

# Mobile-assisted Language Learning in Technical and Engineering Education

## Tools and learners' feedback

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**Abstract**—Mobile devices have become standard within didactic means on all levels of education and in all subjects to appropriate extent, including foreign languages. This study focuses on their use within technical (i.e. bachelor) and engineering (i.e. master) higher education in Informatics and Management study programmes at the Faculty of Informatics and Management (FIM), University of Hradec Kralove (UHK), Czech Republic, particularly focusing on comparison in general subjects to English for specific purposes (ESP). Following questions were set to be researched: (1) What sources of information do students use for ESP?, (2) What mobile devices do they own and exploit for mobile-assisted ESP learning? and (3) What is students' feedback after MALL? As the availability and exploitation of mobile devices have been spreading sharply lately in the Czech Republic, the results closely reflect the state in education, particularly in MALL, in the world.

**Keywords**—mobile-assisted language learning; MALL; m-learning; English for specific purposes; ESP; higher education; engineering education

### I. INTRODUCTION

Latest trends in technical and technological development having been implemented in the ICT-enhanced process of instruction, a shift was detected in their exploitation from traditional, non-portable (immobile) devices to mobile ones. Mobile devices have become standard within didactic means on all levels of education and in all subjects, to appropriate extent, including foreign languages. Until now the traditional e-learning using non-portable devices has been widely implemented into the education in the Czech Republic. Further development reflected the fact mobile devices were not available to desirable extent as in other, more developed countries. Within last two-three years the situation changed substantially and currently the mobile learning has been step-by-step moving from small-scale, short-term trials to larger, more sustained and blended deployment. It can be even stated the field of foreign languages is a leader in mobile-assisted language learning (MALL), starting from unintentional listening to songs, mostly in English, to highly intentional learning activities, e.g. listening to texts, speaking – communicating, writing short messages etc. [1].

This study focuses on the use of mobile devices within technical (i.e. bachelor) and engineering (i.e. master) higher education in Informatics and Management study programmes at the Faculty of Informatics and Management (FIM), University of Hradec Kralove (UHK), Czech Republic. Despite the mobile devices-enhanced instruction has had a short history at this institution (only one-year long pilot process), several researches have been conducted and continuous feedback collected [2]. Consequently, following questions were set to be researched:

1. What sources of information do students use for ESP?
2. What mobile devices do they own and exploit for mobile-assisted language (ESP) learning?
3. What is students' feedback after MALL?

### II. THEORETICAL FEEDBACK

English for Specific Purposes (ESP) as the most prominent area of English as a foreign language teaching is meeting specific needs of the learners, using methodology and activities of the disciplines it serves, which may differ from those of general English, and focusing on the language appropriate to these activities in terms of grammar, lexis, learners' skills etc. It may relate to various disciplines, being designed for adult intermediate/advanced learners on tertiary education level or in professional work situation [3].

The term of mobile devices (technologies) to enhance learning (m-learning) has not been precisely defined. Some authors, e.g. Crompton [4], defined it as learning across multiple contexts, through social and content interactions, using personal electronic devices, concerned with a society on the move, particularly with the education; or Sharples [5] described it as a way how the mobility of learners augmented by personal and public technology can contribute to the process of gaining new knowledge, skills and experience Quinn [6] has given a definition of m-learning from a technical perspective stating m-learning is a digital learning method realized through Intelligent Apparatus equipment. These Intelligent Apparatus equipment include Palms, Windows CE equipment and digital cellular phone etc. Chabra and Figueiredo [7] have given a broader definition stating m-learning means to be able to use the task equipment to acquire

knowledge at any time and any place. In this research m-learning, i.e. using mobile devices for educational purposes, is an approach how to reach the same objectives as defined by Comenius didactic principles [8], i.e. purposefulness, clearness, system approach, learners' activity and awareness of intentional activities, retention of knowledge, adequacy, emotionality, and last but not least the joint approval and the consensus of the family. Topically, the ICT-implementation in the process of instruction has become standard; online courses are currently being developed towards MOOC (Massive Open Online Course) and latest technologies, which are of high interest of young people, are being implemented in education so that m-learning was activated.

