Language (Medical Terminology) Assistance to Multinational Partners in Coalition Operations

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FINAL REPORT
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INTRODUCTION

This report covers the progress made during the period March 2011 to February 2012. At the beginning, we provide a summary of the background and history of the project and indicate the intended research objectives. The body of the report addresses these objectives in three main blocks. First, we describe the research methodology and present the results of the needs analysis. Then, we provide a brief overview of mobile learning in relation to e-learning, followed by a synopsis of vocabulary learning techniques and an outline of mobile-assisted language learning cases considered from the perspective of the project requirements. Finally, we suggest a framework for language (terminology) assistance as an outline of the strategies which are recommended based on the extensive literature research.

BACKGROUND AND HISTORY

Our coalition forces accomplish a wide variety of missions - combat, stabilization, humanitarian support and natural disaster relief - where they interact with a range of other international organizations. During these multinational operations, common language is one of the factors of interoperability. A potential area where sharing a common language becomes a critical factor for success is basic medical terminology needed for communication in case of accidents and injuries. Knowledge of medical-related terminology and communication skills are essential for evaluation of injuries, planning MEDEVAC, and rapidly coordinating health services to save the lives of international partners or support humanitarian operations. Stressful environment and time deficiency are additional challenges for non-native speakers. Furthermore, as initial vocabulary and communication skills differ significantly from person to person, it is desirable to combine group training with individual learning. For this purpose technology-enriched approaches, such as e-learning, distance learning or m-learning may be used. In particular, m-learning capabilities that support individual just-in-time training may serve as an efficient tool to enhance language skills required for critical medical support tasks in multinational forces.

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OVERVIEW

Growing potential of mobile devices for classroom learning and support of learning activities in a blended mode has been extensively studied during the past years. Case studies cover a spectrum from attempts to adjust distance learning content delivery to a selected mobile platform to proposals of innovative ways to use new mobile devices functionalities [1-5].

Most of the "success stories" take advantage of the new features of mobile devices rather than making the connection between current organizational learning approaches and the new capabilities. Further, researchers examine the potential extension of learning activities through the use of various media, net services and social networks within a single learning community without addressing multinational and multi-lingual approaches. Although language learning and vocabulary building are some of the distinct topics [6-9] in m-learning, the specifics of adult language learning, just-in-time, and competency-related language skills building have not been considered.

Another obstacle to making generalization of m-learning research results and their direct realization within mobile language learning assistance projects is related to the variety of mobile platforms and lack of their compatibility. Selection of devices in most of the research studies is based on their availability for the project rather than on features that make a particular class of devices more appropriate for a specific learning task. As a result, these "device-driven" solutions often ignore potentially beneficial learning activities that are difficult to implement on the chosen devices. From a cognitive point of view, the focus of many current research studies has been on creating motivating, sometimes game-based environment, and on supporting students' creativity. Whereas educational games are becoming popular in student training, the issues related to cost-effectiveness of proposed m-learning solutions or their scalability and transfer across platforms have not been considered.

To summarize, known research studies do not address many important issues that affect the development and deployment of effective m-learning for multinational parties in coalition operations.

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This research study focuses on identifying effective methods to enhance communication among multinational partners that will enable performance in medical-related tasks and the implementation of these methods in an m-learning environment. It will differ from other research in several aspects, namely:

1) it will focus on pragmatic solutions enabling scalability;
2) it will focus on creating content patterns and samples allowing for transfer and extension;
3) it will make use of the cognitive and didactic theories, as well as technical standards for justification.

RESEARCH OBJECTIVES

To support further development of m-learning for military and civilian coalition and alliance members the following research objectives are set:

1. Identify challenges to the use of mobile learning in language/terminology assistance for support of coalition operations.
2. Research and evaluate a range of methods to overcome the identified challenges.
3. Identify the most promising methods and make recommendations regarding further refinement of those methods to enhance support of coalition medical operations.

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METHODOLOGY

The project started with a needs analysis phase to reveal specific language gaps and challenges in using common medical terminology in English that may be addressed by individual mobile learning. It was intended to identify typical communication situations and vocabulary that should be addressed. Since English is the language of interoperability, and due to the fact that multinational operations and instruction use English as a language of communication, all interviews and questionnaires were composed in English. By "native speaker" the authors refer to speakers whose mother tongue is English, and by "non-native" speakers – individuals who have studied English as a second or foreign language.

The Team involved in the needs assessment stage comprised of members who represent three different nations – Bulgaria, Ukraine and the United States. The Bulgarian and the American representatives are English language instructors, while the Ukrainian representative is a scientific researcher. The project team experts collaborated for a number of years within the PfP Consortium ADL Working Group and developed two courses for on-line delivery: ESSO (English Skills for Staff Officers in Multinational Operations), a topic-based course based on the DLIELC manual and audio materials, and ELTEC (English Language Training Enhancement Course), a competency-based course, which is focused on targeted professional language skills and NATO-specific contexts. The efforts of the Team members and the effectiveness of their product have been renowned by senior military institutions like JFCOM, ACT, PfP Consortium, etc.

The Team conducted focus group interviews in order to determine communication tasks for handling medical emergencies. The first step was to identify individuals who might be able to provide the necessary information. Key population groups were recruited from George C. Marshall Center in Germany and from Rakovski National Defense Academy in Bulgaria. The focus groups were homogeneous, composed of 5-8 members with similar background. Three groups were all militaries – commissioned and non-commissioned officers - who had participated in stability operations around the world. The groups included native and non-

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native English speakers from NATO and partner countries. One focus group consisted of English speaking instructors of military medical terminology.

Participants were invited to take part in the interview and it was made clear that individual comments would be strictly confidential. No Informed Consent Agreement was distributed. The participants were given clear instructions on the purpose of the interview as initial part of the project. The facilitators created relaxed informal atmosphere and directed the discussion without being part of it. They never expressed their own opinions; neither did they make judgments on the opinions of the interviewees. All focus group members were encouraged to participate without anyone dominating the discussion. The interviews lasted between 60-90 minutes.

The facilitators were experienced English language instructors from George C. Marshall Center, Germany, and Rakovski National Defense Academy, Bulgaria. These were structured interviews with pre-planned questions. The questions were open-ended, simple, unbiased and focused on the matter. The questions and the discussions were all in English since this is the language of interoperability in multinational operations. The questionnaires were in line with the recommendations given in research papers on how to conduct focus group interviews and the number of questions did not exceed eight.

The Focus Group Questionnaire can be found in the Appendix for reference.

Preliminary findings:

1. **Participants.** Most of the interviewees were non-native English speakers and had experience in multinational coalition forces missions in Europe (Kosovo, Cyprus, BIH), Asia (Afghanistan), the Middle East (Iraq, Sudan, Qatar, Sinai Peninsula), and Africa (Liberia, Kenya/Somalia). Their positions vary: an interpreter, a military observer, a UN peacekeeper, a platoon commander, a police officer, etc. The participants were from Albania, Brazil, Bulgaria, Canada, Germany, Hungary, Poland, Romania, Slovakia, Slovenia, Switzerland, Turkey, Ukraine and USA.

