Research & development paper

Developing CALL for heritage languages: The 7 Keys of the Dragon

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Abstract

In this article we present an interactive extensible software, *The 7 Keys of the Dragon*, for the teaching/learning of Albanian and Russian to students that attend primary and secondary education in Greece with the respective languages as their heritage languages. We address the key challenges we encountered during the conceptualization phase of the project development and the specific design choices we implemented in order to accommodate them. Drawing on recent research on the role of Computer-Assisted Language Learning (CALL) applications for young bilingual populations, we aimed at creating a user friendly environment with a clear pedagogical orientation. Furthermore, given that games in language learning are associated with intrinsic motivation and meaningful exposure to the target language, we have integrated a fairy-tale background narrative, a game-inspired reward system, and two cartoon-like assistant characters to stimulate the user's involvement in the learning tasks. Five chapters for each target language were created, each comprising a text, a variety of scaffolding material and quizzes. The software is designed to provide real-time automatic correction of quizzes and allow for easy expansion with additional quizzes and texts. A separate application for teachers facilitates essay correction and commenting on the students' language learning progress and achievements.

Keywords: Online language learning, heritage languages, Russian, Albanian, focus-form activities.

1. Introduction and motivation

The programme 'Education of Immigrant and Repatriate Students' was designed to improve the education of students of immigrant or repatriate background in order to lower school failure and dropout rates by offering equal learning opportunities to these students. A particular action of this programme, Action 5, aimed at the reinforcement of the mother tongue, or *heritage language* (HL) (1), as a means to attain the social integration of these students, who otherwise lack the opportunity to maintain their mother language outside their family environment. For this purpose, a pilot programme of mother tongue language classes for Albanian and Russian were organised in several schools in Thessaloniki and Athens. These two languages were chosen as they had the largest number of speakers in the target population.

One of the central tasks of Action 5 was to bring together linguists, language education and bilingualism specialists, Albanian/Russian-speaking writers-editors of educational materials, software engineers and graphic designers, in order to organize the structure and the syllabus of the pilot language classes and, of course, to produce the appropriate language material that would best meet and accommodate the learning needs of the student population at hand. The ultimate goal was to present a comprehensive and feasible proposal for teaching HLs that could be easily implemented in the Greek education system. In this article, we present the methodology followed for the construction of the electronic language learning environment with emphasis on the pedagogical, linguistic and technical challenges we met which, ultimately, led to the incorporation of certain innovative features in the design of the environment.

The language lessons began in 2011 and were completed at the end of the school year in 2013. Due to restrictions imposed by the operating conditions of the cooperating schools and the constitutional status of the Project, the language courses were adjoined as an extra-curriculum activity ('additive approach' to learning, see Banks, 1989), and were allotted only a two-hour slot per week at the end of the school day. The courses took place just after the end of the morning classes, with a half-hour break between them. Our students were between 9-13 years old, they came from different backgrounds and had various language proficiency levels ranging from no or limited knowledge of the target language to advanced spoken ability. However, all exhibited limited or non-extant writing skills. The students were grouped in classes for beginners or advanced learners, according to their scores in a language placement test they took at the beginning of the school year.

With respect to the language instructors, the ones recruited for the Albanian and Russian language courses were keen on using traditional teaching methods and had limited or no efficiency in computer-assisted language teaching skills. The teachers' poor digital literacy rendered them suspicious or unwilling to integrate Computer Assisted Language Learning (henceforth CALL) into the language classroom thus putting the whole project at risk. This was a major problem which was tackled via two training seminars (3 hours each) on CALL and, especially, on the administrator/teacher application structure of the 7Keys.

Given the pilot nature of the endeavour and the specific conditions under which the classes had to be structured, we decided that a *blended learning model* (Neumeier, 2005; Motteram & Sharma, 2009) would be the most fitting strategy to organize our courses since it integrates components from both face-to-face and CALL into a single language learning and teaching environment. According to Yager & Roy (1993), computers should be integrated in a classroom setting with the rest of the learning resources and should be treated as one more of the possible ways of accessing the learning materials. In-class and computer-assisted modes of teaching and learning are expected, therefore, to curtail differences at language proficiency levels such as the ones mentioned above. More importantly, blended learning constitutes an ideal strategy for enhancing the creation of networks among the students within and outside the class, thus, paving the way for collaborative work and assistive learning.

