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## The Use of Current Mobile Learning Applications in EFL

Rodríguez-Arancón, Pilar<sup>a\*</sup>, Arús, Jorge<sup>b</sup> and Calle, Cristina<sup>c</sup>

<sup>a</sup> UNED, Senda del Rey 7, Madrid, Spain <sup>b</sup> UCM, Ciudad Universitaria s/n, Madrid, Spain <sup>c</sup> UCM, Campus de Somosaguas, Madrid, Spain

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### Abstract

Technological developments in ubiquitous computing and wireless communication together with the adoption of mobile multimedia devices and applications have translated into huge opportunities for English as a foreign language (EFL). Operating systems like Google's open source Android, Apple's iOS, and Microsoft's Windows 7 are getting more sophisticated and now have the potential to dramatically change this field. These handheld devices support individual and collaborative learning and offer the opportunity to develop technology that will assist students to learn anytime and anywhere and a large amount of applications for mobile phones, tablets and i-pod players has already been widely employed in EFL.

Mobile learning (m-learning) refers to the use of mobile technologies for educational purposes. These devices can offer learning opportunities that are: spontaneous, informal, contextual, portable, ubiquitous, pervasive, and personal (Kukulska-Hulme *et al.*, 2011). Thus, as Pilling-Cormick and Garrison (2007) explained, learners take primary responsibility and control of their learning process, including setting goals and evaluating outcomes. They are no longer the passive recipients of education, but consumers making choices in the learning market.

However, although the stimuli from multi-channels (sound, image, interaction, etc.) may be very advantageous for the learner, mobile technologies also require the thoughtful integration of EFL pedagogy. In this paper, we intend to examine both the qualities and limitations of some mobile applications available by assessing their features from a pedagogic and technical point of view with the aid of a quality rubric. The results here presented are the starting point for the development of MALL (Mobile Assisted Language Learning) applications for EFL teaching/learning as part of the work carried out by linguists and IT engineers within the context of the SO-CALL-ME project in Spain.

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\* Pilar Rodríguez-Arancón. Tel.: +34 91 3989215.  
E-mail address: [prodriguez@flog.uned.es](mailto:prodriguez@flog.uned.es)

## 1. Introduction

MALL is a teaching and learning methodology that uses mobile phones or other handheld devices with some form of wireless connectivity, such as phones, PDAs and tablets, among others. O'Malley *et al.* (2003: 6) defined it as “any sort of learning that happens when the learner is not in a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies”. It is considered a booming future trend, thanks to its ubiquity, which facilitates education anywhere and anytime, and the ever-increasing interest among the growing number of users of smart-phones and portable devices.

The world is changing at high speed, we are moving from an industrial economy to one that is media-driven and based on information. As the world that surrounds us is becoming smaller and communication and media are becoming more global and diffuse, the nature of society, and of ourselves as human beings, is being defined quickly on the basis of our ability to be consumers but also producers of knowledge. The nature of knowledge - how and who creates it-, as well as the spaces where it is possible to find it are evolving rapidly (Kress, 2003). In the 21st century, the need for inserting the principles of *lifelong learning* in education and in broader development policies seems to be more urgent than ever before. These principles, if implemented systematically, will contribute to the establishment of more just and equitable societies. *Lifelong learning* comprises learning at all ages and forms: formal, non-formal and informal. Two UNESCO reports, which constitute real milestones in learning throughout life (Faure *et al.*, 1972; Delors report, 1996), articulated its fundamental principles (UNESCO, 2013).

MALL is without any doubt the next step in the evolution of educational technology, reflecting the digital convergence of mobile technology and e-learning in response to a more dynamic society that seeks a personalized, lifelong and universal education (Romero *et al.*, 2010). It is, therefore, the educational technology of the new century, as it can provide frequent and comprehensive access to systems and applications that support formal and informal learning. It gives the learner the opportunity to control and to take advantage of the free time that most people have during a typical day: while travelling to and from work, having a lunch break, or waiting to see somebody. Learning spaces have departed from the traditional classroom and have expanded their horizons: it is now possible to learn at home connected to a virtual space, or even walking down the street with a virtual application that provides information added to the place that you are visiting, or to an object that you are looking at in real time. MALL also presents a number of very attractive features that prove very useful for universities and educational institutions and rewarding for the students, such as: ubiquity of access to information, resources, materials and educational content; flexibility which promotes independent and collaborative learning; interactivity, usability and efficiency which enhance the learning environment, develop professional skills and encourage learning.