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Demographics of Focus Group Members	
Number of participants	27
Sex	Males
Age	25 - 37
Nationality	Albania, Brazil, Bulgaria, Canada, Germany, Hungary, Poland, Romania, Slovakia, Slovenia, Switzerland, Turkey, Ukraine and USA
Education	Military: commissioned & non-commissioned officers Civilian instructors
Occupation	interpreter, military observer, UN peacekeeper, platoon commander, police officer; instructors

2. **Situations related to the use of medical terminology in English:**

Car accidents. This is the most typical situation encountered during various missions.

- The Canadian officer had to call MEDEVAC after an IED car explosion, as a result of which 4 persons were killed and 1 heavily injured.
- The Hungarian officer said he also experienced an IED car accident in Macedonia with 2 slightly injured individuals. He had to call for MEDEVAC in English.
- The Hungarian officer as a UN military observer in Sudan had to report on the deaths of 2 soldiers in a car accident.
- The Turkish police officer and the Swiss army officer both talked about the need to deal with car accident victims while on UN missions.

Health problems. These include diseases of the individual or other people that require assistance in communicating the problem.

- The Polish officer became ill while working in ISAF HQ, and had to describe his problems in English to the ISAF medical personnel at the Czech-run hospital.

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- The BU officer had to take members of his unit to a medical facility on several occasions – hernia, broken arm, fever, nausea, etc. He himself was in hospital with malaria. In every situation he participated as a mediator, taking care of the language interpretation part. He dealt with medical personnel from many different nationalities. Apart from the above-mentioned cases, medical terminology or phases were necessary every time he went on a humanitarian mission, for health education, vaccination or medical assistance.

- The Hungarian officer had to communicate in a common language (English) with other UN personnel about a pandemic in the villages.

- The Turkish police officer mentioned the need for peacekeepers in UN missions to be able to describe their own health problems to medical personnel if the occasion arises while on a UN mission.

Injuries other than in car accidents.

- In Cyprus, an interviewee had to communicate in English about injuries during a MEDEVAC exercise to call in the helicopter support provided by Argentine forces.

- One participant had to describe a police officer's injuries in requesting medical assistance during a border skirmish.

Other findings.

- Multinational units, such as in ISAF, must know basic first aid procedures in English.

- When reporting casualties, one never uses the word "dead" even if it is obvious. Instead, you use the abbreviation VSA "Vital Signs Absent".

- The combat troops would use national language (Polish, Ukrainian) when communicating with an injured soldier and only the paramedic might have to use English to communicate with the doctors.

3. **Medical emergency and first aid training.**

- Participants from Albania, Bulgaria and Slovakia indicated that their nations provide pre-deployment training that includes first aid and handling medical emergencies, but that it is not enough. There is so much else that has to be covered in pre-deployment training.

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The 2-week on-the-job training in Afghanistan squeezes in some basic first aid procedures but again not enough. The officer who served in a UN mission said they had no medical training of any sort before going on the mission.

- Canadian & Hungarian officers: A 2-week training course for first aid called CCCP – Combat Casual Care Program, but no medical terminology.

- Every soldier has the **"nine-liner"** and must be able to complete it when necessary. Soldiers are responsible for **Role 1** – combat saving life system – assistance on the battlefield. **Role 2** LM – life manoeuvre. **Role 3** is performed in the hospital, where there are usually trained medics. When calling MEDEVAC it is important to follow the **"triage"** – prioritization of injuries.

4. **Medical terminology and language training.** Although some participants mentioned that basic medical topics were included in the English course, they confirmed that a quick self-test demonstrated that most of the words have been forgotten. English instructors also confirmed that their students know first aid and MEDEVAC procedures but in many cases are not able to articulate verbally what they are doing and communicate in English for coordination.

   All of the interviewees agreed that abbreviations were difficult and not many people were familiar with them. A list of common abbreviations would be beneficial for the soldiers.

5. **Opinion on the prospects of mobile devices use.** The participants were asked what kind of applications for a personal mobile device, such as a Smartphone or iPad, might be useful and practical and what kind of information presentation they expect to be most effective for providing assistance (linguistic or other) in medical emergencies. The list included voice + text, photo + video, data collection, multi-media messages, data analysis, GPS.

- All participants thought a mobile device was a good idea. Given the applications listed above, most said GPS was the most important application. One man said all the applications were important but their degree of importance would depend on the function

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of the unit using the device. One person suggested a video connection with the hospital, such as in telemedicine. Another liked the idea of photo + text + voice.

- US soldier: Yes. A mobile device would be very useful for sending information to the hospital in advance in order to prepare for treatment. This will save time upon arrival. Picture + text, video + text. Describe the injury as detailed as possible.
- BU officer: Definitely. I am using it myself mostly as a dictionary. But I can also save emergency forms that will help me to shorten the reporting time.
- Canadian officer: A mobile device should be very simple for operation, otherwise it will not be used because time is limited and people are under stress. We should not try to be very precise with the description of the injuries because we may mislead the medics. It would be better to send a picture or a video to show the injured person.

Conclusions

The needs analysis stage helped the research team draw the following conclusions:

1. Participants in coalition operations attend pre-deployment training on rendering first aid and handling medical emergencies. Generally, nations do not provide language medical terminology courses to help militaries articulate verbally what they are doing and communicate in English for coordination.

2. Most typically medical terminology is needed to assist in two types of situations: car accidents and health problems.

3. Participants in multinational missions need to learn vocabulary in order to be able to articulate body parts, injuries, pain, illness symptoms, first aid activities and communication patterns. In the task-based language learning context, they should be able to perform the following tasks: describe, explain report, comfort, ask questions, and comprehend.

4. Regarding established procedures on the battlefield, soldiers are responsible for **Role 1** – saving life and rendering assistance on the battlefield. Every soldier has the **"nine-liner"** and must be able to complete it when necessary. When calling MEDEVAC it is important to follow the **"triage"** – prioritization of injuries.

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5. All participants agreed that a mobile device would be helpful. All the applications were valuable but their degree of importance would be judged on case-by-case basis. The applications should be easy to work with or initial training is necessary.

Based on the discussions with focus group members we identified three potential options for mobile language assistance:

1. Language training, individual learning and refreshing used before and during the mission.
2. Quick and simple help obtained from electronic dictionaries and special applications facilitating filling in the forms.
3. Transfer and transformation of the information, such as voice recognition, translation or transmission information to the point where it could be processed.

Having performed the needs assessment phase, the project staff proceeded to the next step – literature review, in order to study the capabilities of mobile devices and their applications for providing language assistance during multinational coalition operations. Further on, the advantages and drawbacks of m-learning are discussed to identify efficient strategies for mobile language learning.

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MOBILE LEARNING: DEFINITION

To identify the best way of exploiting mobile learning for language assistance to multinational partners, we need to clarify the differences between e-learning and m-learning and identify features of m-learning that may be beneficial and even unique in supporting terminology acquisition for the multinational audience participating in the operations.