In the two-year development phase of the pilot project, an e-learning system with game features, dubbed *The 7 Keys of the Dragon* (henceforth 7Keys), was developed in order to better organize the HL learning lessons, enhance the form-focused practice and enrich the teacher-student interaction outside the time and space limits of the class. A welcome result of an e-learning environment such as the 7Keys is that it allows the student to engage in a fruitful and enjoyable process of language learning in the comfort of his/her own personal environment (e.g. at home), at his/her own pace and, more importantly, with a focus on his/her own language needs. Moreover, it offers the

potential to language instructors to keep control of their classroom and constantly adapt the e-learning materials to their students' particular needs.

The remainder of this article is organised as follows: we review the literature on CALL with emphasis on materials and tools that were developed for HL learning, especially, those that were designed for young populations, and report on those characteristics that inspired us in the development of the 7Keys. Then we move on to presenting the key objectives we aimed at and the ways in which these were implemented in the e-learning environment. We also discuss issues pertaining to the architecture of the 7Keys' main components, the type and focus of the language learning materials and the pedagogical and language learning framework that served as its basis. The final section concludes this article.

2. Heritage languages and CALL

In this section we provide a short review of the literature on HL and CALL with emphasis on the young learner. We commence by describing the main characteristics of the HL learners that distinguish them from native and second (L2)/foreign language speakers (§2.1). We introduce the contemporary CALL ((a)synchronous) tools used in language learning classes addressed to young learners (§2.2) and also report on the positive effects of its use in HL classes based on the results of previous studies on the subject (§2.3). Furthermore, we discuss the language instructors' role in the design and assessment of CALL materials and their stance regarding the integration of CALL applications in the teaching practice (§2.4). This section concludes with an enumeration of the key considerations we had to work on in the development phase of the 7Keys, as these were dictated by current research on the design and development of CALL materials and of course by the specific learning needs of the population in question, i.e. the young learners of Albanian and Russian (§2.5).

2.1. The heritage language learner

Due to the heterogeneity of the heritage language speakers, it is hard to identify the basic properties of this group (2). Based on Valdés (2000), Benmamoun, Montrul & Polinsky (2013b: 260) heritage speakers can be defined as "asymmetrical bilinguals who learned language X – the 'heritage language' – as an L1 in childhood, but who, as adults, are dominant in a different language". Heritage languages are usually spoken by immigrant communities although the notion may also refer to colonial languages, indigenous languages, languages that may have or lack an official status in the areas, territories or communities in which they are spoken. Under a broader definition, it also pertains to a cultural or ancestral association of a population with a given language without presupposing bilingualism (see Fishman, 2001, 2006; Cummins, 2005).

It is not uncommon for heritage speakers to lack the full spectrum of language skills (e.g., their proficiency in reading and writing rarely extends beyond the elementary levels of literacy) and, therefore, to exhibit poor or no academic proficiency. For instance, Roca (2000) reports that heritage speakers of Spanish fall short on literacy skills and exhibit a rather confined vocabulary and use of registers. This is anticipated given that the HL speakers' contact with the language community is limited or restricted to their family and community members, whereas education in their heritage language is either fragmentary (Saturday/Sunday schools or after-school programmes notwithstanding) or absent (Campbell & Rosenthal, 2000; Kagan & Dillon, 2001). They do exhibit, however, good or native-like pronunciation and aural competence.

To sum up, HL speakers' grammatical and lexical competence clearly identifies them as a distinct group from native and L2/foreign language speakers.

2.2. CALL and the young learner

Since its first appearance in the 1980s, CALL has made its way through the language learning classes. However, the bulk of CALL research is still either unspecified as for the target age or is addressed to adult populations (Ramirez Verdugo & Alonso Belmonte, 2007: 88). It was only until recently that special attention was given to young learners' language learning needs (3).

A growing number of publications explore how various state-of-the-art technologies can foster language development in younger learners (e.g., Lewis, 2004; Parker, 2007; Pim, 2013). Pim (2013), for instance, offers an insightful presentation of present day e-tools, interactive multimedia tools, digital games, apps and software tools – designed to be used in laptops, tablets and smart phones – that improve the language learning experience for both children and adults. Asynchronous tools like email, wiki writing, blogging, etc. (Terrell, 2011; Wang & Vásquez, 2012) and synchronous environments such as video-conferencing (e.g., Skype), social networks (e.g., Facebook), interaction through online virtual worlds, e.g. Second Life (http://secondlife.com), Active Worlds (http://www.activeworlds.com), among others, have been effectively integrated in language learning methodologies giving to learners the opportunity to develop their reading and writing skills (Hew & Cheung, 2010; Zheng, Young, Wagner & Brewer, 2009).

