhart, R.S. 1972. Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, 11. [671-684].
- Damasio A. 1994. *Descartes' Error. Emotion, Reason and the Human Brain*. New York: Avon Books.
- Jensen, E. 1998. *Teaching with the Brain in Mind*. USA: ASCD.
- Kahneman, D. 1973. *Attention and Effort*. Englewood Cliffs: Prentice-Hall.

- Kennewell, S. 2001. Interactive whiteboards – yet another solution looking for a problem to solve? *Information Technology in Teacher Education*, 39, Autumn. [3-6].
- LeDoux, J. 1996. *The Emotional Brain*. New York: Simon & Schuster.
- Miller, R.R., Fiori, L.M. and Navarro Guzmán, J.I. 1993. Fundamentos de la memoria y el aprendizaje en el marco asociacionista. In J.I. Navarro Guzmán (Ed.), *Aprendizaje y Memoria Humana. Aspectos Básicos y Evolutivos*. Madrid: McGraw-Hill.
- Reid, J. 1995. *Learning Styles in the ESL/EFL Classroom*. Boston: Heinle & Heinle.
- Reid, J. 1998. *Understanding Learning Styles in the Second Language Classroom*. Englewood Cliffs: Prentice Hall Regents.
- Roselló i Mir, J. 1998. *Psicología de la Atención*. Madrid: Ediciones Pirámide.
- Rubio Alcalá, F.D. and Fonseca Mora, MC. (2003). Reflexiones sobre el uso de herramientas tecnológicas para la enseñanza del inglés en el aula de primaria: un proyecto de innovación educativa para alumnos de Magisterio. In M.A. Plaza Mejía et al, *Experiencia en la Universidad de Huelva. La Innovación Docente: un Camino hacia la Calidad*. Servicio de Publicaciones de la Universidad de Huelva.
- Rubio Alcalá, F.D. 2004. *La Ansiedad en el Aprendizaje de Idiomas*. Servicio de Publicaciones de la Universidad de Huelva.
- Rundus, D. 1971. Analysis of rehearsal processes in free recall. *Journal of Experimental Psychology*, 89. [63-77].
- Schacter, D. L. 1999. *En Busca de la Memoria. El Cerebro, la Mente y el Pasado*. Barcelona: Ediciones B.
- Sprenger, M. 1998. Memory lane is a two-way street. *Educational Leadership*, 56/ 3. [65-67].
- Sylwester, R. 1995. *A Celebration of Neurons*. Alexandria: ASCD.