A definition of "mobile learning" has been evolving during the last decade, since the time when the first experiments in using handheld devices in education attracted full attention of the e-learning community. The main emphasis in m-learning has always been put on the use of mobile devices or mobile technologies. It is illustrated by a simple definition of C. Quinn – ***"…elearning through mobile computational devices"*** [10] back in 2000, further elaborated by J. Traxler as ***"any educational provision where the sole or dominant technologies are handheld or palmtop devices"*** [11] in 2005 and considered from a practical angle by the Mobile ADL community in 2011 ***"…the use of handheld computing devices to provide access to learning content and information resources."*** [12]

Mobile devices considered by these and other authors [13-15] fall into the following main categories:

- mobile phones and smartphones, (iPhone as an example, but also recent Android-based samples)
- PDAs, tablet PCs, (iPad as an example)
- Netbooks, small size notebooks easy to carry,
- Other devices, such as e-books, MP3-players, game-oriented devices etc.

The main criteria to include a device in this list initially were portability of the device, its individual use by the owner, and capability both to acquire learning content or information and reproduce it in some form (text, audio, video). In other words, an emphasis was put on the accessibility of content anywhere and at any time the owner needs it. However, for many researchers [16, 17] connectivity is an equally important feature of a mobile device, so those which are not able to support communication between humans or with learning content

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through phone calls, SMS, or internet are discarded. With recent expansion of 3G/4G connection, mobile devices supporting these standards may be considered as the way to ensure ubiquitous learning as their portability and autonomous power supply together with widespread internet coverage enable access to learning content outside the buildings with plugs and cords.

Rapidly evolving technologies and growing capabilities of mobile devices that are available for decent price suggest that “the future of the learning is mobile” [18]. Thus attention was brought to “instructional usability”, discussion of educational relevancy of the devices, specific situations in which their use is justified and their potential to support social dimension of learning. [19-21]

Communication, collaboration, and interaction are considered as critical processes in learning understood as a social activity. Due to this fact, socio-constructivists see prospects of m-learning as a tool to support immediate connection and interaction with teacher or peers [22], including exchange of visual and audio information. Therefore, mobile technologies further enrich social environment and communications, enabling natural combination of formal and informal learning through a variety of contacts and sources.

Considering mobility from a learner’s point of view, as transition from one environment to another, mobile technologies support learning in case of changing surroundings and connection between real world situation and artefacts and information about them [23]. The importance of context [24] for the implementation of immersive and exploratory learning for regular students and life-long learning experiences based on situated learning, as well as the potential of modern devices to facilitate learning linked to the environment and situation a learner is in, is expressed in Gary Woodill’s definition of mobile learning as “learning in context” [25].

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M-LEARNING VS. E-LEARNING

Early research in m-learning emphasized limitations of the mobile devices [26], such as size of the display, reduced input, small memory, abridged or specific OS version, and lack of standards, which positioned m-learning as a specific case of e-learning [27, 28]. However, rapid evolution of mobile technologies, their recent features, including efficient and reliable tactile display, automated adjustment of the resolution and the like, put m-learning on an equal footing with e-learning. Moreover, as distribution of mobile devices significantly exceeds the number of personal computers, and "digital native" generation uses these devices extensively not only for communication but also for accessing information on the web, mobile access to e-learning content may increase several times in the near future [29].

The table below outlines certain facets of technology-enhanced learning and their typical usage or most prominent features for each case.

Facet	**e-learning**	**m-learning**
Environment	Class, home, office Plug & cable/WiFi	On the move, ubiquitous 3G/4G
Educational setting	Formal: school, university, professional training, distance and blended	Informal: life-long learning, performance support, blended learning
Instructional paradigm	Course-based, simulations, collaboration "push"	Immersive, exploratory, situated learning; games "pull"
Interaction	Sync/async (internet) and course-based	As in e-learning + SMS/MMS .
Multimedia	Text, pictures, animations, other simulations	Video, audio, text and other Authentic capturing
Learning session time	20-40 min	5-10 min

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M-learning is perceived to be more flexible, more personalized, more interactive, and more engaging [30 - 33]. Due to smaller portions of content and shorter learning session times, m-learning becomes a natural activity during transfer or waiting periods. Moreover, continuous use of the personal mobile device appeals to personalization of learning content through contextual and learning history relevancy. Integrating learning, communication, information exchange and assistance, mobile device became a natural enhancer/extender of the individuals' capabilities. In perspective, m-learning may facilitate smooth acquisition of knowledge and skills "with less effort, but also without us being conscious that we are learning" [19], i.e. facilitate life-long learning as a part of other activities related to business or leisure.

Taking the features of mobile learning described above as a starting point for considering the potential of mobile devices for language assistance, we further analyze techniques and strategies suggested for language learning and vocabulary acquisition in particular. Furthermore, we overview experiential case studies in mobile language learning to reveal approaches which might be appropriate for the project. Finally, we look through the prism of the acquired knowledge to identify efficient strategies for mobile vocabulary support.

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VOCABULARY LEARNING

In this chapter, we will focus on one of the options of language assistance identified earlier, i.e., language (medical terminology) learning, which may take place before or during missions by using a mobile device. We will explore approaches to vocabulary learning, cognitive mechanisms engaged in recognition, memorization and understanding of terminology, vocabulary learning strategies and some features facilitating successful and efficient learning.

Research in vocabulary learning strategies intended for individual, classroom or computer-supported learning has brought a colourful mosaic of approaches, which could be summarized in the following categories:

- A type of vocabulary, i.e. what exactly should be learned. Most typical examples are first or second language, specialized terms, acronyms, or a subset of language necessary to communicate in a certain situation (e.g., making phone calls). Therefore a vocabulary element may be a word, a term, or an expression.

- Information about the vocabulary element: how much should be learned about its linguistic properties, such as part of speech or grammatical forms, a set of meanings, combinations with other words (e.g. prepositions, phraseology).

- Links between the elements: any natural language has typical collocations, exceptions, specific cases that cannot be produced by formal application of grammar rules to a set of terms. In case of professional terminology, some terms may be related closer than others and might benefit from being learned together.

- Purpose of learning vocabulary: to recognize, translate, understand, or use spoken or written language.

Depending on the objectives, depth and type of vocabulary to be mastered, various cognitive mechanisms and learning strategies may be deployed for efficient vocabulary learning. For the purpose of this project, we consider second language vocabulary learning, with limited

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reference to the native language, no linguistic information about the term, and a strong link to a situation, context, or task.

Learning vocabulary beyond the simple memorization of a word list [34] is usually considered in relation to language learning in general, aimed at the learner's ability to communicate in the target language. Therefore, vocabulary learning strategies should be considered in the context of language learning methods and approaches.

At a glance [35], these methods demonstrate a search for a balance between "immersion" into the language environment and a formal study of a language as a subject, with a range of terminal objectives and variety of teacher's roles. Listed below are approaches which in their turn gained popularity and added value to the language learning techniques, however, being unable to meet all challenges of language learning. Nowadays, some elements of these methods are successfully incorporated into the latest approaches and are reflected in the recommendations and principles of foreign language learning [36, 37].

In relation to vocabulary learning one can consider:

- ***The Direct method*** that mimics child's learning of its mother tongue, thus no translation is suggested during the study; vocabulary meanings are either demonstrated or explained through associations; the topics are basically limited to everyday life.

- ***The Audiovisual Method and Oral-Situational Approach*** which are based on the behaviorists' vision of the learning process and skills formation; learning is based on drill-and-practice exercises; dialog fragments are offered for repetitions and mimicry; retention is supported by the reflexes rather than resulted from the conscious activity.