The contribution of ICALL to foreign language teaching and learning is significant, especially with respect to the development of young learners' language skills or their acquisition of grammar. An instructive example of focused training is the CHELSEA and CRYSTAL (4) computer-training platform that offers individualized and self-paced acquisition of English phonology by pre-schoolers with Chinese as a first language. The platform makes use of automatic speech recognition and text-to-audiovisual-speech tools in order to help users detect the non-target pronunciations of English in their speech and correct them with practice.

Finally, digital games have a special place in the field because they attract the interest and trigger the excitement of younger users (Peterson, 2010; Cornillie, Thorne & Desmet, 2012). Texts and the accompanying language materials are complemented by a captivating fictional narrative and they are appropriately enriched with animations, fascinating characters or avatars, video and audio effects and other virtual experiences that stimulate interaction with peers and foster a spirit of constructive competition among them (Purushotma, Thorne & Wheatley, 2009). Gee & Hayes (2011) claim that with the advent of new forms of digital media, children are increasingly drawn towards video games, social media, and alternative ways of learning.

2.3. CALL in the heritage language classroom

Language maintenance and preservation, especially among young HL speakers, is pivotal and there have been several efforts for the development of more effective and innovative strategies for the revitalization and the teaching/learning of HLs, both within and outside the formal system of education (5). A growing number of studies, for instance, have examined how technology can be used to record and preserve indigenous languages for revitalization purposes (Buszard-Welcher, 2001; Warschauer, 2003; Villa, 2002; Ward, 2004). However, not as much attention has been given in this respect to HL learners in primary and secondary education (Lee, 2006). How the languages of immigrant or minority communities are approached reflects power structures, political systems and basic philosophies in society which influence the language policy of a state or a nation (Baker & Prys Jones, 1998). The language policy in turn affects the curriculum in schools and *if* and *how* heritage languages are taught. For this reason, CALL in relation to heritage languages is often the concern of immigrant

and minority communities and/or the result of applications by individual second language teachers, seeking a way to make their lessons more motivating and effective (Aravossitas, 2010).

The benefits of CALL for HL teaching are explored in a number of studies. For instance, Meskill & Anthony's (2008) research of Russian heritage learners in post-secondary foreign language courses has shown that *computer mediated communication* (CMC) (e.g., email, instant messaging, blogs, chatrooms, gaming, and online instructional forums) had a positive effect on academic literacy development. Furthermore, CMC tools are fruitfully implemented in comparative studies on the language behaviour and development of L2 and HL learners. Blake & Zyzik (2003), for instance, used a synchronous CMC environment (online connection via the university's RTA chat programme) in a paired HL-to-L2 learner task to observe the learners' linguistic behaviour (miscommunications, negotiations, etc.) and explore whether the interaction via the CMC tools is mutually beneficiary for both groups of speakers or not. In a similar vein, Tallon (2009) examined whether CMC (in the form of electronic, asynchronous discussions on BlackBoard) had an effect on foreign language anxiety in HL and L2 learners of Spanish and found out that the levels of anxiety were much lower in the HL learners than in the L2 learners.

More importantly, however, there are a few HL studies addressed to young learners. The project RU_CALL (Katushemererwe & Nerbonne, 2013) is an electronic language learning environment that enables young learners with mother tongue deficiencies to enhance their knowledge of grammar and acquire writing skills in Runyakitara (a Bantu language group spoken in western Uganda). The tool focuses on the complex system of nominal morphology (e.g., declension classes) and employs natural language processing in order to generate a large base of exercise materials (vocabulary, grammar, drills, etc.) which requires limited tuning intervention by the teachers.

Another project that aims at the young speakers' preservation of bilingualism, with emphasis on minority languages, is the Fabula software package (Edwards, Pemberton, Knight & Monaghan, 2002). The main objective of this multidisciplinary, multinational project was the construction of "an easy-to-use software environment for making and viewing interactive multimedia bilingual books" (Edwards *et al.* 2002: 60). Fabula fosters only European "languages of lesser diffusion", that is, languages that are typologically not too distant (e.g., Friesian/Dutch, Catalan/Spanish). One of the major innovations of this project is that both teachers and children actively participated in the construction of the text and the graphic material contained in the storybook, which brings us to our next topic: the use of CALL tools by the teachers and their integration in the teaching practice.