MALL took off in the 1980s, when Xerox Palo Alto Research Center (PARC) developed the *Dynabook*, a device very similar to what it is now known as a tablet. In the 90s, it continued to develop in universities in Europe and Asia, where the possibilities of m-learning were evaluated. Since the year 2000, the European Commission has financed large domestic companies in the creation of contents development projects. Thus, there have been several projects of the European Union related to MALL in the last decade:

- *MOBIlearn*, a research and development of technologies project for mobile learning which included several universities from Australia, America and Europe between 2002 and 2005.
- Mobile learning took its first steps in the *M-Learning program* for the Learning Skills Development Agency (LSDA) designing educational products. In 2001, it started with the M-Learning project that presented different portable devices programmed with games and educational materials. 250 young people from Sweden, Great Britain and Italy aged between 16 and 24 had to interact with them. At the end of this study, 80% of the participants considered that these applications could help them improve their reading and spelling skills.

- The *eMapps* project (Motivating Active Participation of Primary Schoolchildren) which focused on demonstrating how games and mobile technologies could be combined to provide motivating experiences on schoolchildren from 9 to 12 years of age. Its main objectives were to support creativity in the classroom and to contribute to practice for developing new teaching methodologies based on learning games, such as problem solving, memory and physical activity exercises.
- There has also been a rising number of references to MALL at well-known international conferences. *IADIS International Conference* and *Online Educa Berlin*, the largest global conference on technology, provide forums for the presentation and discussion of m-learning research which sketches the developments in the field.

In this light, the ATLAS research group (*Artificial Intelligent Techniques for Linguistic ApplicationS*), (reference no. 87H31), started its latest project, SO-CALL-ME (*Social Ontology-based Cognitively Augmented Language Learning Mobile Environment*), (reference no. FFI2011-29829), in Spain with funding from the Spanish Ministry of Science and Innovation. The project's aim is twofold: firstly, to design and develop a theoretical framework for a new model of EFL computer-assisted learning carried out from mobile devices with permanent access to the Internet to enhance a very flexible, adaptive, interactive and dynamic form of learning. Secondly, to design and develop a linguistic ontology of audiovisual learning objects that allows the enhancement of EFL avoiding the inherent problems in the standard teaching materials, which are largely static and de-contextualized from daily socio-cultural contexts.

In order to develop our own apps and seeing the large number of those already available on the market, it was considered very important to review some of the existing ones. This study was carried out in several phases: a first one focusing not on technical details but on the educational objectives of such applications; and a second one – the object of this paper – which analysed the technical and pedagogical values of some of those apps.

## 2. First phase of the evaluation of EFL apps

The potential of audiovisual materials is already well known as they present a combination of sound, image and creative elements that allow the learners to interact with them (Squire, 2002). This type of stimuli is ideal for learning, as Glasser (2000) remarked that humans retain 10% of what they read, 20% of what they hear, 30% of what they see and 50% of what they see and hear. Nevertheless, there are over 28,000 apps for educational purposes available on the market at present<sup>†</sup>, and it would be difficult to conclude that all of them are designed with a sound theoretical approach to teaching or the necessary cognitive scaffolding mechanisms to be of real value for the learners. Scaffolding is based on Vygotsky's (1978) concept of the zone of proximal development (ZPD), which he defined as the distance between the "actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86).

In a first evaluation phase for our project (Arús, Rodríguez-Arancón and Calle, in press), the aim was to analyze some of these apps in order to gain knowledge and insights into the features that are effective and suitable for learners using MALL. This original assessment phase did not focus on the technical specifications of the apps, but rather on their pedagogic goals, in a most general sense. No in-depth methodological analysis of any particular app was therefore intended at that stage. In order to carry out this evaluation process, two templates were created, and shared through Google Drive: the first was a table with two columns and an extendible number of rows where each of the three evaluators could indicate the app assessed and their URL to avoid any possible repetitions. The second template consisted of a rubric created by the authors of this paper for this purpose, with

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<sup>†</sup> <http://www.eduapps.es>

three criteria and a scale from one to five. The intention was to keep the rubric simple and in line with our project's specific needs. The purpose was to assess as many apps as possible within a relatively short space of time and guarantee the homogeneity of the process. The three criteria considered were: 1) the apps cognitive value; 2) similarity of the app with the pedagogic aims of the SO-CALL-ME project; and 3) the app's complementarity with the project. Each rubric was also accompanied by a brief description of the app and a final evaluative remark.