- ***The Natural Approach*** which further elaborates on congenital human capabilities of language mastery. A key factor for successful vocabulary learning is a "comprehensible input". In other words, if a message is clear, a new term may be easily incorporated into one's own vocabulary. The followers of this approach consider two distinct processes: "learning", which is conscious-based, the same way as in case of learning science, and "acquisition", which imitates language learning in a non-mediated environment and leads to "real communication" [37].

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- ***Communicative Language Teaching*** suggests techniques for engaging learners in using language in authentic situations related to their activities, i.e. prepare for actual application of communication skills. Important feature of this approach is recommendation for a learner to reflect on his/her own language learning style and strategies, and build competencies necessary for further autonomous learning.

Critical analysis of these methods and approaches allow for drawing some conclusions. In particular, we want to emphasize on the

- acknowledgement of a dual nature of the language learning process, as a combination of conscious and unconscious mechanisms, therefore, supporting each of them might require specific content and strategies;

- role of the context and environment as a supporting medium for general understanding, meaning negotiation, and memorization;

- importance of the authentic communicative situations and purposeful tasks for building syllabus tailored to specific learning needs;

- recognition of each learner as an individual rather than "an indistinguishable element of a set" thus addressing his/her specific difficulties, typical errors, strengths and weaknesses, and preferred individual learning strategies.

Here "learning strategies" are understood as "…techniques which students use to comprehend, store, and remember new information and skills." [38]

These findings shape the framework for successful vocabulary learning, within which specific techniques and strategies may be applied. A detailed inventory of vocabulary learning techniques from the prospects of person - task – context – strategy [39], which based on the numerous experimental studies, outlines the research results in the field. However, due to complexity of the problem, incomplete experimental data, and diversity of the underlying theories, each issue is discussed in isolation, so the paper lacks recommendations on the use of specific techniques, their benefits and limitations.

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For the purpose of our project, techniques for meaning formation and memorization are of the most importance. The meaning could be explained to the learner on demand (built-in contextual dictionary), searched for and extracted from various kinds of dictionaries with extended information (including audio and samples) or guessed (derived from the context and illustrations). Regarding memorization [40], a number of experimental studies are discussed, such as mnemonics, the role of repetitions and exposure of the world, word lists and their optimal length, timing of repetitions for better recall (so-called spacing algorithms). Considering the role of the learning strategies, the author mentioned that *"self-initiation, selective attention, and deliberate activation of newly learned words consistently predicted both vocabulary size and general proficiency. Other predictors of success included contextual learning, dictionaries, and note-taking strategies"*[39]

Several classifications of the language learning strategies outline some groups of activities beyond the cognitive mechanisms and memorization [41]. Taking Stern's classification as an example, one needs to consider planning and management strategies necessary for self-regulated learning, communicative strategies for keeping conversation (such as paraphrasing), interpersonal strategies, and affective strategies to keep motivation, cope with frustration or a fear to speak. The language learning environment ideally should enable the realization of all these types of strategies.

Although "*research does not provide a definitive account of how to ensure that instructed language learning is successful*" [42], it is possible to derive some guidelines supported both by theory and experiments, and valid for both instructed and self-regulated learning. Below are some conclusions relevant to the MoLE project based on [42, 43]. The digit after the semicolon identifies the number of the language learning "principle" suggested in the paper.

- **Individual learning**: a learner may have his/her own systematic errors [43: 2], and preferred sequencing (learning path, syllabus) of language acquisition [42: 5], so instruction should be individual-oriented [42: 9].

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- **Learning environment**: adults are able to “acquire” language to a certain level [43: 1 and 7], for this purpose both conscious and subconscious mechanisms should be employed [43: 5], [42: 4], and interaction is critical [42: 8].
- **Context**: understanding in context is easier [43: 10], isolated error correction is less effective [43: 6], meaningful input as well as output are important for language mastering [42: 6 and 7].

Understanding of the vocabulary learning mechanisms and strategies from the standpoint of cognitive mechanisms facilitates the critical analysis of mobile-assisted language learning experiments. Theoretically-grounded cases are more tolerant to the changing conditions of the experiment and have better chances of being replicated.

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MOBILE-ASSISTED LANGUAGE LEARNING (MALL)

A close view at the computer-assisted language learning (CALL) history demonstrates a gradual enlargement of the roles that computers have been assigned in the learning process. This enlargement follows a transition of the language learning paradigm from general capabilities extension towards task-based competency development and from traditional readings as a source of authentic language towards conversational language through audio-video input. Comparing to other disciplines, the prominent feature of the language learning courses and other technologies used in language learning, such as e-dictionaries, Skype, web 2.0 technologies, language games, is their continuous emphasis on the learner's activity.

Thus, it is not surprising that a potential of mobile learning was immediately recognized by the CALL community and therefore many early mobile pilot studies were done in language learning. The educators' enthusiasm was supported by two believes. First, that mobile devices are more common than computers and thus are perceived as easier to operate (which is not necessarily true), and second, that the mobile phone is initially intended for communication, thus communication, which is critical in language learning, might be supported by the mobile devices more easily and naturally. Although both hypotheses hold for some conditions, there are still doubts about the state of "m-readiness", i.e. readiness to use all range of functionalities offered by advanced mobile devices [44] in less technology-savvy communities. Besides, voice-based communication supported by the phone is not completely integrated into the mobile versions of e-learning technologies, so there is still a gap between the information flows in audio and text-based communication.

Numerous case studies may be described using the following parameters:

Parameter	*Values (descriptors)*
Age range and status of the participants	school children, students, adults; participation in formal or informal (voluntary) learning, language courses, or professionally-motivated enhancement
Learning objectives	vocabulary learning, refreshing or extension; reading comprehension, communication practice, etc.

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A level of foreign language and the language itself	basic, intermediate, language for specific purpose English, Japanese, Spanish, Chinese, Arabic, etc.
The role of instructor – if available	instructor-led, instructor-guided, instructor-assisted, final assessment only, self-study
Communication occurring during the study and its synchronization	communication with a teacher, peers, seeking for assistance within a community, or none
A format of information exchange	text, audio, video, pictures, audio-video files from the learner
Learning infrastructure - where the learning takes place	classroom, homework, intermediate activities, self-study
Origin of the mobile device	owned by a person, provided by the organization, donated for the pilot study group
Type of the research	a proof of concept experiment, qualitative study, statistical evaluation

Due to the varieties of the MALL studies as described above and quick progress of the mobile technologies that changed availability, affordance and attitude to the mobile devices as learning tools, it is difficult to argue for a particular learning approach. Except for a few studies [45], the participants were university or college students, who were learning language as a part of their academic study. Thus, some of the suggested learning activities were group-oriented [46], and use of the mobile device was reinforced by the academic framework [47]. Early experiments belong mostly to the "proof of concept" group [48], exploring whether some learning activity (e.g. SMS-based reminder [49]) is acceptable and perceived as beneficial by the learners. Further, benefits of availability of the learning content any time due to mobile access and comparison with a regular access to the content through the "wired" computers were explored [45, 50], followed by the evaluation of some scenarios created specifically for the mobile devices [51- 53].