2.4. The role of the teacher in CALL

With respect to the language instructors, it is not uncommon in the CALL literature to encounter teachers who are unwilling to integrate CALL into the language classroom (Lam, 2000; DelliCarpini, 2012; Hedayati & Marandi, 2014, among others). Research on the topic has identified several reasons for teachers' reluctance to use CALL, among which are the following: low level of digital literacy, curricular and administrative restrictions, and the teachers' beliefs about the effectiveness of instructional technology. It is also often the case that instructors feel overwhelmed by the abundance of the tools and the way they can implement technology into their classes (see Stanley, 2013 and references therein). Recent research, however, emphasizes how important the teachers' contribution to CALL is, not only as users but also as developers and evaluators of CALL materials (Villada, 2009). According to Amaral & Meurers (2011), instructors endorse the idea of students using computers to practice receptive skills, reinforce the

acquisition of language forms, propose remedial work, and raise linguistic awareness, which paves the way for their active involvement in the design, use and assessment of CALL materials.

2.5. Developing CALL for the Albanian/Russian heritage language classroom: key considerations

Guidelines for developing and/or assessing effective CALL materials can be found extensively in the literature with major contributions in the field made by Chapelle (2001), Hémard (2003) and Hubbard (2006). Despite their methodological differences on the research focus, these studies concur that a sound pedagogical context and a set of well-specified usability guidelines must be employed in the design of electronic environments for language learning. The common ground in all these studies is the concession that a CALL tool can qualify as effective only if it is designed to best suit both the instructors' and the learners' needs. In a similar vein, Villada (2009) argues in favour of an interpretivist approach to the evaluation of CALL resources for *early foreign language learning*, according to which the perspectives of the developer, the teacher and the students in the development and evaluation of CALL are equally important (Villada 2009: 385). Finally, Cumbreño Espada *et al.* (2006: 48) call attention to Haugland's (1997) scale for determining whether an application addressed to young learners actually fosters learning. The scale applies the following criteria: adaptation to the learner's age, ability of the child to pay attention and to be able to control the process, clear instructions, progress of difficulty levels, self-access and work possibilities for the child, non-violent content, orientation on learning process, capability of programme for real world modelling, technical features of the programme, and capability of the programme to undergo adaptations and developments.

Drawing on the existing CALL literature and research, we decided to incorporate tools and features that are broadly available for electronic language learning purposes into a *single* environment that could support the linguistic needs of young Albanian and Russian HL learners and would be appealing, yet usable by both learners and teachers. For this purpose, in the conceptualization phase of the project development, we worked towards defining the key qualities that 7Keys should exhibit in terms of both its content and its architectural design. More specifically, our main objectives were:

- To develop a system that considers both instructors and learners as users
- To engage instructors in the design and development of CALL materials and provide them with the opportunity to tailor language activities to their students' needs
- To respond to our learners' specific linguistic needs and raise their language awareness
- To accommodate diverse language proficiency levels
- To stimulate both student-teacher interaction and interaction among peers
- To offer students control over their learning
- To provide meaningful feedback
- To intrigue motivation
- To develop a usable and user-friendly environment for all users

In the following two sections, we describe in detail the architecture of the 7Keys and its main applications and spell out the technical details of the implementation (§3). Furthermore, we elaborate on the pedagogical and linguistic framework that guided us in the design and construction of the language materials in the 7Keys (§4).

3. The 7Keys environment: The architecture

In this section we describe the 7Keys system, both in terms of user structure and organisation of learning materials. We also present the features and capabilities of the various subsystems of the environment, and expound on the technologies utilized.

3.1. User structure

7Keys features three tiers of users that form a pyramidal hierarchy. Learners form the bottom tier and are organised into groups paralleling their assignation into school classes. Each class is presided over by a teacher, who will usually be the learners' real life teacher in the HL classes. Teachers form the middle tier of the pyramid and are responsible for managing learners in their classroom, commenting on their progress, answering their questions using the inbuilt messaging system, and grading their essays. At the top of the pyramid is a single administrator, who can manage teachers' accounts, issue general announcements, upload new learning materials, or modify the existing ones. The administrator may also double as a teacher.

Since the 7Keys was conceived as a complement to classroom HL teaching, our main considerations when designing its user structure were the following: First, we wanted to keep as much as possible with the existing structure of the HL classes, so as to provide learners with the feeling that the 7Keys is an extension of the class, and also hoping that some of the excitement incited by the game-like mechanics of the 7Keys will rub off onto the classroom courses. Second, we wanted to provide de-centralized user management, so that each teacher is responsible only for their own class, and the administrator is responsible only for the teachers. In this way, future expansion to include more classes is easy, as each class can function as an almost independent cluster. The administrator needs only to create a new teacher account, and the new teacher can then work at building his/her new class. Lastly, we felt that all the learning materials had to be controlled centrally, by the administrator, who must ensure that new texts, translations, and quizzes contain no errors and are culturally appropriate by cultivating a deeper understanding between the two nations.

