

**Project Title: Using wireless technologies for
context sensitive education and training**

Project Number: 2007-1968

REPORT

WP5 Art Gallery and Museum Education

Pedagogical and Didactic Characteristics

We present mlearning as a form of performance support system for educational and training purposes. The advantages for trainees are derived from providing learners with a job aid in the context of their work and more flexibility and choice in where and when they learn outside of the wired (or un-wired) classroom. Performance-centred approach has been proven to be more effective than the traditional lecture-practice-test (expository inductive) in training higher order skills, for preparing learners for self-learning, improving, adapting for changing jobs. Wireless mLearning performance support systems are similar to traditional PSS. mLearning solutions integrate mobile devices with the learning to help the student to perform a task by providing information, guidance, and learning experiences when and where they are needed. The advantages to apply performance support in mLearning to create knowledge are derived from providing learners with a job aid in the context of their learning. The disadvantages of mLearning are a combination of technical and education challenges. Some of these disadvantages disappear if we apply performance-centred approach to mobile technology enhanced learning. It means that performance-centred method is very appropriate for mLearning pedagogical solutions.

The courses are presented as tasks for performance. To support this performance, tools are available – task-specific training, references and additional information, instructions how to perform and examples, expert advices. Each task is presented to the learner with a task description – text and/or a file.



Fig.1. Task Description

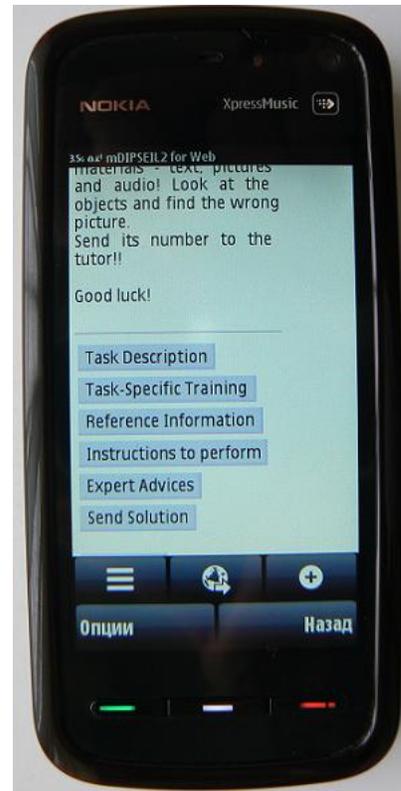


Fig.2. Task description and System's menu

Reference information describes the task that the user has to perform. This reference information supports the user by making immediately available information, which (s)he previously had to memorize or look for in a book or a manual. The reference section allows the user to learn more deeply about a given task and is always available for her/him to read and *provides the theory behind the task it supports.*



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Task-specific training reduces preliminary training by helping the user to learn while performing the task. This type of *training is learner-centred* because the learner asks for help when he needs it to perform a task, and the help gives him the specific information that (s)he requests.

Educational performance support systems contain specific advice on performing tasks and it is its greatest advantage. The advice is usually provided by the tool Instructions how to perform and as expert advices for each task.

The learner selects the task, then clicks on "Learn Selected". He can read the task description and look at the file with the graphical presentation. He can use all available instruments to perform the task: task-specific training, reference information, instructions to perform, expert advices.

