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MOBILE TECHNOLOGIES FOR MOBILE STUDENTS

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Abstract. The paper deals with analysis of mobile devices as possible students' and lecturers' tools in education process. Supporting wireless communication technologies and possibilities of integrating these technologies in studies are also investigated. A technological solution schema is presented. Problems of different its elements selection are analyzed. The advantages and shortcomings of such integration are examined. Successful integration cases are presented. Preconditions of mobile technologies integration in Lithuania education infrastructure are investigated.

Keywords: mobile technologies, handheld computers, education.

1. Indroduction

Information-communication technology changes so rapidly, that it is problematic to develop optimal methodologies of their implementation in different areas of human life. Technologies provide us with new possibilities in organizing educational process. In Lithuanian's scientists' works there are investigated more widely: internet use in teaching and learning, distance studies, their both models – synchronous and asynchronous – with their methodologies. Distance education infrastructure is widening, there are implemented new elements and, on the other hand, their impact is investigated.

Often when somebody speaks about distance learning, he/she accents its advantage – possibility to learn anywhere and anytime. In reality there are some limitations – students must have computer and Internet connection. Mobile devices and wireless connection technologies can provide with wider possibilities.

The purpose of the article is to deal with analysis of mobile technologies as possible students' and lecturers' tools in education process.

2. Problem

Shiller in the book "Mobile communications" [4] says:

What can we expect in the future: computer – mobile, connection – wireless, person – mobile. Mobility is human possibility to function despite of his/her place and time. Mobility is necessary for businessman, but not only for them. In change of educative paradigm from teaching to learning, when amount of individual work increases, when distance studies are widening and necessity to improve competencies in the workplace increases, also increase needs to use mobile technologies in education processes.

The scientists have argued not once that restrictions for using computer don't let us see really influence of information-communication technology on learning effectiveness [10, 12]. P. Ramsden [2] argues that the purpose of teaching in higher school is to make student's learning possible. Every student must be provided by different means. D. Lipinskienė [1] in her dissertation work "Educative student enabling to study environment" turns her attention to context of limited recourses, which is characteristic to Lithuania's higher education system. It is necessary to get big investments in order to begin using some technology in education process first in the world and investigate it. That's why we must observe situation in the more progressive countries. Every country has its own specifics of education system, that's why sometimes it is useful to investigate not very progressive countries successful technologies integration examples.

In order to effectively integrate technological innovations in some specific area, we must put enough attention to the following three dimensions [8]:

- Persons;
- Activities, processes,
- Technologies.

In the education institution first of all must be discussed:

- What profit it will bring to organization?
- What benefit can be seen for lecturers and other staff?

- What advantages can be considered from student perspective?

After analyzing usually defined benefits of mobile technologies integration, one can think that staff productivity will increase, it will be better reacted toward changes, learning will be more effective, satisfaction with higher institution will increase and institution will occupy better position in the market.

Activities in education institution can be divided into two large groups:

- Studies and science;
- Organization's control.

In order to avoid troubles about data and programs compatibility in further information system's development, when technological solution is accepted, it must be paid attention to activities of both groups.

3. Problems in technologies selection process

In technological dimension solution can be described as follows [8]:

Solution = Devices + Applications + Connectivity

3.1. Devices

When device is called "mobile", it means, that it can be carried easily. Description "wireless" means, that device can connect to the network without cables. Devices for communication can be stationary with cable, mobile with cable, stationary without cable, mobile without cable. There is no strong classification of such devices [4].

3.2. Laptops

Laptops have the same characteristics and realize the same functions as table PC. Wireless networks and laptops have become popular in the USA universities and colleges in 2000. Students must buy or lease laptops according to the order accepted in the institution. Some opinions and fact evaluations can be found in electronic journal "The Chronicle of Higher Education" [14]. Solution "Laptops + wireless connections", as well as some other, helps to solve some problems but also creates new problems.

Solution "Laptops + wireless connections" has the following advantages (for educational organization) [9]:

- Students can learn anytime and anywhere;
- Solution can be applied for greatest amount of students;
- Rapid classroom preparation;
- Less administration expenses;
- It can be better security for data and application;
- It can supplement tethered connections;
- It is useful for learning in collaboration;
- Costs of devices decreases;
- We can reconsider that in the future organizations will be lacked only specialized computers.

3.3. Raising problems:

- Lacking experience in realization;
- Rapid standards change and their lack;
- Cost;
- Security;
- Lack of suitable services.

Applying methods of solution "Laptops + wireless connections" [9]:

- Mobile laboratories;
- All members of organization are provided by laptops. The biggest part of educational processes can be transferred to virtual learning environment.
- Not all members of organization have laptops. Wireless connection broadens the tethered connection.
- Mobile classrooms.