3.2. The learner application

The learner application is a game-like environment, with fairy-tale graphics, animations, sounds and an introductory video sequence aimed at immersing the learner in a story that progresses alongside the learner's language skills. Drawing inspiration from modern games, the 7Keys promotes motivation using a reward mechanism for certain quiz-related achievements, while a separate point system marks the learner's progress towards a goal, that is, the game's finale, which is concluded with a second video sequence.

Figure 1. The game's start.

Figure 2. The game's finale.

The learning materials are organised into chapters. Each chapter is based on a text, is aimed at a specific learner level, and includes the text and a substantial number of quizzes. Quizzes are organised in three groups according to focus (see §4.1), with each group further being divided into three levels of difficulty (see §4.2). In this way, 7Keys can accommodate diverse language proficiency levels, as each learner (under the teacher's guidance) can choose the texts and difficulty levels in each focus area that are most suitable for him/her.

Navigation is designed to be intuitive and clear. Navigation buttons are marked by universally recognised symbols, such as an ear for listening or a left-pointing arrow for back. All levels of the structure of the learning materials (texts, foci, levels, and quizzes) are represented by clickable in-game objects, providing intuitive navigation forward. A button that takes the user back to the main menu is always available. All navigation components are highlighted on mouse-over, marking them clearly as such. Pop-up tooltips provide an explanation of a button's function on prolonged mouse-over.

Outside the main learning sequence of texts and quizzes, 7Keys provides four additional features:

- The *profile* page (see §4.3).
- The *portfolio* (see §4.3).
- The *magazine*, dubbed the "Wizard's Magazine", is a selection of learners' essays, viewable to all students of all classes. A teacher may publish an essay in the magazine after its author has placed it in their portfolio. The magazine was included to provide inspiration and offer an extra incentive.
- The *crystal ball*, an inbuilt communication system between the learner and the teacher.

Figure 3. The inbuilt communication system.

3.3. The teacher/administrator application

The applications created for the teachers and the administrator provide these types of users with all necessary tools to fulfil their roles. The administrator application expands upon the functionalities of the teacher application to provide tools for updating learning material and manage teacher accounts. User management enables teachers to create and delete learner accounts in their own classroom. The administrator can create learner accounts and assign them to any teacher, and can also create or delete teacher accounts.

A learning materials tool gives the teacher and administrators access to the texts that form the core of the curriculum. Similarly, the quiz overview tool provides access to the quizzes that accompany each text. An inbuilt filter-driven search engine enables the teacher to locate desired quizzes easily, filtering for type, difficulty level or corresponding text.

The learners' answers tool provides teachers with access to quizzes completed by students in their class. The teacher may grade essays (which, as mentioned, are the only type of quiz not automatically graded by the programme), give feedback upon any type of quiz, publish essays in the magazine and review each learner's progress.

A messaging system, analogous to the one built in the learners' application, is also included, with settings for both one-on-one communication and group announcements. A final tool provides both the teacher and the administrator with access to essays already published on the magazine.