Despite extensive studies, some spots remain unexplored, such as efficiency evaluation for a particular strategy in mobile language learning, or requirements to the environment for the individual language learning support. We also concur with G. Stockwell that "*A limitation plaguing research into using mobile phones for language learning, however, is that much of it occurs in artificial environments, generally within the classroom itself.*" [54, p.96]

Evaluation of the relevance of the research results presented in the numerous studies to the potential audience and objectives of our project was based on the following key features:

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- Support to individual self-regulated learning, not related to any academic degree;
- Provision of communication patterns related to a specific goal-oriented activity;
- Learning activities aimed at refreshing and activating the vocabulary.

Based on that, and taking into account the general guidance for efficient language learning outlined in the previous chapter, some interesting findings are worth being mentioned.

First, considering individualization of the learning material, [55] demonstrated that choice of either verbal or pictorial annotations, which are made based on the student's verbal or visual proficiency could enhance his/her recognition and recall of the words. This finding also supports Dual Coding and Cognitive Load Theories thus recommending limiting variety of input for students with lower capabilities both in visual and verbal comprehension.

Another topic persuaded in some studies [56, 57] is related to the H. Ebbinghaus [58] findings of the learning curve and retention mechanisms. The idea is implemented in the so-called "spacing" algorithms, intended for arranging repetition of information for its better retention at the optimal intervals of time. Unfortunately, "*Although practice and forgetting have been researched extensively by psychologists for more than 100 years (Ebbinghaus, 1885), there is still no consensus on the mechanisms responsible for these effects.*" [59], however, research of the memory mechanisms provides enough evidence of the need for repetition or rehearsal, as well as the effect of difficulty or accessibility on the long-term retention.

Second, in relation to student's active involvement, a note-taking strategy [60] which initially was considered in a form of hand-written/typed notes nowadays is extended to audio/video clips containing vocabulary in context thus assisting in understanding the terminology.

Context awareness [61, 62] is addressed in many tourist-related projects offering environment-aligned language support.

Finally, refreshing and vocabulary activating activities not necessarily should be based on classical drill-and-practice. A game-based vocabulary learning [63-65] might be a good alternative providing better motivation (supporting affective strategies).

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A FRAMEWORK FOR EFFICIENT LANGUAGE (MEDICAL TERMINOLOGY) ASSISTANCE

Summarizing findings from the needs analysis and literature research, one can conclude that potential users of mobile language assistance may benefit from three major types of support:

- ***language learning*** arranged as a sequence of learning activities intended for the acquisition of new vocabulary;
- individually-tailored ***refreshing of the language*** and activation of the vocabulary intended for targeted support of vocabulary memorization;
- ***authentic language practice*** for easy immersion into English language environment during missions, flexibility to accents and speech rate.

Learning content for all cases may be arranged within the common framework described below. As a didactical backbone for language learning activities the task-based language teaching (TBLT) approach [66] is suggested. It addresses communication rather than theoretical aspects of language learning and is especially relevant for this project because of its ability to treat targeted mission-specific and situation-linked language. According to the TBLT, the communication tasks linked to the specific situations (e.g. calling for MEDEVAC, triage - evaluating the seriousness of the injury, explaining symptoms to the doctor) are the main building blocks of the syllabus. In other words, the learning process is considered as a sequence of communication tasks for the learner, arranged from simple to complex, aimed at raising his/her communication abilities. Accomplishment of each task has an important motivational effect on the learner observing his/her achievements at each stage, which rises confidence in the personal capabilities to attain the overall. Authenticity of the tasks makes them more interesting and appealing to the learner as well as facilitates future immersion of the learner into a real-world communication. Keeping the level of complexity of communication tasks relevant to the learner's current language level encourages further practice and enhancement of grammar and pronunciation.

The TBLT approach has been successfully implemented by the Team in the ADL course ELTEC [67] which proved to increase the confidence and competence in English

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communication related to meetings. A modular course structured according to the main medical-related tasks – the same way as it was done for office communication tasks in ELTEC - may be recommended for initial medical-related vocabulary acquisition. Instructional sequencing, timely feedback and authentic communication tasks ensure efficiency of learning. Basic elements for mobile learning would be exercises, corresponding to some learning objective and implemented as a learning objects.

Although individual differences among learners exist at the stage of the initial vocabulary acquisition, ADL practice has proved that good instructional design applied to the relevant content results in a quality course for all. However, when the learners differ significantly in their communication experience, vocabulary subset relevant to the topic, methods used for language learning in their country, when a learner strives to fill some minor gaps in his vocabulary, refresh or activate terminology learned a while ago, an individually selected content would be more beneficial than a linear course. A framework for individual mobile-based medical vocabulary assistance is outlined below as an illustration of functions which might be useful in the environment for learner's support.

The content is represented by the learning objects (the term is understood in general sense as defined in LOM [68]) which might be accessible from mobile devices. The learning objects facilitate language learning in relation to some professional tasks/situations and communication tasks. Description of each object (metadata) may be extended to identify the vocabulary words and expressions it contains for its search and selection according to the individual learner needs. Learning objects are stored in a repository (such as [69,70]) and may be further grouped for different purposes, e.g., creating an instructional sequence as required for the initial vocabulary learning, arranging a set of objects related to a specific situation to diversify vocabulary refreshing, grouping objects offering the same type of learning activity or implementation for a specific class of mobile devices. The repository of the learning objects may be used by the instructors and the learners themselves, making use of the grouping of the objects by task, type, situation, or searching by vocabulary words.

Further steps towards individualization and efficiency of learning require information about the learner's vocabulary gaps and learning history. We expect that each learning object initiates some learning activity, which might be evaluated or monitored, so that the results

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might be recorded. This information may be used by a teacher or an automatic "recommender" for planning and managing vocabulary learning. A simple example of this technique is implemented in some commercial vocabulary learning programs, in which a simple algorithm counts mistakes made in tests and arranges repetition of the words that contained larger number of mistakes.

A recommender may be implemented as a tool or service that provides a learner with a list of objects which might be most relevant for his/her current learning situation taking into account the state of his/her vocabulary knowledge, preferences, history, and selected learning strategies. A simple recommender may be based on the experience of other vocabulary learners, as it is done in recommender systems elsewhere. The idea of on-demand content supply rather than topic-based pre-sequencing learning objects in a course is not new. Learning analytics and service-oriented architectures provide a background for unified management of various learning experiences, facilitate tracking the results of both formal and informal learning, increase flexibility, and ensure enhancement of the individual functionalities without disruption of the overall framework.

Content samples

Below are outlined some content samples which are aligned with the guidelines for efficient mobile learning and may be recommended for medical terminology assistance (self-study, refreshing).

1. ***Game-based*** body parts ***vocabulary learning***: Practice in recognizing terms related to the human body. The game may use a touch-screen to accept a learner's answer (pointing to a certain part of the picture, enlarging, moving a focus). Audio may name parts of the body randomly, continue asking upon a correct answer, and provide feedback for mistakes naming the part the learner actually pointed to. The score would be based on the number of words per allocated time. Another option – an audio segment tells a story with the names of the body parts embedded into it. The player needs to pick up a word from the story and point to the respective body parts before the next one is mentioned. Text representation of the word should be available upon request.

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Game-based scenarios supposedly provide motivation for repetition which is critical in language practice and facilitates focusing on audio information. These scenarios differ from traditional exercises used for testing and help the learner focus on critical information. A combination of pictorial and audio information facilitates memorization.