3.4. Tablet PC

Tablet PC are comfortable, because they let different information input: by keyboard or by stylus. Tablet PC most often are offered to the sales managers. These devices are useful in meetings, where they can be used as laptops or tablet layouts. Additional software can be used for converting notes, made in specific format (semantic networks, hierarchical structures), towards an electronic form. There are no data about effective use of tablet PC in studies. The main reason can be quite big their cost. One of the tablet PC functions – to form an image – is not an important aspect in academic infrastructure.

3.5. Pocket PC

Pocket PC are now investigated together with handheld PC, not separated in other group.

3.6. Handheld PC

Handheld PC – electronic appointment books or portable digital assistants (PDA) initially hardly forced the market. In 1996 Palm Computing released Palm Pilot. The company tried to design device realizing useful and not complex functions. From developing the first such device, it was considered about data synchronization mechanism. Separate versions of usual programs are designed for handheld PCs: calendar, notebook, e-mail client, address book. Handheld are used more and wider due to its size and functional possibilities.

Handheld computers are suitable for integration into Lithuania education infrastructure due to best cost and functionality relation. Software and communication possibilities will be investigated in relation with handheld computers.

3.7. Mobile phones

Simple mobile phones can transfer voice and text messages. In our days smart phones forces the market. Modern mobile phones are more likely electronic appointment books. SMS (Short Message Service), MMS (Multimedia Messaging Service) services, internet browsing possibility during WAP technology (Wireless Application Protocol), activating and control by voice, data transfer with infrared and Bluetooth technologies, data synchronization were introduced. Mobile phones take wider market's part for their increasing functionality.

3.8. Possible areas of using mobile phones in studies process

The main function of mobile phone is rapid and quite inexpensive transferring of data despite of distance and location. Mobile phones can be used in education process in these areas, where it is necessary information dispersion. It can be transferred messages of common nature (e.g. information about activity, taking in new place). As well there can be transferred information related to learning process directly (e.g. results of tests, diagrams, etc.). Students' mobile phones can be used as an additional tool in distance studies. What information can be gained from mobile phones?

- Lectures, meetings schedules;
- The list of the books, which are in the library;
- Academicals information about students;
- Announcements – information about new activities, changes in schedules.

Information from educational organization can be reached from mobile phones in two different ways:

1. In form of SMS messages (Figure 1):
   a) As respond to user (lecturer, student) request.
   b) Automatically.
2. Through internet browser (Figure 2).

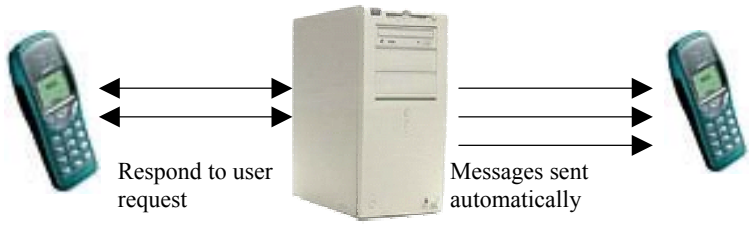

Figure 1. Information transferring through SMS

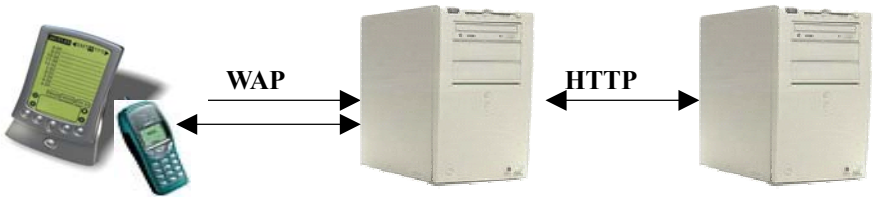

Figure 2. Information transferring through web browser

In educational sphere, as well as in the others, it is important to be oriented toward amount of possible users. The same service can be delivered cheaper if it is delivered to a greater amount of users. That's why it is important to observe the market of mobile technologies sales. It is argued [15] that the first quarter of this year "Nokia" left behind "PalmOne" and became the company with best sale. The users chose modern smartpfones instead of handhelds.

3.9. Pagers

They are designed only for transferring of text messages.

3.10. Criteria and problems in selecting of mobile devices

All mobile devices – from pagers to laptops – can find their user. They are selected according to using plans. When selecting suitable technology, someone must consider about the following aspects:

- Functional requirements. What functionality mobile devices can deploy for studying or lecturing person? The following factors can be listed: possibility to reach internet from anywhere, synchronization, size, weight, multimedia support, additional functions (e.g. location aware services), battery life, system startup time, user interface (screen characteristics, data input mechanisms).
- Economical and practical benefits. What advantages innovative technological solutions can give for university, faculty, lecturer, and student? Factors can be named so: cost, popularity, possibilities to change, compatibility with used devices.