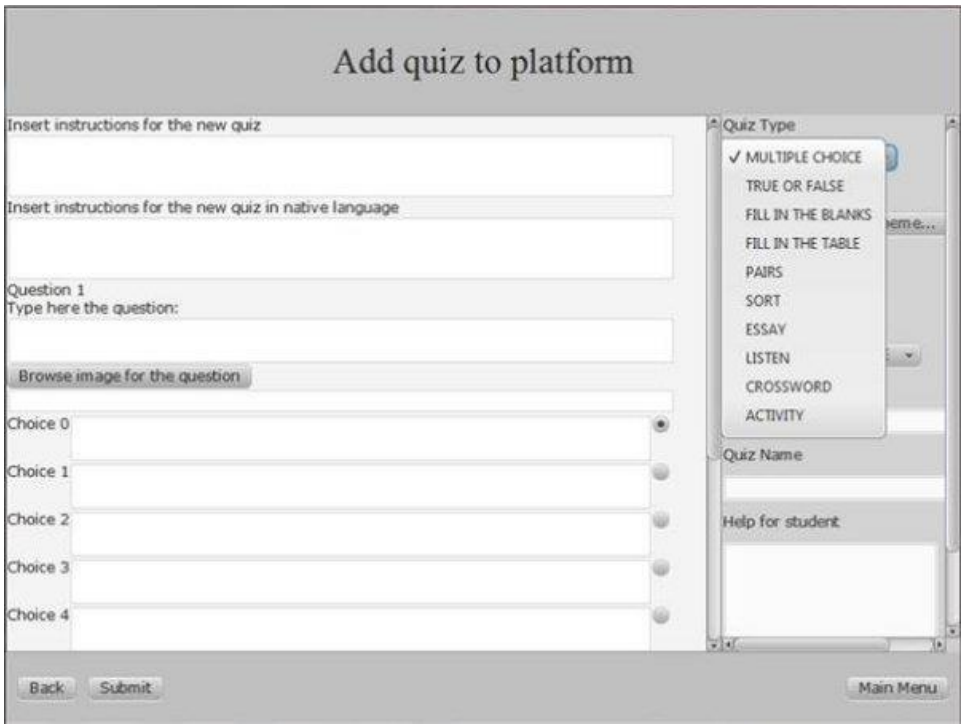

Figure 4. The teacher/administrator quiz tool.

3.4. Technical implementation

The system is designed with a client/server architecture. A different client was created for each of the three types of users. All clients are served by a single server application. The server application implements all necessary functionalities for data storage and retrieval. All data is stored centrally in one database instance, which can be accessed directly only by the server application. The server then exposes the appropriate methods as web services in order for the clients to communicate with it. Since no data is stored locally, this allows users to log in from any device on which the client has been installed and have access to all data and progress. As new learning materials are added by the administrator, all the users have instantaneous access to them.

Technically, the server application is a custom web application written in the Java programming language. Java forms a mature and well-tested technology and its use minimized development risks. Certain Java Enterprise Edition (Java EE) features were used, such as Stateless Session Beans. Consequently, the application should only be deployed on a Java EE compatible server. Specifically, the system was developed and tested only on the Glassfish application server. Java Database Connectivity (JDBC) was utilized for accessing the database. All the server functionalities are available to the clients via web services over the Simple Object Access Protocol (SOAP).

The clients were implemented as three executable standalone applications, namely the administrator's, teacher's and student's applications. They make use of the server provided web services over SOAP in order to fetch and store data from/to the database. Moreover, a centralized custom authentication system was implemented in order to provide a minimum level of security. The authentication system is also used for authorization, since each role can authenticate only to the corresponding application.

The clients' development was also based on the Java technology. For the presentation layer of the applications, the JavaFX 2.0 framework was used. JavaFX supported the development of rich interfaces that would be able to be incorporated to web pages with minimum effort if required. All clients are distributed in a package that includes the Java

Runtime Environment (JRE). This negates the need for the hosting device to have the Java JRE installed, and avoids incompatibilities that may arise due to different versions of the JRE.

4. The 7Keys environment: the language materials

In this section we present the solutions we provided to issues pertaining to the learners' specific language needs, which dictated the pedagogical and language learning framework the materials were constructed on (§4.1), the learners' diverse language profile (§4.2) and their option to have control over their learning (§4.3).

4.1. Accommodating the learners' language needs

As mentioned above, one of the main objectives of our endeavour was to respond to our target learners' linguistic needs and to improve their academic proficiency in the heritage language. In order to focus on academic language proficiency, we decided to follow Cummins' (2001) *Framework for academic expertise,* which was designed specifically for second language learners. An immediate result of this decision was that we did not follow the traditional classification of language skills as productive or receptive skills (i.e., reading, writing, listening and speaking) but Cummins' classification of language proficiency in relation to L2 learners, whereby:

- *Conversational fluency* represents the ability to carry on a conversation in face-to-face situations.
- *Discrete language skills* reflect specific phonological, literacy and grammatical knowledge.
- *Academic language proficiency* includes knowledge of less frequent vocabulary as well as the ability to interpret and produce complex written language.

Activities were designed according to three distinct language foci: focus on meaning, focus on language and focus on use. Activities that focus on meaning are geared towards enhancing text comprehension and developing critical literacy. Activities that focus on use serve to support students' creativity in language use. Hence, in the 7Keys environment these types of activities are mostly tasks or projects – often with a strong identity orientation – designed to be implemented collaboratively in the language classroom (e.g., organizing a summer holiday in Albania in the form of a webquest).

Activities that *focus on language* are designed to cultivate an awareness and critical analysis of language forms and uses and were given special attention. More specifically, we designed drills and exercises that aimed at enhancing the students' grammatical knowledge, such as their ability to grammatically identify a given form or produce another one with the appropriate grammatical characteristics (e.g., case, number, gender, aspect, tense). However, activities went beyond the formal knowledge of language, focusing on the critical analysis and awareness of the similarities and differences between the two languages in the bilingual students' repertoire. The content of these activities was determined by: (a) the results of a comparative study that examined the basic grammatical properties of the ambient language with the languages in question (i.e., Albanian-Greek and Russian-Greek) conducted by the team of linguists (Revithiadou & Spyropoulos, 2013), and (b) the students' own errors, as revealed by the placement tests. To enhance the students' assistance, a grammar book (with easy to understand grammatical rules, special reference of language-transfer phenomena, comparative tables with the similarities-differences of the Greek and Albanian/Russian grammatical structures and illustrative examples) was written for each language and was incorporated in the environment.