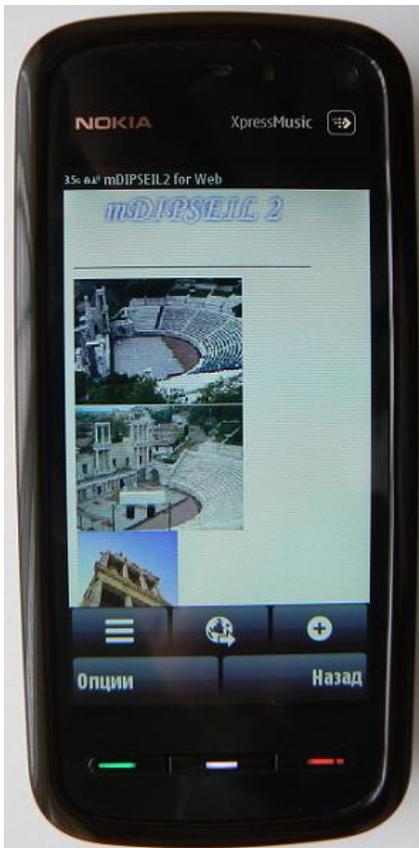


Fig.3. Task-Specific Training



Fig.4. Task-Specific Training



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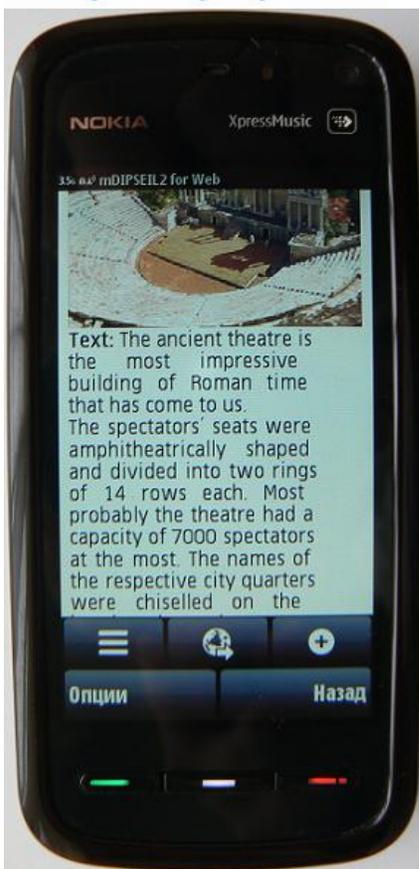


Fig .5. Task-Specific Training

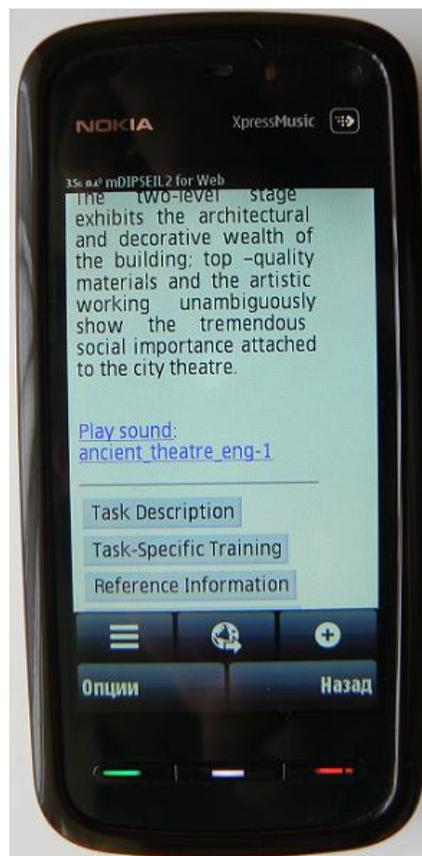


Fig .6. Task-Specific Training



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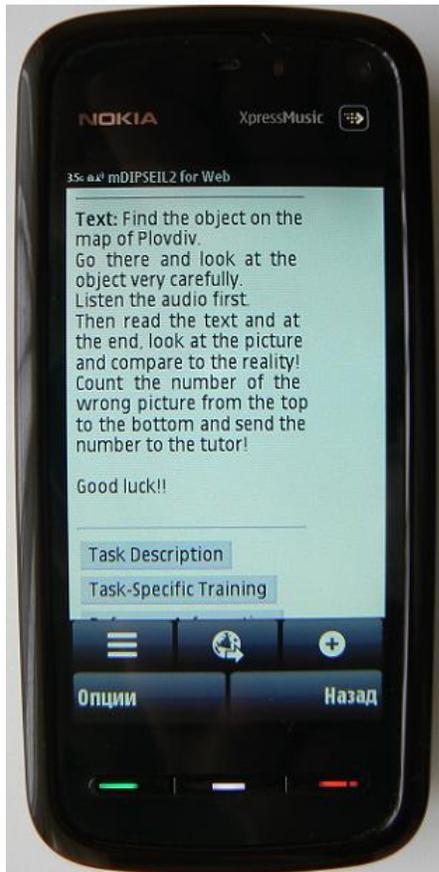


Fig .7. Instructions how to perform

When the learner is ready with the performance, he/she sends the performance using "Send solution" to the server for a feedback and an assessment.