This process concluded with 67 assessed EFL apps through a combination of the study of the information available on websites that described them and, whenever possible, the testing of how they work on a mobile device. Each evaluator assessed different apps, which has the advantage of providing information about a larger number of them but also the potential disadvantage of less reliable assessments. However, the comparison of the rubrics in the only two cases in which two evaluators accidentally assessed the same app proved to show rather similar criteria of analysis.

There were interesting conclusions at the end of this first phase, as the study had put forward several aspects to take into consideration for the following stages. There was a high number of apps that presented technical problems at the time of downloading or when starting them. In fact, more than one third of the apps downloaded by the evaluators proved not to work properly or not to work at all. Concerning software, the vast majority of apps assessed were available for Apple devices –*iPhone*, *iPad* and, sometimes, *iPod Touch* – and around one in four were also available for *Android*; very few were *only* available for the latter. Other operating systems such as *BlackBerry OS*, *Bada* or *Ovi* do not seem to be targeted by app developers to the same extent. A few of them could also be directly run from the Internet on a conventional computer.

Another interesting observation regarded prices, as three marketing approaches were defined: expensive apps, which are in fact mobile versions of traditional dictionaries, textbooks, vocabulary or grammar tests, etc. have prices as high as 30 euros. A second group are downloadable for a small amount (1 to 3 euros) such as Cambridge's *English Monstruo*, or have an initial free sample and the possibility to download further packs as, for instance, the British Council's *LearnEnglish Grammar*. A third group is represented by English courses such as *Busuu* or EF's *EnglishTown*, in which the price depends on the needs of the user and/or seasonal offers.

The apps were also categorised in several groups according to their contents: a) Games, very often aimed at children, e.g. the apps available from Cambridge English Online; b) app versions of dictionaries, handbooks and textbooks, e.g. Cambridge's EFL methods, dictionaries, etc.; c) apps providing vocabulary, grammar and/or pronunciation practice, such as *My Word Book*, *Johnny Grammar's Quiz Master*, *60 Second Word Challenge* or *Sounds Right*; d) the adaptation of online courses such as *Busuu* and EF's *EnglishTown* to mobile devices; e) most closely related to the interests and goals of the SO-CALL-ME project are those apps exploiting the use of language in context and presented in a variety of ways, such as podcasts –e.g. *Learn English*, *Talking Business English*– videos –e.g. *Learn English Audio & Video*, *Conversation English*– films –e.g. *English Attack*– and cartoons –e.g. *Big City Small World*.

A last conclusion resulting from the assessment and which will be very relevant for the future development of our own apps concerns those features found which differentiated some apps from the rest and provided and added value. Features such as “drag-and-drop” available in *Learn English Grammar*; the possibility to draw with your finger, as in *Premier Skills*; connectivity with social networks, as offered by *Language City*, *Learn English*, *60 Second Word Challenge* and *Tongue Mystery English*; or the inclusion of an Avatar, as in Cambridge's *Quiz up* which could be particularly appealing from a pedagogical point of view.

### 3. A quality guide and rubric for the evaluation of educational apps

In the second evaluation phase here described, a guide was created containing the quality criteria for the evaluation and creation of educational apps. This guide, based on the one created by Fernández-Pampillón *et al.* (2012) for the creation of Learning Objects, has the purpose of guiding app assessors and creators when carrying

out their tasks, specifying those aspects, or criteria, that should be taken into account to identify or create quality apps and spelling out the specific points to be considered within each criterion so as to try to reduce subjectivity to a minimum.

The app quality guide takes the ten criteria used by Fernández-Pampillón *et al.* and adapts them to the characteristics and goals of educational apps. Table 1 shows the ten original quality criteria for Learning Objects and our adaptation for educational apps. An important aspect of this guide is that it combines pedagogical criteria (1-5) with technical ones (6-10). This avoids the risk of evaluating apps only from a technical point of view, which, as stated by Balance (2013) “is to discuss little more than mobile-enabled CALL” (2013: 44) but also reflects the fact that apps are very much dependant on technology and should therefore not be evaluated from an exclusively pedagogical perspective.