In Fig. 5, we present an informative example from an activity that aims at teaching the intonation pattern of *yes-no* questions in Russian, a topic that both the comparative analysis and the placement tests suggested that requires special attention. The reason is that in Russian the high-low contour of the question extends to the whole word that is the focus of the question, whereas in Greek, the focus word is pronounced with a low tone and the high-low contour of the question is realized towards the end of the utterance. In the 7Keys, students listen to Russian questions with the use of hypermedia and they are asked to decide if the intonational pattern they hear is correct or not. The source of confusion is that some questions are rendered with the Greek contour instead of the correct Russian one. This type of activity assists students, apart from mere practice, to develop a critical analysis of the language forms of their respective language.

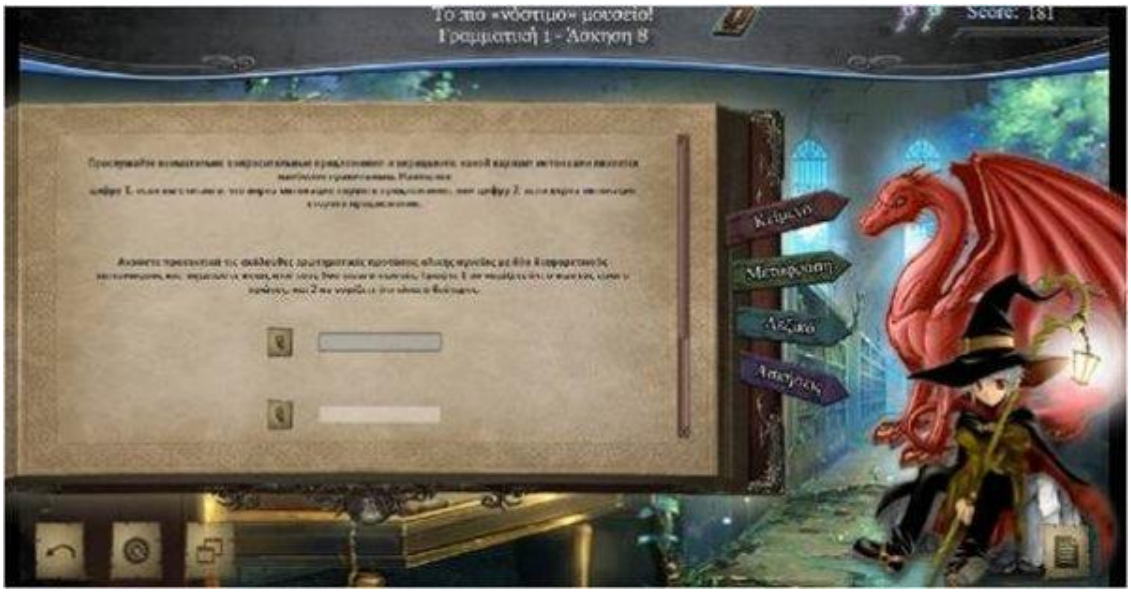

Figure 5. Example of an activity on the intonation of *yes-no* questions in Russian.

With respect to the typology of the activities, we opted for drill and practice activities (true/false, multiple choice, fill-in-the-blanks, fill-in-the-table, sorting, pairing, crosswords) for the focus on language and meaning activities, and essays and collaborative tasks/projects for activities that focused on language use. This decision was in agreement with the blended-learning rationale we adopted for the e-learning environment. Students could practice language in a self-access mode more easily when working with drill-based activities without, however, missing out on the opportunity to work cooperatively by participating in challenging tasks in the context of the language learning classroom.

Acknowledging the importance of feedback (see Murphy, 2007 and discussion within), we contemplated upon the form it should take and came up with the solution that all quizzes and drills will be automatically graded by the programme, whereas essays will be sent via the inbuilt communication system to the teacher for grading and personalized feedback. Users receive positive feedback in a friendly and encouraging manner by the wizard assistant; directive feedback is also offered in the form of pop-up hints or prompts that direct the user to the relevant chapters of the grammar book for consultation.