Structure of the Educational Content

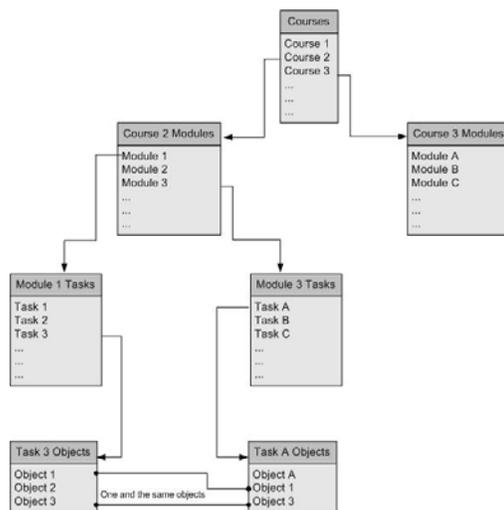


Fig.8 Structure of the Educational Content

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This is the standard performance-centered educational structure: courses, containing modules, containing tasks. In mDIPSEIL a new level was integrated in this structure, called "Objects". Objects are the building elements of the tasks. Objects can be: text, picture, sound or video. One task may have as many objects as the teacher want. One object can be used not only in one task, but in as many as there are in the system, not only in the same module or course, but also in others and by other teachers. This has two positive sides: if the student has already made a task from the module, he will find the same objects in the new task and thus it will be easier for him to study them; the sharing of objects will save time and resources of the tutor, and saves also the time of the student, because the system is not overloaded with one and the same information, so it needs less time to search and use its database. For security reasons objects cannot be edited or deleted while they are assigned to a task.

Content sensitive and location sensitive elements

Context sensitive and location sensitive elements

Upon start of the J2ME application on the student's mobile device it tries to determine the current client's location. Since not all mobile devices nowadays support GPS (Global Positioning System) it is possible, that this process is skipped. This will happen if the application cannot load the needed libraries or cannot find a supported hardware. Specially chosen criteria for the coordinate determination process, may force the usage of alternative positioning methods like: non-integrated GPS modules (Bluetooth modules), A-GPS (Assisted GPS) – obtaining coordinates using an active internet and base-station connection, as also other device and network specific methods. After the current coordinates of the user are obtained they may be used in the following two ways: 1) to determine all tasks related to objects (specific for the task), which are near the student; 2) to show only tasks in the language, which is spoken in the country the client currently is. For example if the learner is studying in a bus in Bulgaria, then (if he chooses the option) only tasks in Bulgarian will be shown. For our learners we have developed several tasks in Historical Plovdiv both in English and Bulgarian language. Since they use their mobile devices only in Bulgaria, they were presented only with the Bulgarian version. Of course tasks in other languages will be shown, if the user requests so.

With the fast development of technologies nowadays users request more and more media rich content. Mobile devices are the perfect platform to offer interactive multimedia experience and educational content on the go. But still devices with small screens like the legacy phones or new and tiny ones cannot (and should not) display large images or video materials. That's why (and also to support more mobile devices) images are made smaller and only specific, widely-supported formats are used in the system. Video size is also reduced and a mobile compression format called 3GP is used. When the teacher uploads the educational content to the system, he/she specifies which of the materials are for advanced and which for legacy devices. When the learner connects with his device the using mobile learning management system (Plovdiv University case) mDIPSEIL determines what functions it supports and what characteristics it has. Then it presents the learner with the materials specified for his/hers device. Since the best mobile device nowadays is the Apple's iPhone, we have developed a special module, which works with it. The special headers sent to our system from the iPhone are used to detect the operating system and video and sound materials are accordingly converted and presented to the learner.

Another important criteria for mobile devices is the internet connection speed. Since this is a Web-Based educational system, educational content is presented using web services. The faster connection speed, the better multimedia features the device may present. This determines the type of device the client is using and thus determines what type of content the learner will be presented with. It is inappropriate to „isolate“ modern devices from rich multimedia content and it will be terrible for the learner to wait a lot of time if he uses a slow internet connection.

In mDIPSEIL there are two roles of persons – learners and teachers. Teachers use a specially developed Web-System, which directly communicates with the Web-Engine, to upload educational content to the system. Using this Web-System they may create and/or delete courses, modules, tasks and objects, assign objects to tasks or remove assignments, but only for tasks created by them. They could also specify how objects are used inside of tasks. For proper view of educational content teachers must also specify coordinates for the tasks and/or country for the task.