This example illustrates an overall idea that vocabulary information should not necessarily be ordered alphabetically. For the quick assistance, a pictorial English dictionary with audio output would be more beneficial than a bilingual text-based one, it would be easier to operate and illustrations would support confidence in selecting the right term. The perspective of this kind of assistance was discussed with the English instructors in the OMLET (operational English for militaries) course who participated in the focus group.

2. ***Webcasts on medical-related scenarios.*** Absence of communication practice and language environment leads to deterioration of language proficiency. To compensate the inevitable process of forgetting inactive foreign lexis, we suggest a sequel of short scenarios to activate medical vocabulary and expressions. Arranged around some character, the way it is done, e.g., in "Dr. House", these video clips could tell some stories with intensive use of the terminology directly illustrated and repeated without boring the learner. The user can receive notification and a link with new episodes and also have access to the whole "story". Each part should be short, 3-7 minutes to keep the learner's attention.

Besides the expected motivational effect supported by engagement by the "unfolding story" and natural repetition of vocabulary, this approach would facilitate some "acquisition" of phrases and collocations, some "noticing" which is expected to happen due to the repetitive character of the content.

3. An interactive video. The same way as reading provides context for clarifying the meaning of words and expressions, video information facilitates deeper understanding and intake of the new terminology bypassing verbal translation. Interaction would be used to control the information flow beyond usual stop-rewind combination when the message is not clear. In particular, interaction could be used to imitate communication, check the understanding (asking for the user input) and then provide visual and contextual feedback.

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The idea is grounded in the quest-style games, comics-style animation and instructional video.

This way, a person may "immerse" into a situation and refresh his/her professional skills together with communication capabilities. The long-term goal is to extend the learner's ability to work with media information the same way as he/she can work with a text, i.e. focus on an element (a word), compare two fragments, or return to an episode for deeper understanding. With the growing use of audio and video, learner's skills to notice expressions, communication patterns and delivery styles from this kind of media would be as important as reading in a foreign language for enhancing literacy.

4. A comprehension workout. It would be useful to fill the gap between a studio recording for learning purposes and a documentary (real world recording) – noisy, with unclear pronunciation, too quick to follow, containing language slips and unfinished sentences. In the situations when there is no time to clarify each word, repeat and rephrase, the learners must be able to focus on critical information. For instance, the authentic recording may be supplied with a list of vocabulary words which a learner should identify in real time. Then, the whole situation may be divided into stages, and the learner has an opportunity to enhance his/her understanding by watching or listening to a similar story.

The goal of this type of exercises is to ensure an overall comprehension and train how to increase the level of understanding. It would be also useful to encourage language learning in an environment with interferences, which is often the case with mobile learning.

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CONCLUSION

The research project combines needs analysis in language terminology assistance to identify the challenges to coalition partners and literature research to reveal some efficient strategies to address them through mobile learning. We have come to the conclusion that success of the vocabulary learning depends on the person's conscious involvement in the learning process, active participation in vocabulary acquisition and communication practice rather than specific memorization strategies. Further exploration revealed the importance of context, individualization and repetition as key factors in language learning. These factors may be addressed through mobile support ensuring access to individually selected learning objects.

Although multinational partners interviewed during the needs analysis had a limited experience in applications and on-line services on mobile devices, they were interested in using them for language terminology assistance. Due to limited training in medical-related topics, assistance in medical and health-related vocabulary learning and refreshing is necessary, whereupon the most important topics cover body parts, injuries and symptoms in communicating situations during car accidents, MEDEVAC call, and a visit to a doctor.

As a first step towards personalized mobile learning environment, we suggest a framework for language terminology support and describe some potentially useful samples of learning objects. Their features are aligned with recommended cognitive mechanisms, their design reflects some trends in mobile learning, and their topics and learning objectives correspond to the project.

Finally, the research revealed that little attention has been paid so far to arranging efficient learning and support for diverse multinational audience. Thorough research is also needed to identify the ways to integrate structured learning and training with self-managed learning for life-long learning support. Further development of mobile learning will also lead to the change in e-learning design which would facilitate flexible rearrangement of the learning objects for target audience. Context awareness may finally lead to the fusion of learning and performance support techniques delivered individually to the mobile user.

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MEETINGS

- A formal meeting took place on 8 February 2011 to start the project. The meeting was attended by Jacob Hodges, Dr. Tammy Savoie, Scott Shephard, Dr. Kateryna Synytsya and Greta Keremidchieva. The initial scope of the project was discussed at the meeting as well as stages for development.
- A working meeting took place in July 2011 to discuss research efforts and preliminary results of needs analysis, to discuss language gaps, learning content and teaching strategies with instructors who teach English related to MEDEVAC and emergency situations, and identify further steps in needs analysis. Present – Dr. K.Synytsya, G.Keremidchieva, Scott Shephard, and Peggy Garza from George C. Marshall Center, who expressed her keen interest in facilitating the study and interviews with focus groups.
- Dr. Kateryna Synytsya made a presentation entitled “Medical Terminology Assistance to Multinational Partners in Coalition Operations: Preliminary results of the research project” at the ADL Forum in Norfolk in August 2011.
- A working meeting was conducted on 2-4 November 2011 with the purpose (1) to plan the second phase of research; (2) to identify teams working on mobile learning; (3) to investigate partner-countries’ readiness to use mobile learning.
- A Semi-Annual report was sent to Dr. Tammy Savoie – coordinator of the project. Feedback was received with quite positive comments and some recommendations for further investigation and findings to be included in the final version.

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- A meeting in late January/early February 2012 was held to finalize the structure of the project research report.
- A research paper on the topic of the project has been published in **Information & Security International Journal Vol. 27 nr. 1 - C4ISR Support to the Comprehensive Approach.** The contributing paper is on-line at http://infosec.procon.bg/contents/vol_27.htm.

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REFERENCES

1. Kukulska-Hulme, A. (2007). Mobile Usability in Educational Contexts: What have we learnt?. *The International Review Of Research In Open And Distance Learning*, 8(2).

2. M. Sharples. (2007) (Ed) Big Issues in Mobile Learning. Workshop report. Ed Kaleidoscope 2007.

3. Economides, A.A. & Nikolaou, N. (2008) Evaluation of handheld devices for mobile learning. *International Journal of Engineering Education*. 24 (1).

4. Ally, M. (2009). (Ed.). *Mobile learning: Transforming the delivery of education & training.* Athabasca: AU Press.

5. Specht, M. (2009). *Learning in a technology enhanced world. Context in Ubiquitous Learning Support.* Open University Netherlands, 53.

6. Joseph S., Binsted K. & Suthers D. (2005) "PhotoStudy: Vocabulary Learning and Collaboration on Fixed &Mobile Devices", *Proc. of 3rd IEEE Int. Workshop on Wireless and Mobile Technologies in Education.*

7. Chinnery, G. (2006). Going to the MALL: Mobile Assisted *Language Learning*, *Language Learning & Technology* 10(1).

8. Kukulska-Hulme, A. and Shield, L. (2008). An overview of mobile assisted language learning: From content delivery to supported collaboration and interaction. *ReCALL*, 20(3).

9. Stockwell, G. (2007) Vocabulary on the move: Investigating an intelligent mobile phone-based vocabulary tutor. *Computer Assisted Language Learning*, **20**(4): 365-383.

