M-learning – Use of Mobile Technologies in Teaching

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Abstract

Modern technologies are becoming an important part of education. Its broader application is however hindered not only by the fact that schools are insufficiently equipped with these technologies, but also by the fact that schools are increasingly struggling with its misuse. Examples of misuse include the unethical use of mobile telephones by pupils in classes, the release of manipulated teachers´ records onto the Internet, and the like. However, it is also important to note that schools do not yet offer many opportunities for the meaningful use of these up-to-date technologies. This research project deals with the design of a course on m-technologies for the further education of pedagogues. The output of this research project is an original course that provides a manual for the concrete application of mobile facilities in teaching and the opening of a creative space for teachers in individual schools to approach these problems.

Keywords: m-learning, m-technologies, research, course, ICT

Introduction

The design of an m-technologies course for pedagogues requires not only a contemporary point of view, but also a vision of the future development of new technologies that are appropriate and meaningful for application in an educational environment. According to reports published in 2013 and 2014 in Innovating Pedagogy (Sharples et al. 2015; Kukulska-Hulme and Sharples 2015) it is predicted that the areas of expansion in this field will include m-learning, personal educational environment, MOOC, new subjects in distance education, wiki, blogs, RSS, use of the Creative Commons licence, sharing of electronic study supports through the use of cloud services, u-learning, t-learning, educasting, seamless learning, social networks, omnipresent intelligent telephones and tablets, extended mobile reality, and in general a shift towards the greater utilization of mobile technologies. As a result, new skills, often denoted as skills for the 21st century, will come to the fore.

It is also necessary to be aware of the fact that this period of time is also characterized by the advance of e-technologies. Communication methods in traditional schools was, and still is, for the greater part oriented towards direct verbal and non-verbal forms. However, electronic communications have now permeated the educational space in the form of e-mail, chat, ICQ, Skype, WhatsApp, Viber, Linkedin, Facebook, Cloud, LMS systems, Webinars, Educasting and Podcasting. These are all effective and prospective means of supporting the educational process.

Any new educational programmes should therefore correspond with the up-to-date requirements of pedagogical practice, with a healthy regard for the dynamically developing sphere of information and communication technologies.

Research objectives, research methods

The principal objective of this research project was to analyse the contemporary state of the utilization of mobile facilities and m-learning in teaching, and on the basis of the research investigation to create a functional course on m-technologies for the further education of pedagogues working in technical and science subjects.

The first stage of the research project was to prepare the concept of a course on m-technologies for pedagogues working in technical and science subjects based on a literature search and the study of relevant sources. The concept course would form the basis for effectuating discussions with experts on its applicability and effectiveness. The course would then be revised according to the conclusions drawn from those discussions. The second stage of the research project was to organize and facilitate a course on m-technologies for the further education of the target group, and to subsequently optimize the course structure according to the results of the facilitated course (didactic test, reflection and evaluation of the course by its attendants and a questionnaire). The third stage of the research project was to prepare the dissemination of the final course on m-technologies for the further education of pedagogues.

The opinions of experts with regards to m-learning and the concept course were investigated by way of discussions. These discussions were structured and individual, of which a written record was made.

The results of the facilitated course were investigated by way of a didactic test, in combination with the reflection and evaluation of the course by its attendants. A non-standardized didactic test, consisting of open and closed assignments, was used to assess the results of the teaching. For open assignments, participants were required to provide brief answers, whilst for closed ones, optional answers were given. One of the assignments at the start of the test was dichotomous (Bílek, Doulík and Škoda 2004).

The participant´s opinions on m-learning and its applicability in teaching were determined on the basis of a questionnaire survey. This survey included closed and polynomial questions, with priority being given to optional questions, of which two included a Likert-type scale (Bílek, Doulík and Škoda 2004).

Theoretical bases for the investigated problem

One of the theoretical bases for the research was an analysis of the contemporary state of the utilization of mobile facilities and m-learning. In addition, an analysis was carried out of modern didactic instruments, new subjects in distance education, m–learning and new methods and forms of education.

To complement these analyses, a mapping exercise was undertaken of the contemporary state of, and thoughts about, the utilization of mobile facilities in teaching, as well as the classification and characteristics of mobile electronic facilities. A comparative analysis was also made between traditional forms and methods of teaching with possible new methods through the provision of ICT support, in particular the support of mobile technologies. An extension of this was to study the motivational factors behind the utilization of mobile facilities in teaching and self-study and the importance of m-learning as a support to, and supplement to, up-to-date interactive teaching. This included drawing attention to the opportunities for, and limits of, m-learning in contemporary schools (Svoboda 2009).