Learners are actually the direct user of educational content through their mobile devices and thus the system is specially developed for them. In order to use the system, they must download and install a JAR file to their phones. Learners are identified with unique e-mail and password from the DIPSEIL system. Once logged in, they may view all tasks, which they have chosen or use the special positioning features to show only specific tasks. Learners are



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presented with the educational content using the standard performance-centered learning objects – the simply organized menu in the task screen allows them to browse through “Task Description”, “Task-specific Training” and so on. According to the specification of their phone and its features they may view advanced content (such as video or sound), or else they will only see text and images.

Content sensitiveness and location sensitiveness from the learner point of view

We developed under the second scenarios:

Mike is a learner (trainee/master degree student/working person). He has a registration and login to a mobile Learning Management System, which he accesses via the web browser on his mobile device. The LMS recognizes Mike's location, and which country he is accessing the system from. This recognition can be carried out by using mobile positioning, or GPS. The system then offers the learner content that has been designed to match the specific language of that country.

The system also interrogates the mobile device to identify its characteristics, the quality of mobile services at Mike's location and will then present the learning material according to the results from this interrogation. For example, when the mobile device of Mike has characteristics of an advanced mobile device, the learner may be offered streaming video / text / voice, whereas for a lower quality connection and a legacy GSM, he may be only offered text and voice.

Developing context sensitive and location-based content (Content sensitiveness and location sensitiveness from the course developer/teacher/tutor point of view)

Creating context sensitive and location-based content is done through the web-based teacher environment. When teachers log in with their username and password, they will be presented with an educational content tree structure, containing all courses, modules and tasks created by the teachers. Using the menus at the top of the screen new course elements could be created. Once the basic course structure is developed, the teacher should choose a task and select the edit button.

On the „Edit Task“ screen the educational content developer sees again the courses structure, but this time not only developed by the teacher, but from the whole system. This way he/she may use course elements, developed from other teachers, for building his task. A second tree structure is now shown, which displays all the uploaded, but still unused objects.



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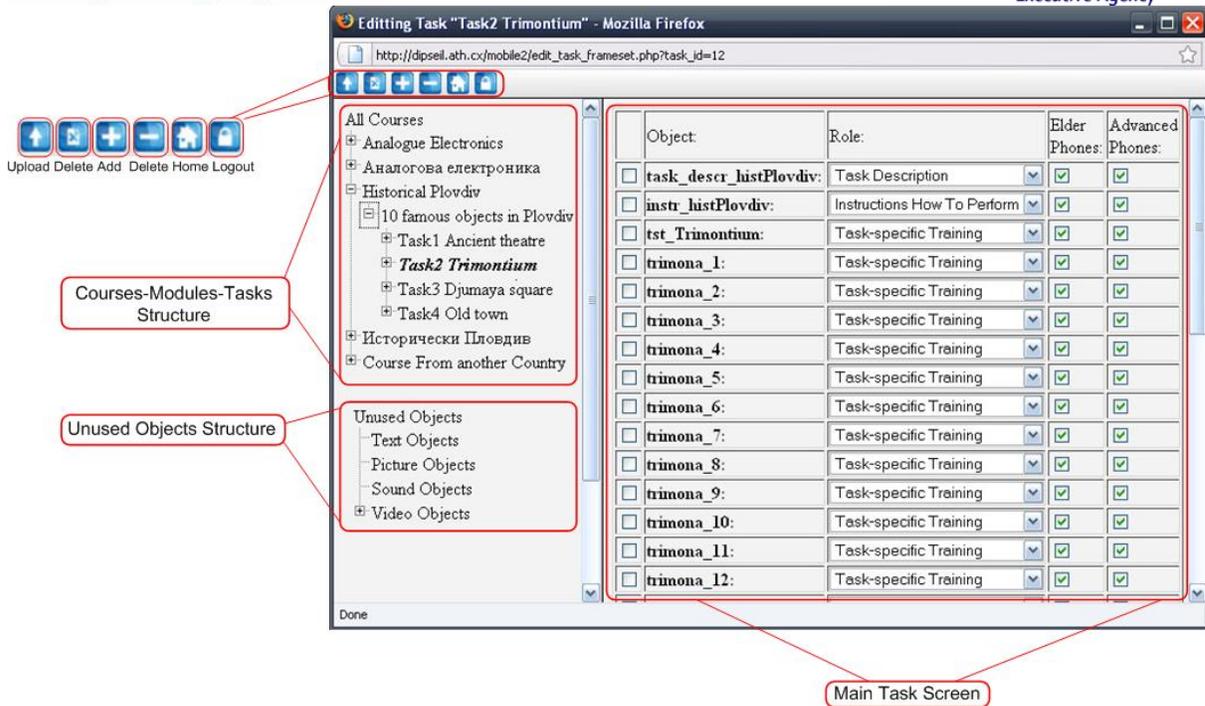