10. Quinn, C. (2000). mLearning: Mobile, Wireless, In-Your-Pocket Learning. [Online] LiNE Zine. Fall. http://www.linezine.com/2.1/features/cqmmwiyp.htm [Accessed September 2011].

11. Traxler, J. (2005) Defining mobile learning, Proc. IADIS International Conference Mobile Learning.

12. ADL (2011). ADL Mobile - home. [Online]. ADL Advanced Distributed Learning. Available from: http://adlmobile.wikispaces.com/. [Accessed September 2011].

13. Cobcroft, R. S., Towers, S., Smith, J. and Bruns, A. (2006) Mobile learning in review: Opportunities and challenges for learners, teachers, and institutions. [Online] In *Proceedings Online Learning and Teaching (OLT) Conference* 2006, Queensland

This report was funded by the Coalition Warfare Program (CWP) as part of the Mobile Learning Environment (MoLE) Project and awarded by the Office of Naval Research Global (ONRG) under N62909-11-1-7045

University of Technology, Brisbane. http://eprints.qut.edu.au [Accessed September 2011].

14. Geddes, S.J. (2004), "Mobile learning in the 21st century: benefit for learners", *Knowledge Tree e-journal*, 30(3), [Online] http://knowledgetree.flexiblelearning.net.au/edition06/download/geddes.pdf.

15. Kineo and UFI/Learndirect (2009) Mobile Learning Reviewed. [Online]. http://www.kineo.com/documents/Mobile_learning_reviewed_final.pdf [Accessed September 2011].

16. Georgieva, E., Smrikarov, A., Georgiev, T. (2005) A General Classification of Mobile Learning Systems. In: *CompSysTech' 2005-ConferenceProceedings*.

17. Nyiri, K. (2002). Towards a Philosophy of M-Learning. IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE 2002), August 29-30, 2002.

18. Carg, A. (2010) The future of the learning is mobile [Online] http://www.upsidelearning.com/blog/index.php/2010/06/10/the-future-of-e-learning-is-mobile-mlearncon/ [Accessed September 2011].

19. Laouris, Y., Eteokleous, N. (2005) We need an educationally relevant definition of mobile learning. [Online] 4th World Conference on Mobile Learning. Cape Town, South Africa. [Accessed September 2011].

20. Traxler, J. (2007) Defining, Discussing and Evaluating Mobile Learning: the moving finger writes and having writ … . *International Review of Research in Open and Distance Learning* **8**(2) http://www.irrodl.org/index.php/irrodl/article/viewArticle/346/875 [Accessed September 2011].

21. Guy, R., R. Guy (Ed.) (2010) Mobile learning defined. In Mobile learning: Pilot projects and initiatives. Santa Rosa, California. Informing Science Press. http://www.tnstate.edu/bis/RettaHGUY.pdf [Accessed September 2011].

22. Cooney, G., Keough, K. (2007). Use of mobile phones for language learning and assessment for learning, a pilot project. In: mLearn Melbourne 2007 – Conference Proceedings.

23.Dyson, L.E., Litchfield, A., Lawrence, E., Raban,R.and Leijdekkers, P. (2009) Advancing the m-learning research agenda for active, experiential learning: Four case studies. *Australasian Journal of Educational Technology*, http://epress.lib.uts.edu.au/research/bitstream/handle/10453/9856/2008007827OK.pdf?sequence=1 [Accessed March 2012].

This report was funded by the Coalition Warfare Program (CWP) as part of the Mobile Learning Environment (MoLE) Project and awarded by the Office of Naval Research Global (ONRG) under N62909-11-1-7045

24. Liu, G.-Z. and Hwang, G.-J. (2010), A key step to understanding paradigm shifts in e-learning: towards context-aware ubiquitous learning. *British Journal of Educational Technology*, 41.

25. Woodill, G. (2011) The Evolution of the definition of mobile learning. Float Mobile learning. [Online] http://floatlearning.com/2011/08/the-evolution-of-the-definition-of-mobile-learning/ [Accessed September 2011].

26. Wang, S., & Higgins, M. (2006). Limitations of mobile phone learning. *The JALT CALL Journal*, 2(1).

27. Trifonova, A., Knapp J., Ronchetti M., Gamper J. (2004) Mobile ELDIT: Transition from an e-Learning to an m-Learning System. *Proc. ED-MEDIA 2004*, June 21-26, 2004, Lugano, Switzerland.

28. Naismith, L. et al., (2004) Literature Review in Mobile Technologies and Learning, NESTA Futurelab Series, United Kingdom. http://www2.futurelab.org.uk/resources/documents/lit_reviews/Mobile_Review.pdf

29. Johnson, L., Adams, S., and Haywood, K., (2011). The NMC Horizon Report:2011 K-12 Edition. Austin, Texas: The New Media Consortium. http://www.nmc.org/pdf/2011-Horizon-Report-K12.pdf

30. Cherian E. J. and Williams P., (2008) Mobile Learning: The Beginning of the End of Classroom Learning. Proc. World Congress on Engineering and Computer Science - WCECS 2008, October 22 - 24, 2008, San Francisco, USA.

31. Cochrane, T. and Bateman, R. (2009). Transforming pedagogy using mobile Web 2.0. *International Journal of Mobile and Blended Learn*ing. 1 (4), 56-83.

32. Wagner, E. D. (2005). Enabling mobile learning. EDUCAUSE Review, 40(3). 40–53.

33. Börner, D., Glahn, C., Stoyanov, S., Kalz, M., & Specht, M. (2010). Expert concept mapping study on mobile learning. Campus-Wide Information Systems, 27(4) http://dspace.ou.nl/bitstream/1820/2837/6/cwis_draft.pdf

34. Godwin-Jones R. (2010) From memory palaces to spacing algorithms: approaches to second-language vocabulary learning. Language Learning & Technology. http://llt.msu.edu/vol14num2/emerging.pdf

35. Decoo, W. (2001) On the mortality of language learning methods. Given as the James L. Barker lecture on November 8th 2001 at Brigham Young University. Retrieved from. http://www.disseminate.be/mortality.htm

36. Nunan, D. (ed) (2003) Practical English Language Teaching McGraw Hill/Contemporary.

This report was funded by the Coalition Warfare Program (CWP) as part of the Mobile Learning Environment (MoLE) Project and awarded by the Office of Naval Research Global (ONRG) under N62909-11-1-7045

37. McKendry, E. (2006) Theory and Practice in Language Teaching and Learning. An Overview of Second Language Teaching Methods and Approaches. Retrieved from. http://www.cramlap.org/documentation

38. Gu, P. (2003) Vocabulary Learning in a Second Language: Person, Task, Context and Strategies. TESL, 7(2), September 2003. http://tesl-ej.org/ej26/a4.html

39. Chamot, A., Kupper, L. (1989) Learning Strategies in Foreign Language Instruction, Foreign language annals –February.

40. Nakata, T. (2008). English vocabulary learning with word lists, word cards and computers: implications from cognitive psychology research for optimal spaced learning. ReCALL, 20(1). http://journals.cambridge.org/action/displayFulltext?type=1&fid=1584888&jid=REC&volumeId=20&issueId=01&aid=1584884

41. Hismanoglu, M. (2000) Language Learning Strategies in Foreign Language Learning and Teaching. The Internet TESL Journal, VI (8), August 2000.