The anticipated research solution to the first two stages of the comparative research is based on experiences in Great Britain, Italy and Sweden (Vychová 2010), and that of the International Association for Mobile Education - IAmLearn (Kukulska-Hulme and Sharples 2015) and UNESCO Mobile Learning (Sharples et al. 2015).

Research methodology

For the research part of this project it was necessary to formulate a question, based on the analyses carried out in the theoretical part, as to the role and capacity of m-learning in contemporary schools, related to the possibility to prove its importance as a support to, and supplement to, up-to-date interactive teaching. The concept of the course on m-technologies for pedagogues was the subject of the research investigation in order to gain a comprehensive view of these problems. The main body of the investigation involved discussions with experts from the respective professional community. Their opinions, experiences and comments were a valuable source of information for the first revision of the upcoming course. The revised course was tested in pedagogical practice, whereby the participants were acquainted with the opportunities for the concrete utilization of mobile facilities in teaching, and also by way of various outputs (e.g. didactic test, questionnaire, model scenarios of pedagogical activities, workshops, independent work, discussions, presentations, reflection and evaluation of the course by the participants), which contributed to the final adjustments of the course (Svoboda 2011).

The design of the course on m-technologies for the further education of pedagogues working in technical and science subjects was based on the analysis of the contemporary state of the utilization of mobile facilities and m-learning.

The course was designed with experimental material at its core and was gradually revised to give it its final form. The revisions were implemented after the data

processing from the discussions with experts and after the completion of the course, based on the evaluation of the individual stages and application phases of the course. The participants were grouped on the basis of their qualitative characteristics in order to make the sample as representative as possible (Lašek and Chrzová 2003). In total, 20 participants – experts from various types and levels of schools and education institutions in Bohemia and Moravia – took part. The qualitative characteristics on which the choice of participants were selected were: the sphere of activity in education, pedagogical experience in technical subjects or didactic experience in technical subjects, knowledge of m-learning as a prerequisite, and university education.

Research structure

Figure 1 below represents the structure that was used for the realisation of the research project.
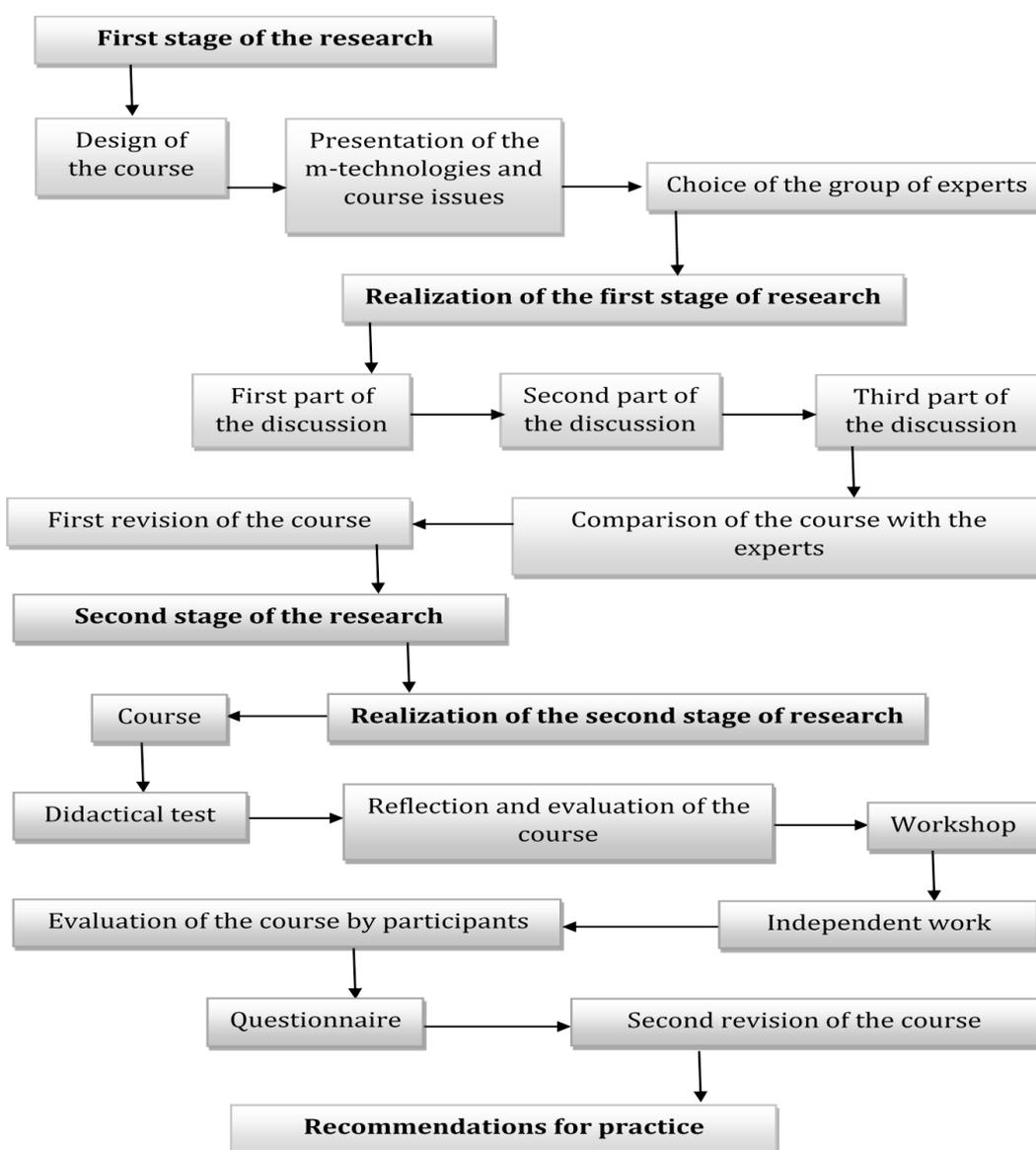
Source: Author