As summarized by Palalas [9], if investigating how the mobile technology promotes foreign language learning reflecting didactic principles, the learners' mobility across authentic contexts enables situated language practice. Mobile-assisted language learning offers learners on-demand flexibility "congruent with learners' increasingly mobile, always-connected lifestyles" [10: 249]. It also enables "continuity or spontaneity of access and interaction across different contexts of use" [11: 273]. Flexible interaction with teachers, experts and peers offered in a more self-paced collaborative environment can further promote learning. "Additionally, Kukulska-Hulme and Pettit [12] mention convenience and portability, productive utilization of dead time (for instance, when commuting), ability to connect and interact, affordability, accessibility of up-to-date material, and multimedia options.

The model of MALL for ESP learning applied at FIM blends three types of activities: (1) the face-to-face instruction of full-time students or autonomous learning of part-time students; (2) work in online courses through non-portable devices of both groups, as well as (3) the individualized approach to the online courses through mobile devices. Such a learning model satisfies learners' time/place preferences [13] and bridges formal and informal learning [14].

Above all, this approach also reflects the FRAME (Framework for the Rational Analysis of Mobile Education) model designed by Marguerite L. Koole [15]. Equipped with a mobile device, the learner can choose to consult a web page, access audio- or video-tutorials, send text message to peers, contact an expert/tutor for guidance etc.

But, how can such a learner take full advantage of the mobile experience? How can practitioners design materials and activities appropriate for mobile access? How can mobile learning be effectively implemented in both formal and informal learning?, Koole asks. The FRAME model offers some insights into these issues as it describes a mode of learning in which learners may move within different real and virtual locations and thereby participate and interact with other people, information or systems – anywhere, anytime. The interaction with information is mediated through technology. Within this context, the FRAME model is presented in the form of a Venn diagram (figure 1) in which three aspects (circles) representing the device (D), learner (L) and social aspects (S) intersect. The device usability (DL) and social technology (DS) intersections describe the availability (which

is called the ownership in our research) of mobile technology [16]. The intersection labelled interaction learning (LS) contains instructional and learning theories with the emphasis on social constructivism. All three aspects overlap at the primary intersection (DLS) in the centre of the Venn diagram which defines an ideal mobile learning situation [15]. The FRAME model takes into consideration the technical characteristics of mobile devices as well as social and personal aspects of learning, thus referring to concepts similar to those found in psychological theories, e.g. in the Activity Theory by Kaptelinin and Nardy [17] and especially pertaining to the work by Vygotsky [18] on mediation and the zone of proximal development. In this model, the mobile device is an active component in equal footing to learning and social processes. This model also places more emphasis on constructivism: the word 'rational' refers to the "belief that reason is the primary source of knowledge and that reality is constructed rather than discovered" [19: 15].

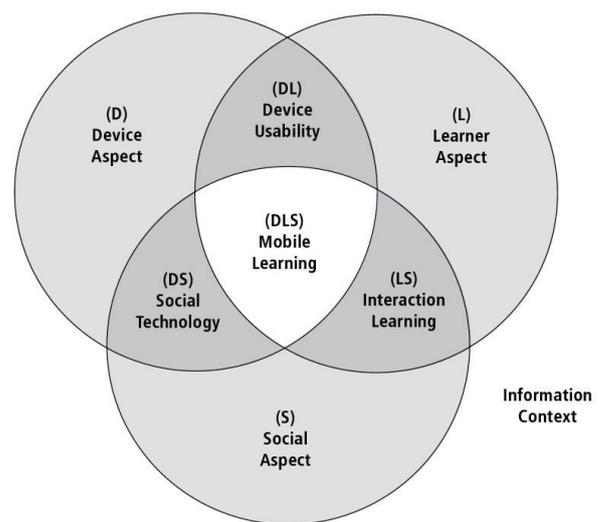


Fig. 1. The FRAME Model [15: 27].