Table 1. Quality criteria. From Learning Objects to educational applications.

Quality criteria in Fernández-Pampillón <i>et al.</i> (2012)	Adaptation to Educational Applications
1. Goals and pedagogic coherence	1. Cognitive value and pedagogic coherence
2. Content quality	2. Content quality
3. Capacity to generate reflection, critical thinking and innovation	3. Capacity to generate learning
4. Interactivity and adaptability	4. Interactivity and adaptability
5. Motivation	5. Motivation
6. Format and layout	6. Format and layout
7. Usability	7. Usability
8. Accessibility	8. Accessibility
9. Reusability	9. Visibility
10. Interoperability	10. Compatibility

As we can see in table 1, changes concern criteria 1, 3, 9 and 10. The change in criterion 1 can be simply considered a nomenclature one, seeking to widen the assessment’s scope, as under ‘cognitive value’ we can include not only the application’s goals but also the specification of its target users and skills to be developed (see table 2, below). Conversely, the change in criterion 3, also chiefly terminological, tries to simplify matters, as the allusion to ‘reflection’ and ‘critical thinking’ as found in the original Learning Objects guide does not seem to go hand in hand with something as transient as an app (see Stockwell 2012 about apps and transience). In addition, ‘capacity to generate learning’ allows a neat contrast with the ‘cognitive value’ in the first criterion, which refers to the potential, whereas criterion 3 has to do with the actual achievement of the promised goals. ‘Reusability’ in the original criterion 9 is a key feature in Learning Objects, as their modular nature precisely seeks to make different parts of them reusable. When dealing with mobile applications, however, the reusability of their different parts is not something essential to the quality of the app, even if it is always convenient for app designers to be able to reuse already created materials. When speaking of mobile apps, a key concept is ‘visibility’, and that is why this has substituted for ‘reusability’ in our guide. Finally, ‘Interoperability’ in 10 has been replaced with ‘Compatibility’ as the former may sound too much of a buzzword for those outside the specialized IT jargon, where it is usually employed to refer to the capacity of two products or systems to work with each other. Since this reciprocity involves looking at both ends, i.e. the app and the mobile device, and we are here focusing on the former, we found that the more widely known ‘compatibility’ served our purposes better.

Space constraints bar us from showing the whole guide here, yet, to give an idea of what the quality guide looks like, we show the complete specification of criterion 1 in table 2. It must be noted that the sub-criteria

within each criterion have also been adapted to meet the needs of educational applications. For instance, one of the points within this first criterion for the evaluation of Learning Objects refers to the existence of a metadata file specifying goals, skills, etc. Since this kind of files are specific to Learning Objects but irrelevant to apps, the mention of metadata files has disappeared from our quality guide.

Table 2. Criterion 1 and its sub-criteria in the quality guide for the evaluation and creation of educational applications.

<p>1. Cognitive value and pedagogic coherence</p> <p>This criterion assesses if the teaching aim(s), the target users and the skills to be developed are clearly set from the beginning. In particular, it must be assessed whether:</p> <p>a. The app’s download page, or the app itself, includes a description or a demo clearly specifying and/or showing the pedagogic aims, the skills to be developed and the users’ type/level/needs.</p> <p>b. There is coherence between the aims, the skills, and the target users.</p> <p>c. There is coherence between the aims/users/skills and the app’s contents, resulting in a potential high cognitive value.</p>
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Based on this guide, a new rubric was designed to facilitate the app evaluation process. As seen in table 3, which illustrates the first row in the rubric, the information in the cells is based on the specifications made in the quality guide. The way in which we proceeded was to first fill in the cell corresponding to the maximum punctuation, i.e. 5, with the fulfillment of all the sub-criteria and gradually slacken such fulfillment as we move down the scale until the minimum punctuation, i.e. 1, is reached, where none of the sub-criteria is fulfilled.

Table 3. Criterion 1 in the educational app evaluation rubric.