Fig.9 Task Edit Screen

Objects are the building parts of tasks. So at first the educational content developer should upload all objects needed for the given task, using the menu at top of the screen. *This is the first step to build the context sensitive course – objects could be video, sound, picture or text. It is important to develop two kinds of materials – for advanced and for legacy devices.* The second type could not (or could, but poorly) display rich-multimedia content, but it is unpractical to display a lot of text on the first type, than a good describing video with a lot of explanations as sound objects. After the objects are uploaded, they should be added to the task. Selecting them from the unused objects tree and clicking on „Add object to task“ button, will import them to the task. The main task screen shows a table with all imported objects, in which the teacher should select the role of each one. This could be – „Task description“, „Task-specific training“, „Reference Information“ or „Instructions how to perform“. In this table there are also checkboxes to select for which type of device the chosen object is – for advanced or for a legacy mobile device. Choosing „Advanced phone“ for a given object, it will be displayed only on mobile devices, supporting video content (this is the *.3gp mobile video format) and higher-speed internet connection. After this „Objects table“ there are some settings for specifying location-based content. First, the teacher should select in which country this task should be shown. Using a drop-down a list he/she is presented with a list of all inserted to the database countries. When this is specified, if the learner selects „Current Country Tasks“ from the mobile learning environment and if he is in the selected country, this task will be shown, or else hidden. The next task option is coordinate selection. The teacher may specify a matrix of coordinates determining the position for the current task. This way if the learner clicks on „Current position tasks“ in the mobile environment and correct coordinates were obtained, this task will be shown. Using this two location-based options the teacher has the full control over location-based content – tasks are specified by country (and thus also by language) as also by position (for displaying tasks or tourist for example). Using the task table, teachers have the full control over, which content is displayed on which type of mobile devices

How to develop Location-based content in mDIPSEIL – defining coordinates for a task.

In order a task to be localizable, there are two important conditions – 1) the mobile device, used by the learner should have available and configured positioning technologies (like GPS, a-GPS or plain Base-Station based positioning); 2) the teacher should define the coordinates for the specified task. There are many options to determine the coordinates for a task – looking at an atlas, going to the desired position with a GPS-enabled device or using online map tools like Google Maps.



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If the teacher opens Google Maps and searches for the desired object, he will get a map with one or more pointers around the searched object:

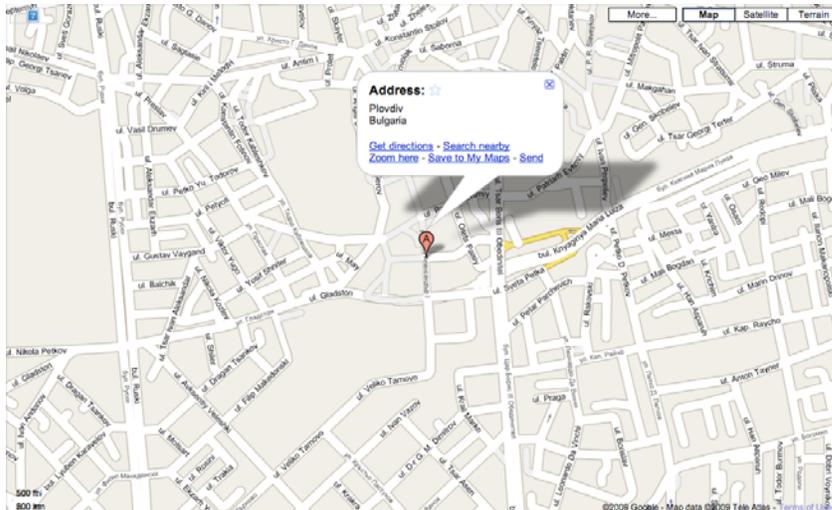


Fig.10 Google Map

On the picture above we have typed „Trimontium, Plovdiv“ in the search bar. Trimontium is the old name of Plovdiv and currently one of the best hotels in the city, situated in the city centrum. After we have found our desired object we should get the locations of four points, building a square around this position. Click the right mouse button north-west from the red marker, and we get the following context menu:

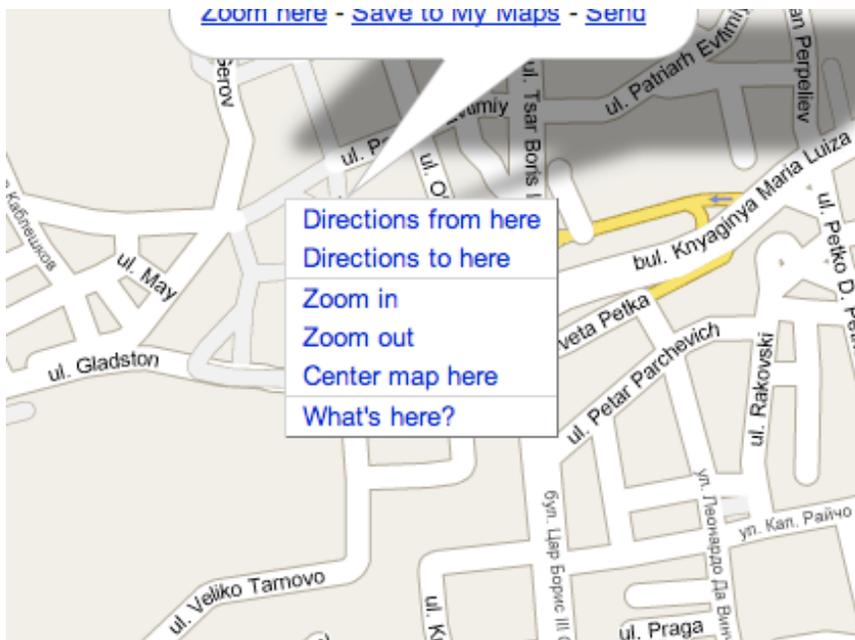


Fig.11 “Trimontium, Plovdiv” location on the map

Select „Directions from here“. After the screen refreshes, we get a green marker defined with „A“. Repeat the same procedure, this time clicking north-east from the green marker. Select „Directions to here“. Now we get two green markers marked with „A“ and „B“ and a blue line showing the route between them. The route is not of interest for us. Now on the upper-right corner of the map we find a button called „Send“. Clicking on it, presents us with the following window:

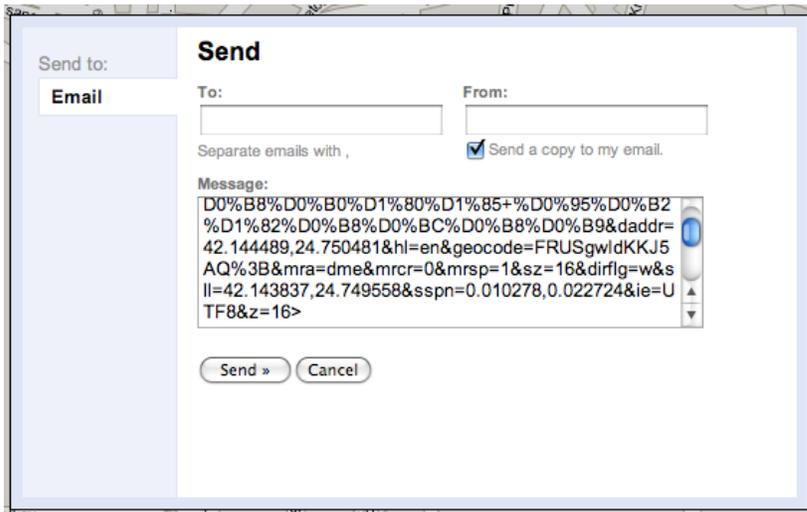


Fig.12 Parameters of the location

The following two parameters are important for us:

daddr=42.144489,24.750481

sl=42.143837,24.749558

“daddr” or “Destination Address” is the point which we chose as “Directions TO here”. “sl” is the other point. So these are the two north points. The same thing should be done for the two south positions. Note: points have two coordinates, delimited with a coma: “,”. Points are decimal-delimiters.