To sum up the description of the whole process it can be concluded that from e-learning, which is widely understood as the immobile ICT-enhanced process of learning, a shift was detected to the exploitation of latest technologies, mainly comprised by mobile devices and relating software. Despite the didactics (pedagogy) of e-learning has defined the theoretical background, m-learning faces the identical process, i.e. basic principles of implementation from the point of both the technology and instruction should be defined and applied. Mobile devices, being very popular within learners of all ages, have a strong impact on the society and education as well, which is the fact that should definitely be taken into consideration.

### III. ESP AT FIM IN TECHNICAL AND ENGINEERING EDUCATION

The process of ICT implementation into education started in 1997 at FIM and widely spread after 2000, when the LMS WebCT (Blackboard) exploitation started. Since 2012/13 academic year the virtual desktops have been available to

students and teachers, mainly for work with software not providing free/open access (e.g. MS SQL Server, Enterprise Architect). Since 2013/14 the Blackboard Mobile Learn™, applied in 4.0 version for Apple and Android devices has been piloted (the 4.0 version supports iOS6+, i.e. iPhone 3GS, iPad 2+, iPad mini, iPod Touch 4+ and Android OS 2.3+). This step produced the shift from e-learning to m-learning. Currently, approximately 250 online courses (called e-subjects) are available to students, either to assist the teaching/learning process, or to be used in the distance form of education. Totally, in 15 of them mobile-assisted language learning approach was applied – in four courses of English for Specific Purposes (ESP) for IT students, Business English (four courses), ESP for Tourism & Management (two courses), History and Culture: UK (two courses), History and Culture: Australia (one course), History and Culture: New Zealand (one course), Academic Writing (one course). All e-subjects run traditionally within the LMS, and currently they are available on mobile devices in the limited extent as well. In this context, mobile devices are defined as very small items to accompany users anytime and anywhere, autonomous from the electrical supply [20], [21].

For technical and engineering students communication in at least two foreign languages is required and defined as a key competence, as mentioned e.g. by Delors [22] and in numerous European Union documents, e.g. [23], [24], [25]. Under the conditions of FIM until 2013/14 academic year the ESP was taught for six semesters. Since 2014/15 ESP has been a four-semester compulsory subject taught in the blended (hybrid) way in four online courses (ESP 1 – 4). Before the first course starts, a face-to-face tutorial is held to show students how the LMS Blackboard works, what services are provided to learners, what study materials are available, in what way assignments are set, submitted and assessed, what tools are available for communication and management of study. Then, 24 hours of face-to-face instruction are held in each semester, organized in two ways: twelve 90-minute lessons per week for full-time students and the same deal of independent autonomous study in online courses for part-time students. The process of instruction to be efficient, special didactic means are available to learners to fix and apply the theoretical knowledge in practice: English IT Reader and application for practising vocabulary. Until last academic year both means were available within each online course. Since 2013/14, when mobile devices were widely exploited for education, as displayed in research results presented below, they have been running in the m-learning form as well.

#### A. English IT Reader

The English IT Reader was created by students reflecting the Comenius' didactic principle of personal participation and engagement in any activity strengthens motivation and improves study results. In practice, this means students should be given possibility to take active part in acquiring the learning content. However, in case of part-time learners most of them have enough experience to share with others, and they like to do so. This is contributive from two views: experience of one student can help another one/other ones and providing own experience boosts professional self-confidence and position within the group.

Reflecting the above mentioned, every year all students of the Faculty of Informatics and Management in the bachelor and master study programmes have been preparing materials for Readers since 2007/8. The Reader is a set of professional texts for education purposes to deepen listening and reading comprehension skills. The work with professional texts is considered useful and appreciated by all students because this activity is closely connected to their everyday work and experience, as mentioned above, and they have a wide range of sources they can search professional texts from.

How did the whole process run? Each student prepares two English texts on an IT topic and their recordings per one semester, then they select several items of professional vocabulary (about 10 – 15 items per text) and translate them into Czech language using Insert, Revisions, New Comment tools. The texts and recordings are to meet following requirements:

- Topic: text on any topic connected to the field of study. At the beginning there were four main topics (IT personalities, hardware, software, latest news and products). During the process new topics appeared.
- Extent: 3/4 – 1 page of A4 format.
- Language: the level reflects student's knowledge, so texts of different levels are included in the Reader.
- Recordings: text recordings are provided in mp3 format.