3.11. Problems and shortcomings:

- When device is more portable, it is less functional and vice versa.

- When device has better functionality, it wastes more power.
- Low bandwidth. In order to get better speed, someone can connect to personal computer through USB port.
- Connection is less reliable. The quality of connection depends on location. Somewhere connection can't be guaranteed.
- The size of the screen is not very suitable for visual information, but for text messaging quite enough.
- Problematic data input. Keyboards are very little. There is no mouse. Using stylus takes much more time than working with keyboard.
- Limits for processor speed and memory available for applications.

3.12. Software for handhelds

Standard software

In our days the most popular operation system (OS) for handheld computers is Palm OS. Together with OS the companies sell standard programs for text processing, spreadsheets formatting, browsers, e-mail clients and others.

Desirable activities oriented at studies directly and at their control can be enumerated as follows [14]:

1. Organizing and planning. Managing time, contacts, tasks, and other lists. Usually these functions are supported by handheld OS. It is easier to work with long-lasting projects. Reminders can help to remember. Data are synchronized with personal computer.
2. Reference information. Databases of staff and students, schedules – all which can be obtained every moment.
3. Information gathering and analyzing. Spreadsheets, databases can be used for accumulating data. Spreadsheets, calculators can be used for analyzing.
4. Learning and self-improvement. Different forms of studies material delivery can be used, e.g. e-books, dictionaries, etc. Specialized educational programs, self-control tools can be used.
5. Communication – the exchange of information. E-mail, fax, data synchronization are used.
6. Teaming and collaborating. Planning projects, sharing information, useful for common company's effectiveness.

As we see from the list, different elements of learning can be without any problem realized with standard handheld tools – parts of OS. Analysis of selected papers showed that handheld computers are most often used for information storage and quick its retrieving. Additional programs can be used for information storage in a specific form, e.g. conceptual model.

Specialized educational software

There are not very many specialized educative programs. Practically, they are developed either very universal (e.g. assessment books, dictionaries) or very specialized (e.g. Cooties for modeling germs spread [10]). When integrating handheld in the studies, somebody must in advance reconsider how they will be used in different courses and in different activities. But to define that is difficult due to the lack of specialized software.

In the *http://www.palmgear.com* among different information about handheld computers a list of software products for Palm OS is given. Software distribution is shown in Table 1.

Table 1. Software distribution according to purpose and thematic

Thematic	Amount of references
Religion	539
K-6	184
Teaching	180
Documents/e-books	1778
Managing of educational institution	323
Lifelong learning	664
Dictionaries	855
Colleges	743
7-12 classes	250
Science	278

At *http://www.handango.com* we have found about 70 educative programs for Palm OS (2004-06-20). Analysis of programs descriptions shows that the biggest part of them are designed for standalone handheld computer (connection is unnecessary), predominate edutainment type, their functionality is small.

Links to software for handheld distributing portals can be found at web sites of companies-handheld manufacturers.

3.13. Connectivity

Handhelds can be integrated in synchronous as well as asynchronous mode of delivery of distance learning.

In the asynchronous studies 3 ways of connectivity are possible: through infrared adapter (Figure 3), using HotSync mechanism (Figure 4), through mobile phone (Figure 5).

Figure 3. Handheld connected to personal computer through infrared adapter

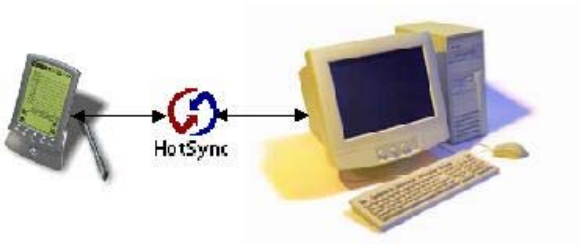

Figure 4. Handheld connected to personal computer through HottSync mechanism

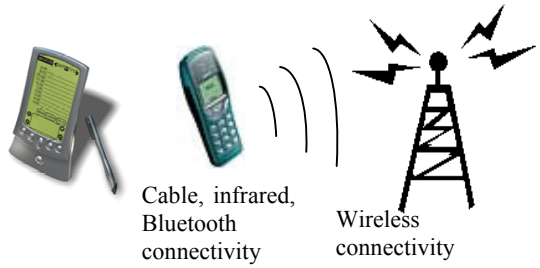

Figure 5. Connectivity through mobile phone

In the synchronous studies there are possible 2 ways of connectivity: when handheld is always in connectivity (as mobile phone, Figure 6) or in WLAN, e.g. in the area of organization (Figure 7.).