42. Ellis, R. (2005). Instructed second language acquisition: A literature review. Wellington: Ministry of Education NZ.

43. Lightbown, P.M. (2003). SLA in the classroom/SLA research for the classroom Language Learning Journal, Winter 2003.

44. Corbeil, J., Valdes-Corbeil M. Are You Ready for Mobile Learning? Frequent use of mobile devices does not mean that students or instructors are ready for mobile learning and teaching. EDUCAUSE Quarterly, 2007,Vol. 2.

45. Ally, M., McGreal, R., Schafer, S., Tin, T., & Cheung, B. (2007, October). Use of mobile learning technology to train ESL adults. Proceedings of the Sixth International Conference on Mobile Learning, Melbourne. http://www.iamlearn.org/public/mlearn2007/files/mLearn_2007_Conference_Proceedings.pdf

46. Pemberton L., Winter M., Fallahkhair S. (2010) Collaborative Mobile Knowledge Sharing for Language Learners. Journal of the Research Center for Educational Technology (RCET) 6(1).

47. Song, Y., Fox, R. (2008) Integrating Incidental Vocabulary Learning Using PDAs into Academic Studies: Undergraduate Student Experiences. In: Proceedings of ICHL.

This report was funded by the Coalition Warfare Program (CWP) as part of the Mobile Learning Environment (MoLE) Project and awarded by the Office of Naval Research Global (ONRG) under N62909-11-1-7045

48. Ducate L., Lomicka L. (2009) Podcasting: an effective tool for honing language students' pronunciation? Language Learning & Technology. http://llt.msu.edu/vol13num3/ducatelomicka.pdf

49. Song, Y. (2008). SMS enhanced vocabulary learning for mobile audiences. International Journal of Mobile Learning and Organisation, 2(1).

50. Kukulska-Hulme, Agnes (2009). Will mobile learning change language learning? ReCALL, 21(2). http://oro.open.ac.uk/16987/2/AKH_ReCALL_Will_mobile_learning_change_language_learning.pdf

51. Wang, S., Higgins, M. (2008) Mobile 2.0 Leads to a Transformation in mLearning. In: Hybrid Learning and Education, Lecture Notes in Computer Science.

52. Zhang H., Song W., Burston J.(2011) Reexamining the effectiveness of vocabulary learning via mobile phones. TOJET: The Turkish Online Journal of Educational Technology – July 2011.

53. Seipold J., Pachler N. (2010) MoLeaP, The Mobile Learning Project Database: A Pool for Projects and Tool for Systematic Description and Analysis of Mobile Learning Practice, Journal of the Research Center for Educational Technology (RCET) 6(1).

54. Stockwell, G. (2010). Using mobile phones for vocabulary activities: Examining the effect of the platform. Language Learning & Technology, 14(2). http://llt.msu.edu/vol14num2/stockwell.pdf

54. Chen, N.-S., Hsieh, S.-W., Kinshuk (2008) Effects of short-term memory and content representation type on mobile language learning. Language Learning & Technology, 12(3). http://llt.msu.edu/vol12num3/chenetal.pdf

56. Diachenko, P. (2009) A Software System for Learning the Vocabulary and Collocations: Results of a Training Experiment. In: A. Méndez-Vilas, A. Solano Martín, J.A. Mesa González and J. Mesa González (Eds) Research, Reflections and Innovations in Integrating ICT in Education, vol. 1. FORMATEX, Badajoz, Spain.

57. Chen C.-M., Chung C.-J.(2008) Personalized mobile English vocabulary learning system based on item response theory and learning memory cycle. *Computers & Education*. 51(2).

58. Ebbinghaus H. (1885) Memory: A Contribution to Experimental Psychology. Classics in the History of Psychology. An internet resource developed by Christopher D. Green Retrieved from. http://psychclassics.yorku.ca/Ebbinghaus/index.htm

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59. Pavlik P. Jr., Anderson J. (2005) Practice and Forgetting Effects on Vocabulary Memory: An Activation-Based Model of the Spacing Effect. Cognitive Science, 29.

60. Kukulska-Hulme, A., Bull, S. (2008). Theoretical perspectives on mobile language learning diaries and noticing for learners, teachers and researchers. In: Proceedings of the mLearn Conference Oct 2008, Ironbridge Gorge, Shropshire, UK. http://oro.open.ac.uk/15105/2/384A7259.pdf

61. Meyer, B., Bo-Kristensen M. (2009) Designing location aware games for mobile language learning. In: A. Méndez-Vilas, A. Solano Martín, J.A. Mesa González and J. Mesa González (Eds) Research, Reflections and Innovations in Integrating ICT in Education, vol. 2. FORMATEX, Badajoz, Spain.

62. Yau, J., Joy, M. (2009) A mobile and context-aware learning schedule framework from a pedagogical perspective – an interview study. Proc IADIS international conference Mobile Learning 2009.

63. Jung J., Graf S. An Approach for Personalized Web-based Vocabulary Learning through Word Association Games SPeL-08.

64. Uzun L. (2009) An evaluative checklist for computer games used for foreign language vocabulary learning and practice: vocaword sample. Novitas-ROYAL, 3(1). http://www.novitasroyal.org/Vol_3_1/uzun.pdf

65. Fotouhi-Ghazvini F., Earnshaw, R. A., Moeini A., Robison D., Excell P. S. (2011) Implementing mixed reality games for mobile language learning. Proc. Mobile Learning 2011.

66. Nunan D. (2004) *Task-based language teaching*. Cambridge University press.

67. Danylova, O., Synytsya, K. & Martynov, D.(2008) A competence-based approach to the design of the on-line English course. Proc. MIPRO-2008.

68. 1484.12.1-2002 - IEEE Standard for Learning Object Metadata. http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf

69. Pathmeswaran, R. and Ahmed, V. (2009) SWmLOR: Technologies for Developing Semantic Web based Mobile Learning Object Repository. *The Built & Human Environment Review*, 2(1) http://www.tbher.org/index.php/tbher/article/view/16/17

70. Yen N., Shih, T., Chao, L., Jin, Q. (2010) Ranking Metrics and Search Guidance for Learning Object Repository. IEEE Transactions on Learning Technologies, 3(3).

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APPENDIX

Focus Group Questionnaire

1. Tell the year, duration, location and purpose of each international mission in which you have participated.
2. Did you ever experience a time when you or a member of your unit had to deal with a medical emergency? Please describe.
3. Was it necessary to know English or communicate in English to deal with this situation? Please explain.
4. Were there any other times during the mission when knowing medical terminology or phrases in English was needed? Please explain.
5. Does your nation provide pre-deployment training in medical terminology for non-medical specialists? If so, please describe. Native vs English
6. Would a mobile learning device intended to provide medical terminology /phrases in English to assist with medical emergencies in the field be useful and practical? Discuss.
7. Do you have any suggestions for where to locate deploying personnel we could interview to help us determine learning needs? Do you have any suggestions for where to locate individuals who can help us with the medical content?
8. In your opinion, which mobile device application would be most effective in case of emergency:

    a) voice + text;

    b) photo + video;

    c) data collection;

    d) multi-media messages;

    e) data analysis;

    f) identifying the location.

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