After careful consideration of the objectives it was concluded that it would be appropriate to use a combination of qualitative and quantitative research. The qualitative research, based on the analysis of the expert opinions which contain many subjective points (Chráska 2003; Strauss and Corbinová 1999), was necessary to gain an insight into the actual situation with regards to the level to which m-learning is used in contemporary schools. The quantitative research, for which data was acquired using traditional research instruments (didactic tests, questionnaires), was necessary in order to obtain an overview of the frequency of homogenous statements from course participants (Chráska 2007).

The structured discussions with experts, which formed the first stage of the research project, were split into three parts and contained a prepared set of questions for which responses were sought. The three parts of the discussion were concentrated on the following main topics: course, m-learning, software for m-learning, classification and selected characteristics of mobile devices, advantages and disadvantages of mobile technologies, transfer of data, examples of the utilization of mobile technologies in teaching, types of software and recommended software applications for m-learning, model scenarios of lessons which include the utilization of m-learning, pictorial material - modern technology in chemistry education in which m-learning is utilized (Wolski and Jagodinski 2010). In the final discussion attention was paid to the questions, answers, comments, suggestions and ideas.

For the second stage of the research project, quantitative research was undertaken. This took place on the basis of the revised course after the analysis and data evaluation from the first stage of the research and after the results of the facilitated course were assessed by means of a didactic test and the opinions on the participants on the course and its contents were evaluated in a questionnaire survey.

Interpretation of the first stage results

The analysis and interpretation of the results was based on the specified factors for forming the groups of participants for the analysis of:

1. The overall experience of the experts with regards to e-learning, m-learning, off-line and on-line courses.

The participants were divided into sub-groups with respect to the time horizon of their experiences (great; little; none) and into further sub-groups according to their opinions (motivation; study fields; the upcoming course; inclusion of m-learning into teaching).

2. The barriers influencing the extension of m-technologies in education.

The participants in this group were divided into sub-groups according to the barriers they identified (barrier 1- insufficient equipment in schools; barrier 2 – lack of interest of students; barrier 3 – distrust in new and untested procedures; and barrier 4 – barrier-free utilization of m-technologies in teaching).

3. The upcoming course from the experts´ point of view.

The participants were divide into sub-groups according to their opinions (the upcoming course, narrower orientation, equilibrium of the course, model scenarios, comments and recommendations on the course, types and proposals for applicable themes).

