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MEDICAL TERMINOLOGY ASSISTANCE TO MULTINATIONAL PARTNERS THROUGH M-LEARNING

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***Abstract**: Knowledge of medical-related terminology and communication skills are essential for multinational partners participating in a wide variety of missions. A study was held to identify the vocabulary learning needs, efficient strategies, and opportunities to arrange language assistance through mobile learning. Specific communication situations and terminology gaps were identified during the needs analysis conducted with questionnaires and focus group interviews. Literature research brought to light benefits of m-learning and its relevancy to implement recommended vocabulary learning techniques. A framework for medical terminology assistance and content samples for individual context-related learning are suggested.*

***Keywords**: M-learning, vocabulary learning strategies, medical terminology, MALL*

I. INTRODUCTION

Knowledge of medical-related terminology and communication skills are essential for multinational partners participating in a wide variety of missions - combat, stabilization, humanitarian support and natural disaster relief. In case of injures and sickness they need to know basic medical terminology in English to evaluate the situation, arrange for MEDEVAC or coordinate health services. Although the First aid and MEDEVAC topics are included into many language training programs, they did not get enough attention comparing to the actual performance. The lack of sufficient practice and intense training schedule at the pre-deployment period leads to low retention of the medical terminology. To refresh the language before and during the mission, enhance communication skills and fill the vocabulary gaps a technology-enriched approach may be a good supplement to the classroom training. In particular, access to learning content from the mobile devices and use of mobile applications do not require scheduling or allocating time for a study, thus adding flexibility.

This study seeks to evaluate the prospects of m-learning as an instrument for enhancing medical- and health-related communication among multinational partners. The main objectives are to identify specific needs of the multinational partners in medical terminology, explore a range of technology-enhanced language learning strategies for vocabulary extension and refreshing, and suggest a framework for medical terminology assistance based on m- learning.

II. NEEDS ANALYSIS

The study started with a needs analysis phase which included identification of persons who could share their experience in medical- and health-related communication in English during the

missions, distribution of the questionnaire and interviews. 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.

Key focus groups to determine communication tasks for handling medical emergencies 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-native English speakers from NATO and partner countries.

Participants were invited to take part in the interview and it was made clear that individual comments would be strictly confidential. The interviews lasted between 60-90 minutes. These were structured interviews with pre-planned questions. The questions were open-ended, simple, unbiased and focused on the matter. Most of the interviewees were non-native English speakers and had experience in multinational coalition forces missions in Europe, Asia, the Middle East, and Africa. Their positions vary: an interpreter, a military observer, a UN peacekeeper, a platoon commander, a police officer, etc. The participants were 27 persons from 14 countries, male persons, the age of 25-37.

Apart from the participants who shared their experience and observations of communication situations related to medical terminology and their view on the use of mobile devices, a focus group of English instructors of military medical terminology was interviewed. English instructors 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.

The findings of the needs analysis phase may be summarized as follows:

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

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

All participants agreed that a mobile device with applications would be helpful. 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:

– Language training, individual learning and refreshing used before and during the mission.

– Quick and simple help obtained from electronic dictionaries and special applications facilitating filling in the forms.

– Transfer and transformation of the information, such as voice recognition, translation or transmission information to the point where it could be processed.

We further focus on the ways to support vocabulary learning with mobile devices. In particular, we explore vocabulary learning strategies, reveal factors recognized as determining the efficiency and success of learning, and overview case studies in mobile-assisted language (vocabulary) learning to identify promising approaches.

III. MOBILE-ASSISTED VOCABULARY LEARNING

3.1. Vocabulary learning strategies

Research in vocabulary learning strategies intended for individual, classroom or computer-assisted learning has brought a colorful mosaic of approaches. Depending on the objectives, depth and

type of vocabulary to be mastered, various cognitive mechanisms and learning strategies are recommended. In our case, vocabulary learning could be described as second language learning, with limited to no reference to the native language, no linguistic information about the term. It is intended for adult learners with medium level of language skills, who needs the vocabulary for specific tasks, thus the language learning should be linked to a situation, communication context, or a task.

Considering vocabulary learning in the context of language learning methods and approaches, we explored several of them with a solid theoretical background and a record of successful implementations. At a glance [1,2], these methods demonstrate a search for a balance between "immersion" into a language environment and a formal study of a language as a subject, with a range of terminal objectives and variety of teacher's roles. In particular, we want to mention:

– *The Direct method* that mimics child's learning of its mother tongue, thus vocabulary meanings are either demonstrated or explained through associations, which limits a range of appropriate topics.

– *The Audiovisual Method and Oral-Situational Approach* based on the behaviorists' vision of the learning process and skills formation through drill-and-practice exercises. The learning strategies exploit basic psychological mechanisms, memorization and retention are supported by the reflexes rather than conscious activity; dialog fragments are offered for repetitions and imitations.

