

Designing an e-Learning System for Language Learning: A Case Study

Gerhard B van Huyssteen

Centre for Text Technology (CTeXt), North-West University, Hoffman Street, Potchefstroom, 2531, South Africa

Email: ntlgbvh@puk.ac.za

Abstract – Within the South African context, e-learning provides various opportunities to contribute towards a multilingual society. This paper describes a new project, ICALLESAL (Intelligent Computer-Assisted Language Learning for Eleven South African Languages), where an e-learning system is being developed for the acquisition of the official South African languages. The paper commences by defining computer-assisted language learning (CALL) and intelligent computer-assisted language learning (ICALL) within the context of e-learning. The benefits of CALL within the South African context are discussed, with specific focus on how it could promote a culture of multilingualism, and also help towards bridging the Digital Divide in South Africa. In the subsequent section, the ICALLESAL system is discussed in more detail by presenting various technologies, content objects, and features of the system.

I. INTRODUCTION

In 1997, Lut Baten and Bert De Coutere (Catholic University of Leuven, Belgium), together with Daan Wybenga and Gert Jooste (Vista University, South Africa) conceived of e-learning courseware for foreign language acquisition, called *Multitaal*. In subsequent years, and in collaboration with colleagues from various other universities, this authoring language was used to develop interactive, multimedia e-learning courseware for various languages and various target groups, such as *InStap!Nederlands* (1999; for Dutch), *InStap!E4B* (2001; English for business purposes), *InStap!Afrikaans* (2002; for intermediate and advanced levels of Afrikaans), *Tsenang!* (2004; for Setswana), and *Ngenani!* (2004; for isi-Zulu).

Since the release of the latter two programs, the Centre for Text Technology (CTeXt) of the North-West University in South Africa has taken over the South African part of the project, and acquired all Intellectual Property Rights. Since then, CTeXt has continued with commercialization initiatives, the release of updates, and the development of similar programs for isiXhosa (called *Sondelani!*), and Afrikaans as a foreign language (called *Dagsê!*). (Henceforth, I will refer collectively to all of these software packages as the "*Multitaal* programs"; when referring collectively to only *Tsenang!*, *Ngenani!*, *Sondelani!*, and *Dagsê!*, I will use "*Multitaal SA* programs".)

However, despite the successes of the *Multitaal SA* programs in the South African market, these programs have some significant weaknesses and limitations, such as no connecti-

ty (limiting true interaction between learners, and also limiting network solutions for corporate clients), weak multimedia content, a rather unintuitive end-user interface, and outdated back-end technologies (e.g. a 16-bit Paradox database and interfaces developed in Delphi 3). A complete overhaul of these programs is thus inevitable, either directly through reengineering measures (e.g. transportation of existing databases to new database technologies), new design (e.g. new multimedia objects, and new content objects for the acquisition of language for specific purposes), or otherwise through the introduction of new components (e.g. Human Language Technology (HLT) components).

With a view to address these shortcomings, CTeXt initiated a project late in 2005, called *ICALLESAL: Intelligent Computer-Assisted Language Learning for Eleven South African Languages*. At the first conceptualization think-tank, held in November 2005, which was attended by role-players and stakeholders from across South Africa, the broad aim of this project was presented as follow:

To develop an online intelligent computer-assisted language learning system for eleven South African languages, based on the pedagogical concept and linguistic content of the Multitaal SA programs, but using new, cutting-edge technologies, with a view to the stimulation of Natural Language Processing research, the development of a Human Language Technology industry, and the promotion of multilingualism in South Africa.

This is the first project of its kind (in both focus and scope) in South Africa, and will draw in all the major role-players in the fields of HLT and Natural Language Processing (NLP) in South Africa (i.e. North-West University, Universities of Pretoria and Stellenbosch, and Meraka Institute). Additionally, partnerships with relevant Black Economic Empowerment enterprises are being established, while the involvement of international collaborators (in addition to the Catholic University of Leuven) is also being investigated. Currently, the project is in the Design phase, with a view to sign-off the final project charter by the end of January 2007. A first thin-slice prototype has also been developed, while a first prototype is being developed currently for deployment in a pilot study in various branches and contact centers of a major South African banking group.