A new edition of the texts and recordings is presented in online courses every year. The content usually covers several topics, e.g. Software, Hardware, Technology, Internet and IT Society etc., but it is not limited to them, any topic of students' interest is welcomed. Students use the Reader to prepare for exams; both to improve their communication competence in general and to succeed in the final exam after the 4th semester which also includes reading and listening comprehension. Depending on the level of knowledge each student can devote an individual time period to the exam preparation. And, one more thing is motivating: students provide their names under each text so that everybody can know who the author is and evaluate the quality of work. Students carefully protect their professional image and avoid sending texts which do not meet the given requirements.

The Reader is available in online courses, on CD-ROMs and in the printed versions. Exploiting the Blackboard Mobile Learn™ version 4.0 for Apple and Android devices, the texts and recordings also run on mobile devices (particularly smartphones, tablets, notebooks, netbooks, PDAs). In practice it means students can listen to the texts and read them. Translated vocabulary items are not available within the texts (as they are in online courses) because of the small screen size. But they can be accessed through the second didactic means – the application for practising vocabulary (APV).

#### B. Application for Practising Vocabulary

The APV is an application which contains a database of professional vocabulary to be practised or explained. It works in following steps:

- after clicking the Start button a Czech word appears in the window;
- student writes the translation and clicks the Check button;
- Correct or Mistake notice appears;
- in case of Mistake, after re-clicking the Check button the correct answer is displayed;
- either Correct or Mistake notice is displayed, a choice appears whether to remove the item to Learned words, or to the Try again group which means the item remains in the database and is re-displayed later on (if you start the APV again, all items are included in the database);
- in case of Correct answer, after re-clicking the Check button another item appears.

The APV works in the Czech – English or English – Czech mode, one item or expression containing several words can be included in the database and translated, or it can be used as glossary – in this case the student writes a word (expression), after clicking the button the explanation appears, either in the Czech – Czech or English – English version; or e.g. formulas and topics they relate to can be included in the database.

This clearly shows both the Reader and APV have been exploited for ESP teaching/learning but they can be applied to any other foreign language and subject (e.g. as an anthology and glossary).

#### IV. RESEARCH DESIGN AND METHODOLOGY

As stated in the introductory part, this research deals with several questions, particularly focusing on sources of information students exploit for ESP learning, what mobile devices they own and use and what students' feedback after mobile-assisted ESP learning is.

##### A. Research Sample

The research was conducted in the sample group of 203 students of the Faculty of Informatics and Management, University of Hradec Kralove

- who enrolled in IT and Management study programmes (IT 63 %, Management 37 %);
- having 60 % of male students;
- 54 % studying in the full-time and 46 % in part-time study programmes;
- 72 % of them 19 – 24 years old, 13 % of 25 – 29-year-old ones, 11 % of 30 -39-year-old and 4 % of 40+.

##### B. Methods and Tools

Data were collected by the method of questionnaire. The questionnaire was distributed in May 2014 within online courses. It consisted of twelve items focusing on the ownership of mobile devices, their use for ESP learning and students' feedback after two semesters of mobile-assisted ESP learning. Respondents provided answers of multiple-choice type

questions; four choices were provided in items 1 and 2, all choices could be marked in items 2 – 8 and one choice in items 9 – 12.

#### V. RESEARCH RESULTS

Data collected by the questionnaire were processed by the method of frequency analysis by the NCSS2007 statistic software and analyzed according to the three above mentioned research questions.

##### A. Sources of information students exploit for ESP

Following sources of information were taken into consideration: personal attendance of lectures, I buy books, I borrow books from libraries, e-subjects in LMS, study materials on FIM web page, Wikipedia, materials available from the Internet for free, Facebook, discussion groups, LinkedIn, Google+ other sources. As displayed in figure 2, sources of information respondent's use for ESP show following distribution.

E-subjects are obligatorily used by all students (100 %), as well as the personal attendance of lectures (96 %) and work with textbooks (printed, electronic, scanned, ...). That is why students borrow textbooks from libraries (96 %), fewer of them buy books (35 %), but most of them download study materials from the Internet for free (92 %). They rather frequently participate in discussion groups within LMS (81 %) and on Facebook (95 %), they also often use Wikipedia (72 %), LinkedIn (24 %); no materials are available on the FIM web page for ESP.