– *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".

– *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.

Another facet of the vocabulary learning is related to specific mechanisms for meaning formation and memorization. Traditionally, reading was recommended as a mechanism to identify a meaning from context, or consider its specific facets, when a general meaning is supplied by a dictionary. Recently, video-content is sometimes used for the same purpose. Although efficiency and accuracy of the meaning formation from the context is lower than in case of direct exposure, the efforts taken facilitate longer retention. Regarding memorization, a number of techniques are recommended for "mechanical" memorization, such as mnemonics. The experimental studies discuss the role of repetitions and exposure of the word, composition of word lists and their optimal length, timing of repetitions for better recall (so-called spacing algorithms).

A search for the best learning strategy leads to the recognition that successful learning strategies are specific to the learners rather than to the type of learning, however, "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"[3]. Another finding is that other types of learning activities,

not directly related to cognitive mechanisms and memorization are equally important. In particular, 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 current "research does not provide a definitive account of how to ensure that instructed language learning is successful" [4], it is possible to derive some factors valid for both instructed and self-regulated learning, the importance of which is supported both by theoretical principles and experiments.

Individual learning. The key role of individualization is justified by the facts that systematic errors are learner-specific, as well as memorization and forgetting speed. Learners have their own preferred strategies and sequencing (learning path, syllabus) of language acquisition, so individually-oriented instruction or tailored self-managed learning would maximize the effect.

Context. Relevant context increases motivation, facilitates understanding, error correction, creates conditions for both meaningful input and output, which are important for language mastery.

Learning environment. Communicative language is developed with "acquisition" mechanisms, together with conscious learning. To support a variety of learning content and strategies, interaction and communication, a learning environment is necessary.

Understanding of the vocabulary learning mechanisms and strategies from a standpoint of cognitive mechanisms facilitates a critical analysis of mobile-assisted language learning experiments.

3.2. Mobile-assisted language learning

A definition of "mobile learning" has been evolving during the last decade, but the main emphasis has always been put on the use of mobile devices or mobile technologies. Early research in m-learning emphasized limitations of the mobile devices, 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. 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 natives" use them 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. Rapidly evolving technologies and growing capabilities of mobile devices that are available for decent price suggest that "the future of the learning is mobile" [5].

M-learning is perceived as being flexible, personalized, interactive, and engaging [6 - 8]. Due to smaller portions of content and shorter learning session times comparing to distance learning, 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. 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" [9], i.e. facilitate life-long learning as a part of other activities related to business or leisure.

Because of the 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. Despite the variety of studies, they follow some pattern, i.e. starting with a "proof of concept" and evaluation of new technologies acceptance and "m-readiness" of both teachers and students; continuing with assessment of benefits of any-time availability of the learning content, and finally evaluating scenarios created specifically for the mobile devices [10- 12].

Evaluating the relevance of the numerous publications to the research problem, we focus on the following key features:

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

Despite the limitations of research, as "…much of it occurs in artificial environments, generally within the classroom itself." [13], some interesting findings are worth being mentioned.

First, considering individualization of the learning material, a case study [14] demonstrated that choice of either verbal or pictorial annotations depending 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.

Second facet of individualization [15, 16] is related to the scheduling of learning session based on 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, "…there is still no consensus on the mechanisms responsible for these effects." [17], 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 of the content on the long-term retention.

Finally, in relation to student's active involvement, a note-taking strategy [18] 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. Finally, refreshing and vocabulary activating activities not necessarily should be based on classical drill-and-practice. A game-based vocabulary learning [19-20] might be a good alternative providing better motivation (supporting affective strategies).

IV. A FRAMEWORK FOR EFFICIENT 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.

4.1. Individualized vocabulary support

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 [21] 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 in the ADL course ELTEC [22] which proved to increase the confidence and competence in English communication related to meetings. A modular course structured according to the main medical-related tasks 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 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 mobile learning objects repository 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 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.

4.2. 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).

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.

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 OMLT course who participated in the focus group.

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 unused 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.

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. 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.

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.

V. CONCLUSIONS

Terminology assistance and vocabulary learning for communication tasks may be effectively supported by mobile technologies. The nature of information processing and learning processes in these cases is aligned with distinctive features of mobile devices use – a limited amount of content, short sporadic sessions, multimedia input/output with limited textual information. The research revealed 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. Other important factors include context, individualization and repetition.

Suggested framework for medical terminology assistance draws attention to individualization as an important factor for learning efficiency and outlines features that yet need to be considered under scrutiny for implementation. In particular, further study of the ways to identify a particular learning object, describe or reveal its characteristics is necessary, as well as standardized methods for monitoring and registering learning achievements outside of the learning management systems.

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