This paper presents the design of the ICALLESAL system in more detail. In the next section, the use of e-learning solutions for language learning is defined and discussed, with a specific focus on how e-learning strategies could promote a culture of multilingualism in contexts similar to the South

African context. Section III presents the ICALLESAL system in more detail, focusing on defining features of the system. This paper concludes with a summary of the advantages of ICALLESAL over other e-learning solutions available for South African languages.

II. LANGUAGE LEARNING THROUGH E-LEARNING

A. *Defining CALL and ICALL*

E-learning is generally understood to be learning facilitated and supported through the use of information and communication technologies (such as CD-ROMs, websites, discussion forums, web logs, wiki engines, podcasts, email, video conferencing software, collaborative software, interactive television, audio and videotapes, etc.), made available either locally or via intranet, Internet, or satellite, and delivered using personal computers, digital television, etc. When mobile devices such as Personal Digital Assistants (PDAs) and mobile phones are used for delivery, e-learning is often called mobile learning (m-learning). E-learning can cover a spectrum of activities from supported learning, to blended learning (the combination of traditional and e-learning practices), to learning that is entirely online. Whatever the technology, however, learning is the vital element [1].

When e-learning strategies are employed for language learning and teaching (especially with regard to foreign language acquisition), it is most commonly referred to as computer-assisted language learning (CALL; also known as computer-/technology-enhanced language instruction/learning) (cf. [2]). Although a fairly recent interdisciplinary subject (i.e. over the last forty years – [3], [4]), CALL is considered by and large as "one of the success stories of the end of the twentieth century" [5], with various academic journals, conferences and associations dedicated to this field of enquiry, and an almost endless supply of products, websites and material available for most commercial languages of the world. Nonetheless, CALL can still be considered in its youth, with much research and development work still to be effected.

One of the areas of CALL still in its infancy is so called intelligent computer-assisted language learning (ICALL). In its broadest sense, ICALL can be defined as Artificial Intelligence-based CALL, where tools, techniques and strategies from the field of Artificial Intelligence (AI) are applied to language teaching. This includes, most notably, the development of intelligent tutoring systems and interactive learning environments [6], [7].

More narrowly defined, and as the term is used specifically within the ICALLESAL project, ICALL is simply defined as "CALL incorporating Language Technology (LT) techniques" [8], [9]. These include, for instance, morphological analyzers used for intelligent dictionary look-up procedures of inflected and derivational forms, syntactic parsers in grammar checkers for evaluating freestyle input, spelling checkers for giving feedback on spelling matters, speech recognizers for evaluating pronunciation and for automatic, individualized assessments, virtual chatbots for increased

interactivity, etc. Reference [10] summarizes the current state of ICALL when it states that "research in HLT in CALL is vibrant" and that "HLT has an important contribution to make in the further development of CALL." Since both HLT and CALL are relatively immature disciplines many ICALL projects "have not even reached the stage of the implementation of a fully functional prototype yet. However, successful CALL projects which utilize the advantages of HLT (and avoid some of the pitfalls) are testimony to the fact that these new language technologies have a lot to offer for the development of CALL software that learners can use more easily, more effectively and more naturally" [10].

B. *Potential of CALL in South Africa*

The advantages and disadvantages of traditional methods of language teaching versus CALL are often discussed in the literature (e.g. [4], [5], [11]). Table 1 presents a summary of some of the main points where these two approaches differ, with a stronger focus on the positive aspects of CALL. (For some negative myths about CALL courseware, see [12].)

One facet of the comparison that is still yet unresolved (also in the available literature) is the cost implications of these two approaches. With regard to initial development cost and cost of maintenance (e.g. updates), traditional approaches are believed to be cheaper than CALL systems (i.e. dedicated CALL courseware is very expensive in terms of programming costs, creation of original multimedia content and user-interfaces, systems integration, etc.). However, in terms of delivery CALL courseware is cheaper than traditional methods – not only in terms of the physical delivery per capita (e.g. on CD-ROM or via the WWW to literally millions of learners versus human teachers with restricted numbers of learners), but also in terms of indirect costs (for example, a company will have to pay for employees' traveling costs, accommodation and daily sustenance if the company requires employees to acquire multiple languages).