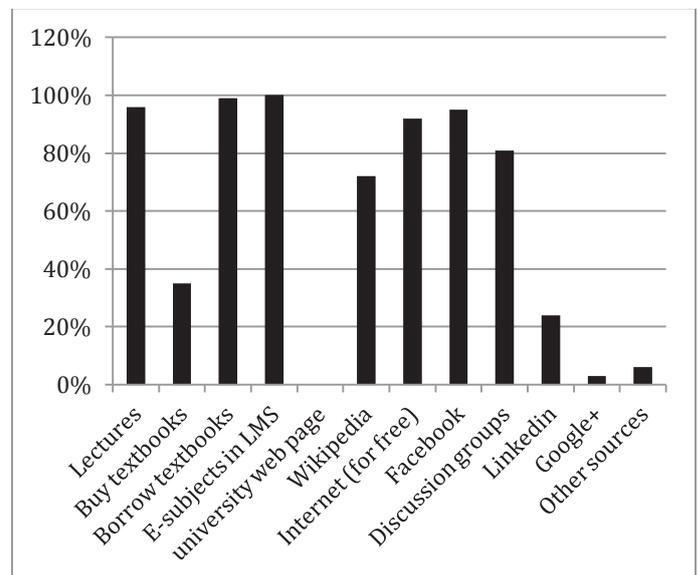


Fig. 2. Sources of information exploited for ESP learning.

We can sum up, most of them are 'traditional' sources of information which have been applied in e-learning for decades. As mentioned above, what reflects the MALL approach is, the e-subjects run on mobile devices and social networks (mainly Facebook) are used through mobile devices for sharing experience, study materials, discussing questions etc.

### B. Mobile devices respondents own and exploit for ESP

The list of monitored devices contained both the mobile (notebook, netbook, tablet, smartphone, mobile phone, mp3 player) and immobile ones (PC, game console, TV, DVD player, HI-FI, radio).

The collected data are displayed in figure 3 and show notebooks are currently most frequently owned mobile devices (88 % of respondents possess them), followed by smartphones (61 %), mobile phones (52 %), PCs (52 %), mp3 players (49 %), DVD players (39 %), whereas Hi-fi (27 %), tablets (24 %), game consoles (13 %) and netbooks (10 %) were rather rarely owned. As expected, students do not have one type of mobile devices only but simultaneous possession of PCs, notebooks, netbooks, tablets, smartphones was proved. Other types of devices were not used so often but respondents also mentioned the ownership of TV (67 %), radio (30 %).

For ESP mobile-assisted ESP learning notebooks and smartphones are the leaders (identical data were detected under 'possessed' and 'exploited for ESP' criteria (i.e. 88 %, 80 %), followed by immobile PCs (42 %), TV (42 %) and DVD player (35 %) – students explained they used them mainly for watching films. Mobile phones and mp3 players are exploited by one third of respondents for ESP learning; other devices are of rather low importance, including tablets (18 %) and netbooks (6 %).

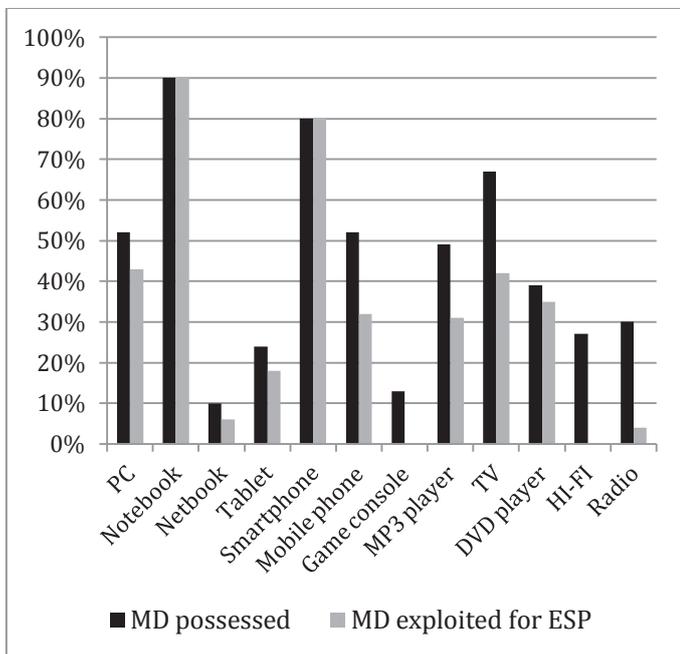


Fig. 3. Mobile and immobile devices respondents possess and exploit for ESP learning.