4.2. Accommodating the different language proficiency levels

A shared property of both Russian and Albanian HL learners, who constituted the target group of the language course intervention, was their diverse language proficiency levels. In order to tackle this problem, we constructed texts and activities that ranged

from A1-B1 (for Russian)/B2 (for Albanian) proficiency levels and categorized them by level of difficulty; a gem of different colour was used to signify each level of difficulty (green gem: beginners, yellow gem: intermediate, red gem: advanced).

During the main learning sequence of the 7Keys, the learner first chooses a text, colour coded for language level. Alongside the text, the learner can opt to use various scaffolding features according to his/her language needs. More specifically, s/he can read a translation in Greek or consult a glossary of selected words that appear in the text and may be new for a learner of that level. The learner may also listen to a narration of the text by a native speaker, having the corresponding sentence highlighted, or not, or even having the whole text turn invisible for the duration of the narration, allowing the learner to focus on listening rather than reading. By clicking on any part of the text the learner can move the playback to that point, allowing him/her to listen to a challenging phrase repeatedly, or to skip those that have already been mastered.

After reading the text, the learner proceeds to a list of quizzes, choosing the focus and difficulty desired. The quiz screen has an option for full or half screen. In half screen the other half can show the original text, the Greek translation or the glossary. This feature mimics textbook quizzes, where a learner may flip a couple of pages back to take a look at the text, while completing a quiz. Each quiz screen also has an area reserved for teacher comments, which the teacher may fill out after reviewing a learner's answers, using their own application.

Figure 6. Example of text "From the diary of a tree" and scaffolding features.

4.3. Student's control over learning.

Acknowledging the importance of allowing the student to have a sense of control over his/her learning experience (Little, 1991) and also of cultivating a spirit of competition and achievement, we developed the Profile and Portfolio pages. In the Profile the student can keep track of his/her performance on the different language foci activities. A progress bar was assigned for each type of focus, where the size of the filled portion shows the total amount of the user's progress. We also integrated a system of award badges for excellence in specific achievements. Each activity is associated with a different badge. For instance, if a student achieves a perfect score in a multiple choice quiz, s/he is awarded the badge "Orator: Invincible in essay writing!", until another user

gets a higher score on the same activity. Finally, the student can upload the activities that s/he likes or show excellence or creativity on the portfolio page and share them with his/her fellow students.

Figure 7. The student's Profile (progress bars and award badges) and Portfolio.

5. Conclusions

This study has presented a CALL system for young HL learners of Albanian and Russian, with an elaborate review of its (a) architecture and design, (b) the technical details of its implementation, and (c) the rationale that dictated the construction and layout of the language materials. Our main objective has been to provide a digital learning environment that enables learners to enhance their grammatical skills and language awareness. Unfortunately, due to the pilot nature of the Project under the auspices of which the 7Keys was developed, and the time limitations imposed by it, we were not able to evaluate the effectiveness of the tool. However, it is in our future plans to commence an evaluation of the 7Keys' content and usability features. Think-aloud protocols and field-research could unveil the learners' and teachers' perspectives on these issues and provide useful feedback for improving both the materials and the various functions. Towards this direction, research conducted on learners that make systematic use of the 7Keys in class or at home with control groups that do not could prove quite informative as well.

Future directions of this research might be to extend the use of hypermedia in both texts and drills, to include more chapters for higher language proficiency speakers and, hopefully, to integrate a Natural Language Processing tool for at least some pivotal grammatical phenomena the acquisition of which has been proven challenging for this group of HL learners.

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Notes

[1] See §2 for a definition of the term.

[2] See, for example, Campbell & Rosenthal (2000), Draper & Hicks (2000), Fishman (2001, 2006), Van Deusen-Scholl (2003), Carreira (2004), de Bot & Gorter (2005), Polinsky & Kagan (2007), Hornberger & Wang (2008), He (2010), Carreira & Kagan (2011), Montrul & Polinsky (2011), Beaudrie & Fairclough (2012), Benmamoun, Montrul & Polinsky (2010, 2013a, b), King & Ennser-Kananen (2013), and references cited therein. For an informed bibliography on heritage languages, the interested reader is referred to Aravossitas & Trifonas (2014) and Polinsky (2011).

[3] See Kennedy (1988) on the learning differences between adults and young learners.

[4] http://www.cuhk.edu.hk/clear/tdg/0508/0508-10.html (*Scientific Directors*: Prof. Helen Meng and Dr. Pauline Lee).

[5] Some representative literature of HL education and learning/teaching strategies include: Valdés (2001), Said-Mohand (2011) for Spanish; Wang (1996), Tao (2006), He & Xiao (2008) for Mandarin Chinese; Lee & Shin (2008) for Korean, among others.