Another facet that is still yet unresolved is whether the one approach will produce the same results in less time than the other approach. It is generally assumed in the literature that language skills for basic communicative purposes (e.g. greeting, buying something in a store, ordering something in a restaurant, etc.) could be acquired in 40 – 60 hours of learning time; to acquire language skills for more advanced communicative situations (such as engaging in conversations about politics, sports, etc.), a learner would need between 130 – 160 hours of learning time. It is also widely assumed that the quickest way to learn a language is to be assimilated and isolated in the target language community; however, in a multi-lingual society such as South Africa, this is almost impossible, since a learner can almost never be isolated from other language communities (left alone to free an employee to spend 160 hours away from work to acquire a new language). Learners (and their employers) are therefore faced with the challenge to find solutions to effectively decrease the learning time required to acquire a new language.

TABLE 1
COMPARISON OF TRADITIONAL LANGUAGE TEACHING AND CALL APPROACHES

Traditional	CALL
Delivery: One-to-Many (one human teacher, many learners).	Delivery: One-to-One (one virtual teacher, one learner).
Mostly, only one language of instruction is possible in a classroom.	Many languages of instruction could be implemented in the same program.
The teacher has to consider the collective aims and progress of the group as a whole, with little room for the needs of individuals (e.g. to learn a language for specific purposes). Repetitive actions are strenuous and time-consuming.	The language learning experience could be individualized, taking the aims and progress of the individual into consideration. Material can be repeated as often as the learner wants to.
Learners are subjected to the teacher's methodologies, language usage (e.g. pronunciation) and norms for assessment.	Programs could provide for different learning styles, different varieties of the language, as well as more objective assessment.
Learners are often confined to learner centers and the availability of courses in their geographical area. Moreover, learners are bounded by course schedules and time-tables.	No restrictions apply to the availability of courses, especially with online and/or mobile learning (i.e. overcome limits of physical mobility). Learners can access material whenever and wherever they want to.
Performance of learners is often inhibited by performance anxiety (e.g. to speak in front of other learners).	Learning takes place in a "safe" environment, where the learner can practice skills more freely.

In South Africa, with eleven official languages, various other current tendencies and factors make CALL an attractive opportunity to explore at this point in time. For example, sales of the current *Multitaal SA* products clearly indicate that there is a definite market need (demand) for CALL products in South Africa, most probably because of a changing multicultural, multilingual work and business environment. It seems as if there is a growing awareness of multilingualism amongst people (cf. [12]), despite the fact that a recent survey by Plus 94 Research indicated that 64% of South Africans favor English as the country's "main" official language and preferred language for business communication [14]. However, incongruence exists between language preferences and language proficiencies, especially with regard to second languages. For example, various research projects indicate that between 19% and 31% of the total population has no understanding of English (compared to, for example, Setswana: 63%; isiNdebele: 67%; Tshivenda: 83%), while between 22% and 47% have a thorough comprehension of English (compared to, for example isiZulu: 49%) [15]. From this it is clear that levels of second-language proficiency in South Africa, even in English, are challenging, and should be kept in mind when making business decisions. For instance, no large public-sector service enterprise can actually afford to have an "English Only" language policy, since they won't be able to reach almost a 1/3 of the population.

This general awareness of multilingualism is also reflected in the business world's reaction to market needs. For example, major South African banking groups like ABSA and

NEDCOR have introduced multilingual service channels, with ABSA currently taking the lead by offering eight languages on Automatic Teller Machines, and four languages for telephone banking. Moreover, corporate businesses are also under constant pressure to deliver services in multiple languages – for instance, section 3.4 of the *Code of Banking Practice* [16] explicitly states that services and products should be provided "...where appropriate in any of the other official languages."

In addition to businesses, government departments are also obliged to make information and services available in multiple languages. Not only is it required by the *Constitution of the Republic of South Africa* (1996; chapter 1(6)), but also by the *Draft South Africa Languages Bill* (2003) and the *National Language Policy Framework* (2002), amongst others.

In order to sustain and/or expand multilingual services and products, civil servants and employees will have to acquire additional languages, improve their current language skills, and/or expand their language skills for specific purposes (i.e. to acquire vocabulary and linguistic constructions for specific situations, such as working as a teller in a bank, or as a civil servant dealing with passports). Given the advantages of CALL listed in Table 1 above, dedicated online CALL courseware could afford opportunities to empower people (specifically adults) to acquire these skills, thereby contributing to a true culture of multilingualism in South Africa. Moreover, CALL programs hold the promise to contribute towards bridging the Digital Divide (i.e. the divide between the privileged and the marginalized in terms of access to technology, specifically computers and related applications), by helping towards e-inclusion, social integration and upward mobility.