Summary of the first stage of the research

On the basis of the analysis of the responses to the first part of the structured discussions with participants, we can state the following:

1. The courses involving e-technologies are set to expand quickly and will become an integral part of the education process.

2. M-learning is already a reality, primarily for the young generation, but its future in education presents a challenge.

3. M-teaching supports and supplements modern teaching with strong motivational factors. The extension thereof is subject to well thought-out access to individual parts of the curriculum, this being dependent on the choice of themes being so interesting that students will not be interested in digressing to other more interesting topics. M-technologies can be used in all fields of education, most of all in the technical, humanistic and scientific fields.

4. The main obstacles to the utilization and extension of m-learning are a lack of financial means, a certain disbelief in all things new and a lack of information. It is evident that the personality of the teacher plays a considerable role i.e. their interest and willingness to accept m-learning as an effective teaching tool with which to enhance the learning experience.

5. A further condition, and not an inconsiderable one, is the financial resources individual schools have at their disposal for the provision of mobile facilities for teachers and students alike. The potential lack of financial resources can be compensated by the utilization of mobile facilities that almost every student has at their fingertips today. Of significant importance is the time frame for the preparation and realization of m-learning and the incorporation of m-technologies into School Education Programmes. Of equal importance is the preparation of those students seeking to work in the pedagogical profession in the future (Vašutová et al. 2008; Walterová 2002).

Results of the processed discussions with experts and the revised course

During the discussions, the participants were asked to express their opinions on both the theoretical and practical parts of the up-coming course. The objective was to obtain information on their evaluation, comments, suggestions and ideas so that these could be incorporated into the revised version of the concept course.

From the evaluation of the first stage of the research project it can be stated that the majority of the participants responded positively to the up-coming course. After

evaluation of the discussions with the experts, the concept course was duly revised to include their comments.

The theoretical part of the concept course was extended with practical illustrations of the utilization of mobile facilities, with the possibility to work with these facilities in the groups. A short motivational report on m-technologies was also integrated into this part.

Two additional recommendations were also accepted. The first, to include the experiences of participants who already use mobile facilities in teaching, and the second, to ask participants to evaluate examples of the utilization of mobile facilities and model scenarios i.e. to what extent they were interested in the topic and to what degree they grasped these technologies.

The participants expressed their complete satisfaction with the practical part and the model scenarios, so much so that it proved unnecessary to change or supplement it.

Selected recommendations and suggestions of experts for the facilitation of the course

The following suggestions and recommendations were selected with regards to the facilitation of the actual course:

1. The course should be set up in such a manner that: a) it does not only have novelty value with regards to its contributions to complementing and motivating up-to-date teaching, but that its contents are variable enough that it can be further developed and extended; b) it can potentially be used by all types of schools, in various fields, both by talented and handicapped students; c) the opportunity arises to create a databank of model scenarios.

2. Maintaining the current trend is recommended by experts: a) on the basis that it opens up opportunities to cooperate with other schools in the creation of a databank of model scenarios; b) because it raises the awareness among parents about the up-to-date methods of teaching applied in schools, which arouses greater interest in schools and education.

3. The proposal that was put forward by the experts that the course for pedagogues should be focussed on a particular professional orientation (e.g. language teachers, ICT coordinators), was inspiring, as was their suggestion to prepare specialized courses for handicapped and talented pupils or students. This of course requires cooperation with specialists and thorough preparations.

4. Of interest was a suggestion by the experts that, for economic reasons, the courses should be prepared in the schools so that they take advantage of those mobile facilities that they already have at their disposal. Of equal interest was the idea to create a shared space for electronic materials in which interesting documents, references, publications, scenarios, etc. could be held. The experts also stated that they would welcome an insight into the (approximate) costs of the relevant applications, as well as the financial impact of providing and operating such facilities.

5. The response to the question, in which fields of education are m-technologies most efficient and substantially applicable, was unambiguous. The experts felt that the technologies could be used in all fields, in some more progressively than others, with the extent to which being dependent on the given topic. The suggestion was that technical subjects and the transfer of data were more directly predisposed to the use of such applications because it allows for the demonstration of data transfer in a different way. In art subjects, in which m-technologies are not yet widely used, they suggested that, for example, mobile facilities would enable students to quickly source quotations, original texts, EU documents, statistic data, yearbooks, up-to-date wording of laws, etc. This was in contrast to their opinions on medicine, where m-technologies have found wide-ranging uses. M-technologies were also suggested to provide a good solution for ad-hoc situations.