Compared to other subjects within university study, the ownership of notebooks was detected with 87 % of respondents, of smartphones with 43 %, PC (42 %), mobile phones (18 %), tablets (18 %) and netbooks (7 %).

### C. Students' feedback after mobile-assisted Language Learning

After the mobile-assisted ESP process of instruction was closed in June 2014, respondents provided their experience and opinions. Seven statements drew answers to the question how the use of mobile technology for ESP learning was viewed by individual users on the 1 – 6 scale (1: completely agree – 6: completely disagree). The detected results are displayed in table 1. Most respondents' feedback was highly positive, only several exceptions were appeared (3 %). These students had been detected as confluent processors from the point of learning styles and preferences within another research; they always march to a different drummer, so their attitudes were expected to differ.

Moreover, respondents provided following examples of mobile devices exploitation in calculation applications for Accounting, animations, simulations, modelling for various IT subjects; high quality video-recordings for culture- and history-relating subjects (English, German, Russian, Spanish) etc.

Above all, those who daily commute to school or work by public transport they highly appreciated the possibility to exploit mobile devices for education.

TABLE 1. STUDENTS' FEEDBACK AFTER MOBILE-ASSISTED ESP LEARNING

	Statement	Evaluation coefficient
1	Compared to learning in online courses, I consider mobile approach anywhere anytime helpful in the process of ESP learning.	1.8
2	Compared to learning in online courses, I consider mobile approach anywhere anytime significantly helpful in the process of ESP learning.	2.2
3	I worked with recommended operational system (OS) and devices (if you did not, list the OS and devices you used).	1.3
4	I did not have any technical problems (if you did so, please list them).	1.1
5	The Internet access was as displayed in Internet signal maps	1.3
6	Would you appreciate using mobile device in ESP learning in the future?	1.14
7	Would you use mobile devices in learning other subjects in the future? (if yes, provide examples, please).	2.04

## VI. DISCUSSIONS

The above presented results collected at FIM reflect those of MALL implementation in the world. In the Czech Republic significant items neither on m-learning, nor MALL have been published. The reason is m-learning has not become so common as e-learning. Long-time data still are not available, as the latest types of mobile devices reached the users later than in economically-strong and developed countries. Currently, the world been global, differences are quickly fading in the field of mobile devices availability. But, the lack of scientifically-

verified methodology (didactics) on how to implement mobile devices, particularly how to start the mobile-assisted ESP learning is still missing.

The only valuable result of m-learning implementation (but not MALL) in the Czech Republic was published by Lorenz [26]. He analyses the concept of mobile education within the changing university environment focusing on the process of learning and the support which libraries can provide and answers two identical questions to our research and adds two other ones, i.e. whether they students and teachers have sufficient learning/teaching skills to use the potential of m-learning (i.e. students' efficient use of materials and activities designed and implemented in the process of instruction by teachers),

- both groups are equipped with mobile devices,
- they are willing/able to cover financial fees for services used,
- their attitudes to m-learning/teaching are positive.