In that case software can be developed taking into account the fact that device is always in connectivity. Practically in Lithuania this is yet impossible.

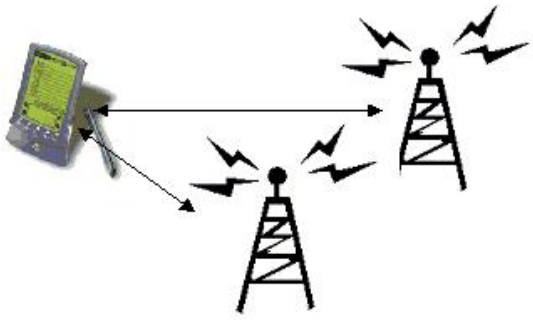

Figure 6. Stable wireless connection

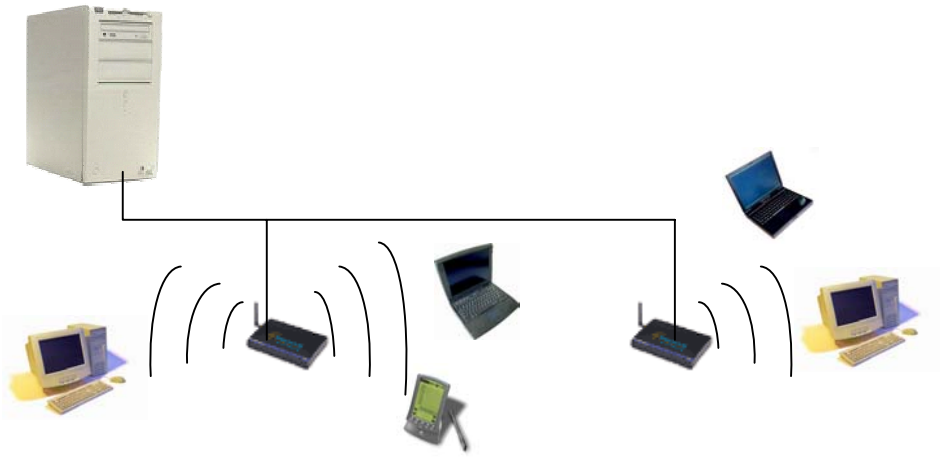

Figure 7. WLAN configuration with Access points

4. Analysis of successful cases of handheld integration in the studies

4.1. Experience in the Carnegie-Mellon University

In the Carnegie-Mellon University there were implemented and tested different programs, oriented toward collaborative activities when using handhelds. Three the most popular programs are described in [11]. Wireless connectivity is realized in the area of University.

1. Portable Help Desk lets input information about environment. The program uses GPS service. It lets determine location of some person or necessary objects. Visual and audio interfaces are built.
2. MatchMaker lets define where the nearest expert is, taking into account his/her location (distance) and availability.
3. IdeaLink is virtual meeting tool. It is white board, optimized for screens of portable devices, designed for work in small groups (2 to 5 students).

Solving privacy problems a specific tool, called Privacy Guard, was developed. It lets control when data are reachable and when they are not.

Programs were tested by 50 students.

4.2. Handhelds for children

Inkpen K. M. [12] described a project, which took place in Canada. 10-12 years children took part in this project. The purpose of the project was to develop effective educative applications and handheld itself, satisfied children needs. Zurita and Nussbaum [13] analyzed a model, how mobile technologies can help training reading skills. Both articles are oriented toward constructivist learning in collaboration.

4.2. Educative aspects of preconditions for handheld integration into Lithuanian education infrastructure

As cases about handheld integration into studies show, there are raised the following requirements for handheld use:

- Mobility,
- Collaboration possibilities.

These requirements correspond to modern educative conceptions: constructivist learning and lifelong learning.

Handheld computer:

- Are individual in essence;
- Have integrated possibilities for information interchange.

5. Conclusions

1. Mobile devices and wireless technologies are used wider and can find their purpose in order to improve education process.
2. A great financial support is necessary for mobile technologies implementation, but support of technology costs relatively not much.
3. Because of the mentioned shortcomings mobile devices can serve only as an additional tool in studies process.
4. Taking into account context of limited recourses the optimal solution is handheld computers and connectivity ensuring asynchronous learning model (through HotSync and GPRS technologies).
5. For practical project implementation it is necessary to collaborate with internet providers.
6. Future investigations are necessary in methodologies, how to exploit standard handheld software in different stages of educational process, because the amount of specialized programs is insufficient and they almost all can be used in very narrow context.

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