After we have these four points, we could enter the mDIPSEIIL editor and edit our task. Underneath the Objects Table in the Main Editing Screen there is a small table, in which the coordinates should be entered:

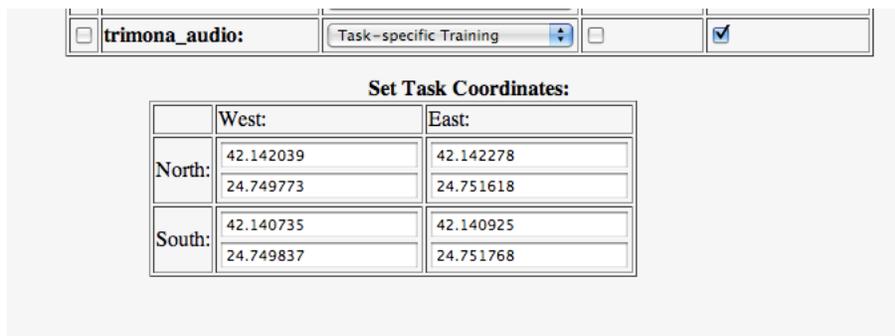


Fig.13 How to enter coordinates in the Editor

On the image above we have already filled the points. Now we press on “Save changes” and the task can now be successfully located by the mobile device.

Course content

The title of the course

- “Historical Plovdiv” for adults/working people/part-time master degree learners at the “Center for qualification and certification” at Physic Faculty, Plovdiv University, and for tourists, in Bulgarian and English
- May 2009



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Course content

Task 1 Ancient Theatre

Task description:

Find the object "Ancient theatre" in Plovdiv city. Carefully learn the given materials - text, pictures and audio! Look at the object and find the wrong picture.
Send its number to the tutor!!

The content is in two languages – English and Bulgarian, with audio and with pictures and text

Task 2 Trimontium

Task description:

Find the object "Trimontium" in Plovdiv city. Carefully learn the given materials - text, pictures and audio! Look at the object and find the wrong picture.
Send its number to the tutor!!

The content is in two languages – English and Bulgarian, with audio and with pictures and text

Task 3 Djumaya square

Task description:

Find the object "Djumaya square" in Plovdiv city. Carefully learn the given materials - text, pictures and audio! Look at the object and find the wrong picture.
Send its number to the tutor!!

The content is in two languages – English and Bulgarian, with audio and with pictures and text

Task 4 Old town

Task description:

Find the object "Old town" in Plovdiv city. Carefully learn the given materials - text, pictures and audio! Look at the object and find the wrong picture.
Send its number to the tutor!!

The content is in two languages – English and Bulgarian, with audio and with pictures and text

Course outcomes

We asked 5 learners from the "Center for qualification and certification" at Physic Faculty and 2 tourists from Graz, Austria and Maribor, Slovenia, to perform 4 tasks from the course "Historical Plovdiv", using their own mobile devices. They had 1 day around Plovdiv to perform four tasks.

We recorded the process of performing during the day and made a demo DVD.

We gave them the Mobile questionnaire after all tasks performance and collect their opinion. We used mainly the information from their comments and their reactions during the conversations and the discussions. We didn't use statistical analysis.



Some conclusions from the questionnaire:

- It is difficult to guarantee that the using file-format for content presentation will be opened on all kinds of mobile devices. The good solution is to present the one and the same content in at least 2 common file formats
- Less text, large font size, more illustrations and graphics.
- While small screen size and the lack of a keyboard were noted as limitations, they did not generate the level of dissatisfaction that the poor wireless network functionality did
- Learners prefer to work with their own mobile devices
- Half of the responders finds learning by GSM interesting, small part thinks that it's necessary
- More than half of responders will recommend learning by GSM to others and agree that learning was easy
- Almost all will take another m-learning course and for them it was a good possibility
- Half of the responders think that mobile learning doesn't increase quality of learning although they think that the learning outcomes were met
- Almost all are satisfied
- Interface for all is good
- All agree that more illustrations, graphics are necessary
- Mobile learning is interesting: "To use mobile phone for learning – why not!!!!"

All agree and recommend that it is necessary to develop more content not only for these 4 places in Plovdiv. They agree that this form is ideal guide for tourists visited Plovdiv.