6. The experts were clear that mobile facilities should be used during the whole school year in order to fulfil its purpose and assist in the activation of the individual, as well as the organization of lessons. It was pointed out that to minimize classroom equipment costs, it should be possible to use the notebooks brought by students from home and to involve creative students in the education projects and not put aside applications such as social networks e.g. Facebook.

The aforementioned comments and recommendations signalize the interest of experts in these problems and the usefulness of courses involving m-technologies in contemporary education.

Contents of the facilitated course

The course anticipated the utilization of a wide spectrum of mobile facilities in teaching. The course dealt with the possible utilization of software, electronic presentations, electronic communications, the Internet, and the preparation of classes. It demonstrated the possible meaningful utilization of mobile facilities and m-technologies in teaching and the way in which these facilities can effectively be used.

Mobile technologies (e.g. mobile telephones, mp3, tablets) are more readily available to students and teachers alike than other ICT and therefore its utilization in contemporary school settings should be given serious consideration.

The first part of the course was focused on lectures. This gave the participants an overview of contemporary m-learning issues and an opportunity to orient themselves in these problems under the supervision of a tutor. This included the chance to clarify what opportunities there are to utilize mobile technologies in teaching in general, and at the same time to consider the opportunities open to themselves and to their schools. The content of this part of the course laid the foundations for the processing and facilitation of the teaching activities which involved the mobile facilities and which formed the second part of the course.

In the second part of the course the participants prepared their own teaching activities, facilitated within the constraints of their own possibilities, under the supervision of

their tutor. A part of these lessons constituted massive methodical support, with illustrations and suggestions drawn from real teaching scenarios (Svoboda 2011).

Interpretation of the second stage results

The analysis and interpretation of the data was carried out on the basis of a didactic test (comprising of two calculations: a) the difficulty of the individual test Q assignments (Chráska 2007); and b) the didactic test reliability as per the Kuder – Richardson formula (Gavora 2000)). Tables were drawn up and subsequently used to analyse the data obtained from the questionnaire survey (statistical evaluation of the questionnaire results according to (Gavora 2000)). Of interest was the position on the scale i.e. whether the participants responses were closer to assent or dissent - the statistical significance (Chráska 2007; Gavora 2000). Furthermore, the participants were requested to evaluate and reflection of the course (through free writing, workshops and independent work).

Summary of the second stage of the research

The following findings were made in the second stage of the research project based on the analysis of the facilitated course, didactic test, questionnaire, and participant evaluation and reflection on the actual course.

On completion of the course, the participants proved they had gained the necessary knowledge on m-technologies by passing a test. They proved that they had learned to apprehend the basic terms, classifications and characteristics of mobile facilities, had acquainted themselves with the theory and practical examples of the utilization of mobile facilities in teaching, and were able to orient themselves in the sphere of m-technologies.

Recapitulation of the opinions on the course:
- The importance and objectives of m-learning were clearly comprehended, which proves that m-learning is starting to win recognition and is being adopted as a useful teaching tool.

- Full agreement was expressed with the opinion that m-learning is an appropriate supplement for supporting and enhancing the efficacy of education and that it is an effective instrument for seeking out new and effective teaching methods.

- Full agreement was expressed with the opinion that m-learning is an effective instrument for creating space for talented and handicapped students.

- Full agreement was expressed with the estimation that m-learning, as a part of supplementary teaching methods, is a favourite activity.

- Participants stated that mobile facilities were frequently used, although a number suggested that they use it only occasionally.

- The use of notebooks is extensive and widespread (mobile telephone and other devices are used mainly for sending test questions, schemes or examples. Pocket computers are used the least).

- Mobile facilities are used the most often for technical and science subjects (for non-technical specializations the greatest range of software applications available are for language teaching and physical training).

- The majority of participants agreed with the statement that schools are insufficiently equipped in terms of software for m-learning.

- The majority of participants agreed that schools are insufficiently equipped with hardware for m-learning.

- The participants agreed with the opinion that students predominantly accept the inclusion of mobile facilities into teaching with enthusiasm, seeing the advantages thereof. Some of the participants held a neutral stance on this.