Given these opportunities that e-learning and CALL afford, the ICALLESAL project aims to develop such a dedicated online ICALL system for all eleven official South African languages.

III. SOLUTION: ICALLESAL

The ICALLESAL system is a dedicated, distributed system, where dedicated means that it is developed for specific purposes, and not integrated in another system. In terms of Reference [4]'s distinction, it is therefore a tutor (courseware), rather than a tool. Distributed implies that it is a connected, online system, running either via a web server, a local server, or else via both. This affords opportunities for learners to learn both at work and at home (provided that they have internet access at home). Moreover, such a connected system offers various possibilities for user interaction, advanced learner management, and customisation (see discussion below). Due to challenges with regard to internet availability and channel capacity (bandwidth) in South Africa, connectivity is currently limited to certain functionalities (e.g. updating of software, submission of results, communication with trainers and other learners, and connection to the ICALLESAL website). The end-user program is hence also client-based, rather than browser-based.

As a design model, we have chosen Colpaert's Research-Based, Research-Oriented (RBRO) design model [12]. This model "is based on the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), in which each stage delivers output which serves as input for the subsequent stage" [12]. The engineering loop implies that this is an iterative process, where the design can be adjusted after each implementation and evaluation, if deemed necessary. In terms of this model, the ICALLESAL project has already been through the first Analysis stage, where information was gathered "about all possibly relevant epistemological, empirical, contextual, technological, feasibility-related, and perceptual aspects, facts, findings, principles, and considerations" [12]. Currently we are in the first Design phase, where the concept is elaborated (conceptualization), the architecture is described in terms of components and their interactions (specification), and discrete topics are being tested using available technologies (prototyping) [12]. As mentioned in Section I, a first prototype is currently being developed for implementation in a pilot study, and is scheduled for completion by the end of January 2007.

Next, some of the key defining features and unique functionalities of the ICALLESAL system are discussed in more detail.

A. *Eleven Languages*

More than 40 languages are spoken in South Africa, of which only 11 are recognised by the Constitution as official languages. Of these 11 languages, isiZulu is the largest home language (first language), followed by isiXhosa and Afrikaans.

Within the context of language learning, a distinction is generally made between the *Target Language* (i.e. the "Learning Object", the language you want to acquire); the *Source Language* (i.e. the native tongue of the learner); and the *Medium of Instruction* (i.e. the language used to teach and explain). The ideal, of course, would be to develop a system with *eleven* target languages, through medium of *eleven* languages. This is also the eventual, long-term goal of this project. However, for practical and financial reasons, some delimitations had to be decided on. Although all eleven languages will be developed as Target Languages (in the following priority sequence: isiZulu; Afrikaans; Sesotho; English (Business English); isiXhosa; Sesotho sa Leboa; Xitsonga; Tshivenda; Setswana; siSwati; and isiNdebele), the Medium of Instruction will be restricted to one language only (English), with the possibility to extend to Afrikaans and other languages in future. Given the general architecture and design of the system, it would also be possible to expand the language offering to other languages (of Africa), such as French, German, Portuguese, Kiswahili, and/or Arabic.

B. *Advanced Learner Management*

In any e-learning system, learner management is of utmost importance. Some of the advanced features in the ICALLESAL system include (amongst others) *progress reports* for learners and trainers, with statistical analysis of progress; a "Virtual Trainer" (i.e. automatic agent) that monitors learners'

frequency of access to the system, probes learners' via e-mail or SMS to access the system (e.g. "You haven't logged on to the system for 5 days! Maybe it's time to learn again!"), and sends early warning signals to human trainers/managers; and *integration of e-portfolios* in other HR management systems, such as SAP. A user therefore builds up a "linguistic profile", which could be added to his/her profile on the HR management system.

C. *Enhanced Communication/Interactivity*

Researchers across the board agree that peer-communication and interaction with other language users/learners are essential for language learning. ICALLESAL deploys various communication and interactivity tools such as *email* (with peers, or with trainer for asking questions); *chat-bots* (i.e. virtual, artificial intelligent agents, simulating human communication); *wiki's* (where a learning community creates its own, shared works of reference, such as terminology lists, lists of frequently asked questions, etc.); *discussion forums* (where learners help each other to solve problems, or where trainers could comment on unresolved issues); and *playful competitiveness* (with high-scores for games and exercises, best performer of the month, etc.).