	1	2	3	4	5
1. Cognitive value and pedagogic coherence	Not very clear learning goals and/or target users; contents are hard to justify	There is coherence between skills and target users but the learning goals are unclear	Clear learning goals but lack of coherence between these goals and skills and target users; contents are not well-suited to the goals, skills and target users	Clear learning goals but lack of coherence between these goals and skills and target users OR contents are not well-suited to the goals, skills and target users	Clear learning goals; coherence between these goals and skills and target users; contents are well-suited to the goals, skills and target users

This is by no means the first rubric for the evaluation of educational apps in the field of MALL. For instance, Toni Vincent’s rubric (Vincent online), drawing in turn on Walker 2010, spotlights the following five criteria: relevance, customization, feedback, thinking skills, engagement and sharing. While this rubric is highly practical by virtue of its simplicity, we find that, by the same token, its scope is somewhat limited. For instance, the fact that, as said above, our rubric –the same as the original quality guide in Fernández-Pampillón *et al.*– includes a number of technical criteria, makes it more complete, with these technical aspects complementing the pedagogical ones. Additionally, the accompanying quality guide provides an important back up to the use of the rubric.

#### 4. Results and discussion

In this paper we have reported on the work carried out in order to develop the necessary tools to evaluate and create educational apps within the context of the SO-CALL-ME research project. A quality guide and a rubric were the results of such work, as seen in the previous section. Before tackling the quantitative evaluation of educational apps with the use of our rubric, as well as using it as a guide in the creation of apps within our project, a first step was taken to test the reliability of the rubric. To that end, two of the authors of this paper undertook the evaluation of four EFL apps so as to get their impressions on the use of the rubric and to check whether the rubric allowed a rather objective evaluation (in addition, of course, to obtaining information about the evaluated apps). In the next few paragraphs, we show and discuss the preliminary results obtained.

Out of the 63 EFL apps previously evaluated with a simpler rubric, as reported in Arús, Rodríguez-Arancón and Calle (in press), four of those obtaining the highest punctuation, i.e. with the highest potential to serve as sources of inspiration for the apps to be developed, were chosen for this preliminary evaluation. The four apps were: *Englishfeed*, *SpeakingPal English Tutor*, *Clear Speech* and *Learn English Audio and Video*. Table 4 summarizes the results of the evaluations and compares the punctuations given by both evaluators.

Table 4. Evaluation results (Ev.1= evaluator 1; Ev.2= evaluator 2).

	Evaluation							
	Englishfeed		SpeakingPal		Clear Speech		Audio&Video	
	Ev.1	Ev.2	Ev.1	Ev.2	Ev.1	Ev.2	Ev.1	Ev.2
1. Cognitive value and pedagogic coherence	5	3	4	5	5	5	4	4
2. Content quality	5	3	5	5	3	3	5	5
3. Capacity to generate learning	4	4	5	5	3	3	4	3
4. Interactivity and adaptability	4	2	4	4	2	3	3	4
5. Motivation	5	4	5	5	3	2	4	3
6. Format and layout	5	3	5	5	2	2	5	5
7. Usability	5	4	5	5	3	3	5	5
8. Accessibility	5	5	4	5	4	4	4	4
9. Visibility	3	5	4	4	4	4	4	4
10. Compatibility	4	4	4	3	3	3	4	4

Although the number of apps so far evaluated is still too small to statistically measure the evaluators' agreement, the results shown in table 4 do seem to show consistency between the two evaluators and therefore allow us to be optimistic as to the usability of the rubric. An interesting point that stands out is that criterion 4 – Interactivity and adaptability– seems to be the weakest one in the apps evaluated. If a wider-scale evaluation confirms this, it will mean this is the aspect on which special emphasis must be made when developing new educational apps. In fact, it comes as no surprise that this should be the weakest point in educational apps. A look at table 5, which shows the specification for this criterion in our quality guide, reveals that these are the essential requisites for successful Foreign Language teaching, and precisely the ones with which teaching methods in general have traditionally found it the hardest to comply.

Table 5. *Interactivity and adaptability* in our quality guide.

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The *interactivity* criterion is related to the fact that the presentation of the content is not static but that it depends on the use by the learner. It must be taken into account if:

- a. The content presented to the users is related to the questions, answers or actions that they have previously carried out.
- b. The content presented depends on the previous knowledge of the learners or on their needs.
- c. Users feel that they really control and manage their learning process.
- d. Conditioned content presentation is automatic, through programming, or manual, through the apps' instructions for use.