- Knowledge in the sphere of m-learning is diverse. According to the research results it is possible to conclude that the participants evaluated themselves as being moderately critical; they neither considered themselves experts, nor amateurs.

- The majority of participants were motivated after completion of the course and showed an interest in this issue.

- Mobile technologies are used for 1-2 hours per week in teaching (for the creation of e-learning applications; where applicable for mobile facilities, up to 4 hours or more per week).

- The groups succeeded in creating and presenting their own scenarios (they were of a good standard and inspiring for all the participants).

- The participants fully understood the principles behind the creation of scenarios (they themselves were able to create a lesson using m-technologies).

Revision of the course on the basis of the experiences from the facilitated course

The objective of the second stage of the research project was focused on acquiring suggestions, comments, proposals and ideas that could be used to enhance the course.

From the analysis and evaluation of the outputs (facilitation of the course, didactic test, questionnaire, reflection and evaluation of the course by its participants) of the second stage of the research project, it was evident that no fundamental adjustments needed to be made to the content or structure of the course. The course proved to be effective, however, the questions in the didactic test with regards to difficulty will require refining.

From the evaluation of the course it was clear that the majority of participants were satisfied with the course. The participants were able to acquire a good standard of

knowledge from the designed course (this was evident from the evaluation of the didactic test, as well as by their ability to create something new during their independent work i.e. the creation of lessons which utilize m-technologies). The model scenarios were chosen in accordance with their professions in various fields. The participants saw and understood the future potential of m-technologies for the development of new methods and forms of teaching.

The contents of the course can be modified to not only include the suggestions obtained as part of this research project, but also as a result of the developments in mobile facilities and their availability on the market, as well as from the inputs of participants themselves on the basis of the pedagogical - educational activities they implement in practice.

Recommendations for practice

The output of the research project is a functional course entitled "M-learning – use of mobile technologies in teaching", which consists of a theoretical and practical part, and includes a comprehensive range of model scenarios. The course can be used to assist and further educate pedagogues (Svoboda 2011).

Summary and conclusion

This research project presents the results of a survey into the use of mobile facilities in teaching. A practical asset of the research project is an original course on m-technologies created for the further education of pedagogues working in technical and science subjects. The research project is therefore instrumental in opening up the opportunities for the meaningful use of mobile facilities and m-technologies in teaching and illustrates how these facilities can be used.

The opportunities and limits of using mobile facilities in teaching is a new theme, one that is innovative and desirable under current conditions in the Czech education system. The structure of the designed course is open and can be adapted to any field of education in the future. The challenge will be to adapt it according to the changing conditions with regards to the future developments in m-technologies, their accessibility, acquired knowledge, and the creation of appropriate teaching scenarios.

On the basis of the findings from the research project, we can conclude that the acquired results influenced the revision of the course. It is possible to anticipate that these revisions will not be the last because every new course will include fresh and innovative ideas that will enhance it. These enhancements will be driven by the needs of pedagogues, the needs of and opportunities in individual schools, new mobile technologies, orientation of school subjects, and the individual needs of students. However, this will require cooperation between experts, psychologists and pedagogical – psychological advisory centres (Mesarošová and Cápay 2012; Straková 2007). It will also be necessary to broaden the team because this is no more an assignment for an individual, but for a team of researches. Establishing relations with pedagogues from other countries would also be beneficial. In this way, it will be possible to learn from

their experiences in this field and to implement suitable ideas in the Czech Republic too (Georgiev et al. 2006).

The course was accredited by the Ministry of Education (Ministerstvo školství, mládeže a tělovýchovy) and was facilitated at the Pedagogical Research Institute ("Výzkumný ústav pedagogický") and at Charles University in Prague (UK). The course took the form of blended – learning and was positively received by course participants. The outputs of the course i.e. model scenarios of pedagogical activities, are used as shared materials and collated in a portfolio for use by teachers. The course is currently open to pedagogues - teachers in primary schools, secondary schools and higher vocational schools - seeking further education in this field. The course is run at the Technical College (České vysoké učení technické) in Prague and The Masaryk Institute of Higher Studies (Masarykově ústavu vyšších studií) in combination with other education programmes with innovative themes. These education programmes correspond with the requirements for pedagogical practice and with the developments in information and communication technologies in the Czech Republic and in the world. In the foreseeable future, it is reasonable to assume that m-learning will be implemented as an optional school subject.

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