Lorenz discovered both parties were sufficiently equipped for m-learning implementation, only 65 % of students and 42 % of teachers proclaimed insufficient readiness for m-learning, i.e. having learning/teaching skills for efficient use. This result contracts to Corbeil and Valdes-Corbeil results where 94 % of students and 60 % of teachers expressed the readiness for using mobile devices for education (from the sample group of 107 students and 30 teachers) [27]. In Lorenz's research totally 57 % of students and 46 % of teachers are willing to pay for services for education purposes and the same amount of both parties would appreciate/are going to implement mobile devices into learning/teaching. The most frequently used services include

- receiving/sending short messages 94 % of students, 96 % of teachers,
- receiving/sending e-mail messages (57 % of students, 65 % of teachers),
- listening to audio-recordings and saving photos (70 % of students and 58 % of teachers,
- 54 % of students and 38 % of teachers make records by themselves,
- instant messaging service is used by 45 % of students and 27 % of teachers,
- podcasts and audio-books are listened by 18 % of students and 12 % of teachers,
- e-readers are used by 23 % of teachers and 21 % of students,
- 32 % of students and 23 % of teachers regularly access to social networks, etc.

All users (teachers and learners) consider mobile devices and technologies useful, easy to use, motivating and enjoyable. These criteria provide strong impact on efficient use of mobile devices and the m-learning in general. No restrictions were detected in this field which would limit this process in MALL.

As mentioned above, this Lorenz's study was carried in 2010, which means data have changed within the four-year-long period since. This was one of the reasons why our study was important providing latest results reflecting the state in the field. Below, selected world studies are mentioned having close relation to our criteria.

Our study proved identical results as e.g. Viberg, Gronlund [28] who monitored attitudes towards the use of mobile devices in second and foreign language learning in higher education taking cross-cultural view into account. They employed Kearney's pedagogical framework to mobile learning from socio-cultural perspective [29]. The findings showed the positive impact on individualization (83 %), collaboration (74 %) and authenticity (73 %), whereas gender was identified to be a predictor of differences in students' attitudes to MALL and concluded technology was stronger culture-shaping factor than inherited cultural environment or age.

Additionally, Hsu [30] investigated the end-users' perception of MALL through cross-cultural analyses in seven countries and regions and discovered that despite significant differences still existed, all respondents agreed MALL to provide potential for EFL learning.

Closely relating to our research topics, in survey by Chen [31] tablets were detected an ideal tool for interactive, collaborative and ubiquitous environment for independent informal language learning supported by students' positive attitudes towards their usability, efficiency and satisfaction for the MALL purposes.

In the field of knowledge, de la Fuente [32] focused on the aural input and indicated that learners in the MALL group demonstrated significantly higher levels of reporting noticing, bottom-up comprehension and top-down overall comprehension than learners in instructor manipulated language learning.

On the other hand, Golonka et al. [33] summarized evidence for the effectiveness of technology use in FL learning and teaching, when focusing on studies comparing the use of new technologies (mobile devices, network-based social computing) to traditional methods and immobile devices (PC) and stated limited efficacy of mobile technologies. The strongest impact was discovered in computer-assisted pronunciation training, particularly automatic speech recognition.

Other studies have demonstrated mobile technologies work as helpful and appropriate for language teaching and learning, e.g. Demouy and Kukulska-Hulme [34]. In other studies, significant improvements were detected in listening and reading skills, e.g. Kondo et al. [35] in vocabulary development, e.g. Agca and Ozdemir [36], in learning idioms, e.g. Kargozari and Tafazoli [37], in English vocabulary revision, e.g. Ma, Chen, Hwang, Ding [38], in using task-based approach to design a contextualized MALL, e.g. Tai [39], in pronunciation, e.g. Saran, Seferoglu, Cagiltai [40], etc.

Unfortunately, none of these studies provided any complex didactic recommendations applied either within the process of designing single activities/tools, or in the MALL implementation, as it had been done by e.g. Palalas [41], when

exploring the design of a Mobile-Enabled Language Learning (MELL) solution she defined a set of ten corresponding design principles and eight technological components which should be integrated into the system.

## VII. CONCLUSIONS

The e-society and i-society produced crucial changes. The process of defining both students' and teachers' key competences towards meeting requirements of today's and future life have been finished, ways to develop and reach them have been set. Putting the whole process into effect is a task we are facing now and in the future. Communication in foreign languages will always belong to key competences, as well as mobile and other types of technologies will be a firm part of our lives. The role of mobile technologies in learning activities and learning contents, difficult financial situation in the field of education in last years, ethical problems relating to the use of mobile devices – these are the hot topics which should be researched and solved in the near future.

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