The *adaptability* criterion is related to the ease with which the app adapts to the different types of users. It must be taken into account if:

- e. The app proposes different contents/activities for different competence levels.
  - f. The app can be used independently of specific teaching or learning methods.
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The discussion in this section has highlighted the educational affordances of the rubric here presented, with the back-up provided by our quality guide, both for the evaluation of educational apps and for the design of new ones. Pending tasks are the extension of the evaluation to a higher number of apps and, most important for the goals of the SO-CALL-ME research project, the actual implementation of the quality criteria for the development of EFL mobile applications that successfully combine technical prowess (criteria 6-10) and a sound pedagogy (criteria 1-5).

## References

- Arús, J., Rodríguez, P. & Calle, C. (in press). A pedagogic assessment of mobile learning applications. *Proceedings of ICDE 2013: Mobilizing Distance Education*.
- Ballance, O. J. (2013). MALL. Somewhere between the tower, the field, the classroom and the market: a reply to professor Stockwell's response. *Language Learning and Technology* 17.1, 37-46. <http://llt.msu.edu/issues/february2013/ballance.pdf> (accessed 18 April, 2013)
- Delors, J. (1996). *La Educación Encierra un Tesoro*. Informe a la UNESCO de la Comisión Internacional sobre la Educación para el Siglo XXI. Madrid: Santillana-UNESCO.
- Faure, E., Herrera, F., Kaddoura, A.-R., Lopes, H., Petrovsky, A. V. Rahnema, M. & Champion Ward, F. (1972). *Learning to be. The world of education today and tomorrow*. Paris: UNESCO.
- Fernández-Pampillón Cesteros, A., Domínguez Romero, E. & Armas Ranero, I. (2012). *Herramienta de Evaluación de la Calidad de Objetos de Aprendizaje (herramienta COdA): Guía para la producción y evaluación de materiales didácticos digitales (Versión 1.1)*. Madrid: Universidad Complutense.
- Glasser, W. (2000). *Every Student Can Succeed*. Chula Vista, CA: Black Forest Press.
- Kress, G. (2003). *Literacy in the New Media Age*. London: Routledge.
- Kukulka-Hulme, A., Pettit, J., Bradley, L., Carvalho, A., Herrington, A., Kennedy, D., & Walker, A. (2011). Mature Students Using Mobile Devices in Life and Learning. *International Journal of Mobile and Blended Learning*, 31(1), 18-52. <http://hdl.handle.net/1822/12035> (accessed 17 April, 2013).
- O'Malley, C., Vavoula, G., Glew, J. P., Taylor, J., Sharples, M. & Lefrere, P. (2003). MOBILElearn WP4 – Guidelines for learning/teaching/tutoring in a mobile environment. <http://www.mobilelearn.org/download/results/guidelines.pdf> (accessed 22 April, 2013)
- Pilling-Cormick, J. & Garrison, D. R. (2007). Self-Directed and Self-Regulated Learning: Conceptual Links. *Canadian Journal of University Continuing Education* 33(2), 13-33.
- Romero, D., Molina, A. & Chirino, V. (2010). *Aprendizaje móvil: tendencias, cuestiones y retos. IEEE-Rita. Vol. 5, 4*, 123-124.
- Squire, K. D. (2002). Rethinking the Role of Games in Education. *International Journal of Computer Game Research*, 2.1. <http://www.gamestudies.org/0102/squire/> (accessed 30 January, 2013)
- Stockwell, G. (2012). Mobile-assisted language learning. In M. Thomas, H. Reinders & M. Warschauer (Eds.), *Contemporary Computer-Assisted Language Learning* (pp. 201-216). London: Continuum.
- UNESCO Institute for Lifelong Learning. <http://uil.unesco.org/es/portal/areas-de-negocio/politicas-y-estrategias-de-aprendizaje-a-lo-largo-de-toda-la-vida/a7eb14a706515833a26abd8b61229ffb/> (accessed 26 April, 2013)
- Vincent, Tony (online) Ways to evaluate educational apps. <http://learninginhand.com/blog/ways-to-evaluate-educational-apps.html> (accessed 18 April, 2013)
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Walker, H. (2010). Evaluating the Effectiveness of Apps for Mobile Devices. *Journal of Special Educational Technology* 26.4, 59-63.