Interactivity is further enhanced through enticing exercises in the form of small *games* (downloadable to portable devices). Worldwide research confirms the suitability of using games in e-learning, and specifically computer-assisted language learning. By creating a *playful, escapist environment*, users "learn as they play": instead of playing *Solitaire* or *Hearts* during a break, s/he could rather play a language game. The didactical "Learn, Practise, Prove Principle" is integrated in such games, while users can also access websites of accredited institutions to acquire more formal recognition for their skills (e.g. certificates of proficiency, etc.).

D. *Customization Possibilities*

One of the key distinguishing characteristics of ICALLESAL, is the advanced possibilities to select and manage content. So-called "shopping cart" functionalities are implemented, where learners and/or trainers can select the content relevant and functional to their needs and levels of proficiency. Such customisation is based on *automatic assessment* (i.e. the learner's proficiency is evaluated, before s/he can access certain modules); and/or *managed by a human trainer* (e.g. the trainer/manager decides which modules should be completed by which learners); and/or *managed by learner* (e.g. the learner can "shop" those modules that s/he is interested in). This ensures optimal learning, since learners engage with learning material that is relevant to their day-to-day operations.

To illustrate the necessity of customisation specifically with regard to vocabulary, consider the data in Table 2, which presents a word-frequency comparison between two equally sized (n=4,182) sets of texts (i.e. a random selection from the *British National Corpus* (<http://www.natcorp.ox.ac.uk>), and a training manual from a South African bank). The words in italics are words that do not appear in the 20 most frequent words of the comparative corpus. What is clear from this

TABLE 2
COMPARISON OF WORD FREQUENCY IN BRITISH NATIONAL CORPUS AND BANKING TRAINING MANUAL (N=4,182)

Rank	British National Corpus	Frequency	Banking Training Manual	Frequency
1	the	304	the	335
2	of	156	card	150
3	to	129	to	111
4	and	93	and	89
5	in	91	client	81
6	a	88	of	81
7	for	50	be	65
8	be	49	number	64
9	by	46	is	63
10	that	43	on	61
11	is	40	this	55
12	it	40	that	54
13	are	33	form	45
14	as	26	enter	44
15	was	25	a	42
16	Lord	24	ATM	40
17	said	24	in	38
18	he	24	if	36
19	from	23	or	35
20	on	23	will	35

small-scale investigation is that 50% or more of the 20 most frequent words in specialised texts do not appear in the 20 most frequent words of general corpora. Therefore, in order to optimise the learner experience and increase the learner's functional proficiency in the target language, a tailor-made solution would be preferable. Instead of learning about "cats" and "dogs", or conveying condolences to an uncle or aunt, the learner would rather engage with relevant material to his/her immediate working environment.

Other customization options include real-world simulations of relevant functions and communicative situations (e.g. answering a telephone, dealing with a difficult client, etc.), incorporation of a corporate client's brand identity (e.g. by including insignia in the graphical user-interface), and system integration (e.g. integrating e-portfolios with a corporate client's human resource management system).

E. Didactical Approach

Given the fact that CText already possesses the Intellectual Property Rights of the *Multitaal SA* programs, the ICALLESAL project was conceptualized as a reengineering project from its very inception. This provides the opportunity not only to build on current strengths and improve on weaknesses, but also to ensure increased speed-to-market.

One of the main strengths of the *Multitaal* programs is the hybrid approach to language acquisition taken in the pedagogical design. Not only does this approach afford the best of both worlds in terms of pedagogical tools and methods, but it also accommodates different learning styles and learning

strategies across learners [17]. On the one hand, an interactionist, functional approach is followed, combined with a more classical ("grammatical") approach. Reference [18] describes the implementation of this approach as follows: "The grammatical sections and the... communicative functions contain references to lexical items and the dictionary includes grammatical and communicative information. Integration also means that examples in the grammar and sentences in the exercises are taken from the communicative sources the user is acquainted with." This hybrid approach therefore presents the learner not only with authentic contexts and typical communicative situations, but also with enriched input ([19]) in the form of works of reference. These works of reference include dictionaries, grammar guides, function guides, and pronunciation guides.

The *dictionaries*, which are downloadable on mobile devices, include words, phrases and collocations relevant to specific domains (depending on the customisation options the user has chosen); i.e. general words like "cat" and "dog" will not be included in a specialised banking environment, while specialised words like "account", "client" or "card" will be amongst the first words a learner will encounter.

The *grammar guides* (also downloadable on mobile devices) contain some basic constructions (such as questions, statements, or commands), while specialised constructions relevant to the working environment (such as on-screen commands, or three word commands) are included in specialised modules (based on extensive corpus research).

The *function guides* provide information on basic functions such as counting, names of the days and months, etc. More specialised functions (such as forms of address, filling out of forms, giving a telephone number, etc.) form part of advanced modules.

In the *pronunciation guides* (also possibly downloadable on mobile devices) speech synthesis (i.e. artificial speech) is used to provide a user with audible examples of words or sentences s/he types in. Further functionalities include the incorporation of an automatic speech tutor, which analyses the speech of the learner, and gives him/her instant and detailed feedback. The full potential of pronunciation guides will be explored in research conducted by Meraka Institute and University of Stellenbosch, in a subproject funded by the South African governmental Department of Science and Technology.

Moreover, elaborate sections on cultural knowledge perpetuate culturally responsive teaching, which is essential for the learning experience and the sense of belonging in a cultural space [20]. In addition, we also believe that it is important for learners to learn contextualised slang and colloquial usage (e.g. the Afrikaans loan word *lekker* 'nice' in English, or the English loan word "nice" in Afrikaans), to ensure a more natural assimilation into the target language community.

Since this linguistic content is chosen, organized and authored by experienced foreign language teachers, and validated by native speakers, the learner is presented with efficacious information on the essentials of the language, which will enable him/her to maximize his/her learning experience.

TABLE 3
COMPARISON OF ICALLESAL WITH OTHER CALL SOLUTIONS

ICALLESAL	Other CALL Solutions
<i>Integrated, connected learner management</i> (e.g. learner progress is stored on a central server, integrated with HR management system).	Learner management is often "paper-based" and done by a human trainer.
<i>Automatic motivation</i> (probing) and progress management of learners.	Trainer has almost no control over the time learners spend on self-study.
Content and "Look&Feel" is <i>tailor-made for corporate client</i> , conforming to their needs, lingo and jargon, and brand personality.	Content and "Look&Feel" is aimed at a general target market (often tourists).
Easily <i>customisable</i> for individual needs and levels of proficiency of a learner.	Very little customisation possible.
Simulation of <i>real-world communication situations</i> , relevant to corporate client's employees.	General communicative situations (e.g. "At the restaurant", "Families", etc.).
Downloadable components and remote access via internet create even <i>more flexibility</i> for users to access learning and reference material.	Learners are bound to desktop computer where programme is installed.
<i>Interaction</i> between peers and trainers are integrated in the system, freeing users from the limits of time and space (i.e. virtual workgroups).	Learners must find own solutions to ensure interaction with other learners, while contact with trainers is often restricted to training sessions and personal appointments.
<i>Hybrid approach</i> to pedagogical design allows for various learning styles and strategies.	Mostly either purely "classical", or purely "communicative" – learners have to adapt their learning styles to the software.
<i>All languages</i> integrated in one system (expandable to other languages). Learners therefore only have to acquaint themselves with one learning environment, while the immediate availability of other languages might also stimulate learning of multiple languages.	Only <i>one language</i> per package. Learners have to buy/register for a completely new package to acquire another language.

E. Mobile Components

As mentioned above, various components will be downloadable to mobile devices, which will cross the line from pure e-learning to m-learning. This will not only afford learners the opportunity to learn "on-the-go" (e.g. while waiting for a bus or train), but also provide them with the necessary tools wherever they might be (e.g. to quickly look up a word when you are at home, etc.). This aspect of ICALLESAL will also prove to be innovative in the field of language learning.

IV. CONCLUSION

Based on the above, Table 3 presents in summary and in conclusion the advantages of ICALLESAL over other CALL solutions that are available for South African languages. Despite these advantages of ICALLESAL, learning will however not take place "automatically": a cultural change (and the management of such change) will need to be implemented in any corporate environment. This could, for example, include the introduction of incentives for employees with multilingual

profiles, or for people who have successfully completed a language course. Also, a culture of e-learning has to be introduced, in order to facilitate a smooth transition from more traditional approaches to an e-learning approach.

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