

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

Project Number: 2007-1968

REPORT

WP4 Product training using location and context sensitive technologies.

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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.

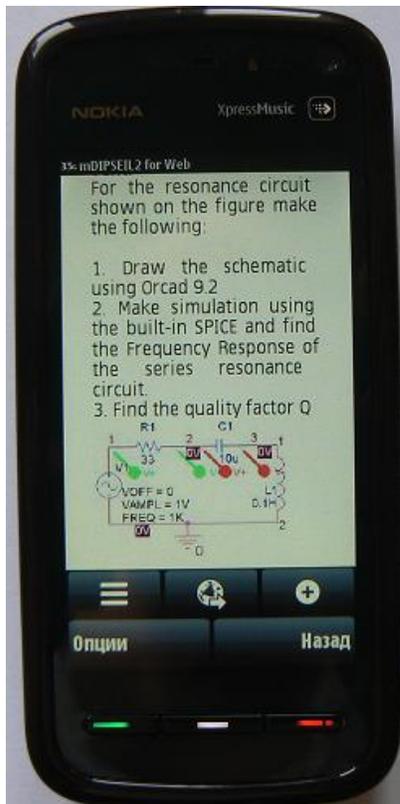


Fig.1. Task Description

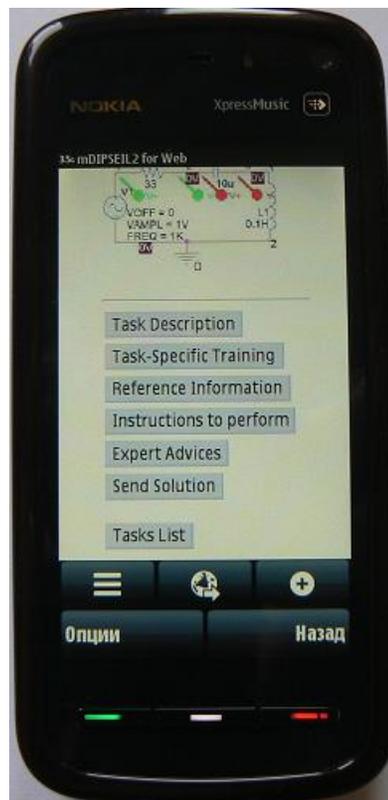


Fig.2. Task description and System's menu

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.

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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*.

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.

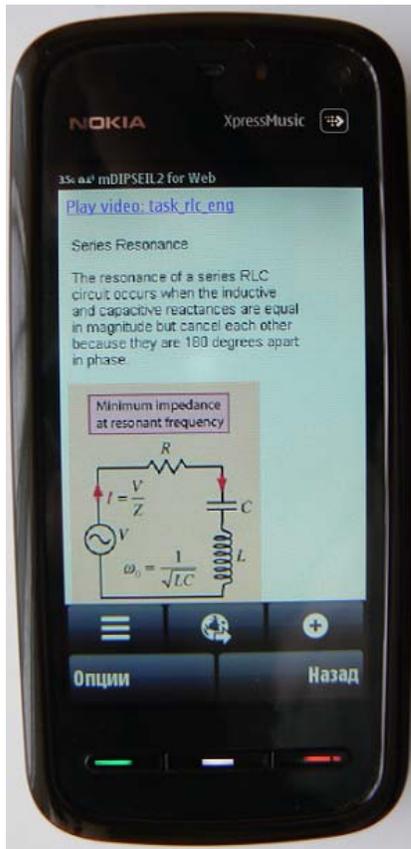


Fig.3. Task-Specific Training

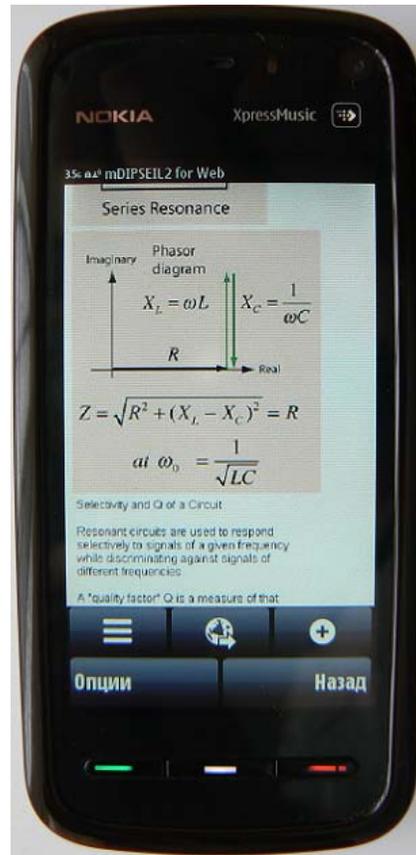


Fig.4. Task-Specific Training



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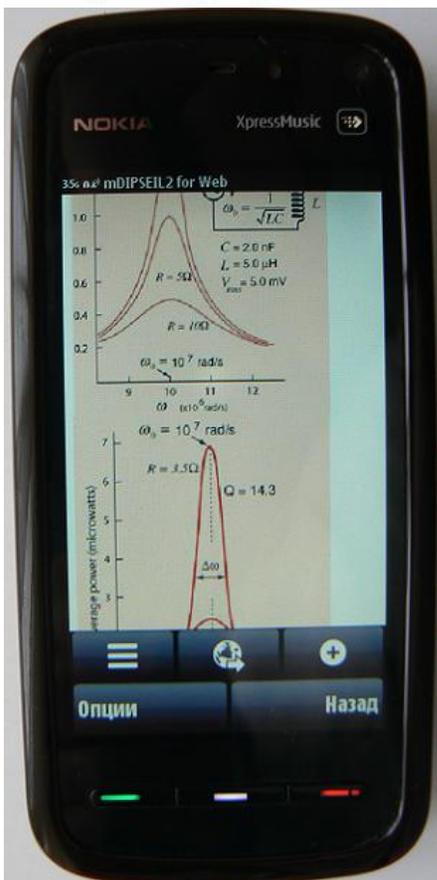


Fig.5. Task-Specific Training

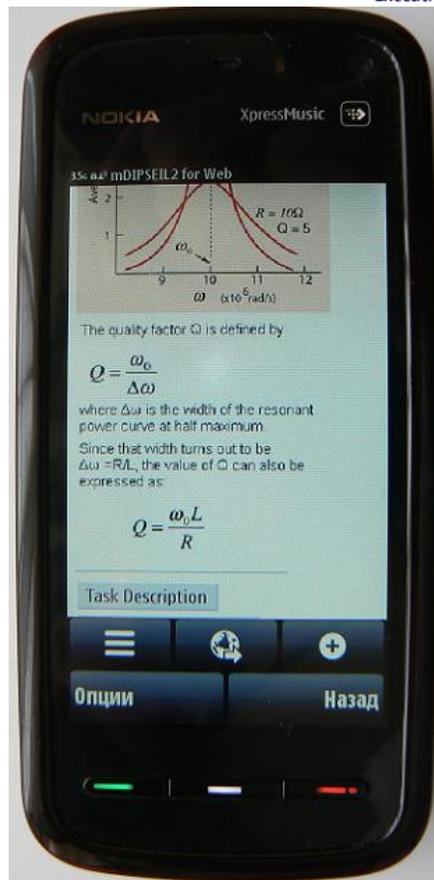


Fig.6. Task-Specific Training



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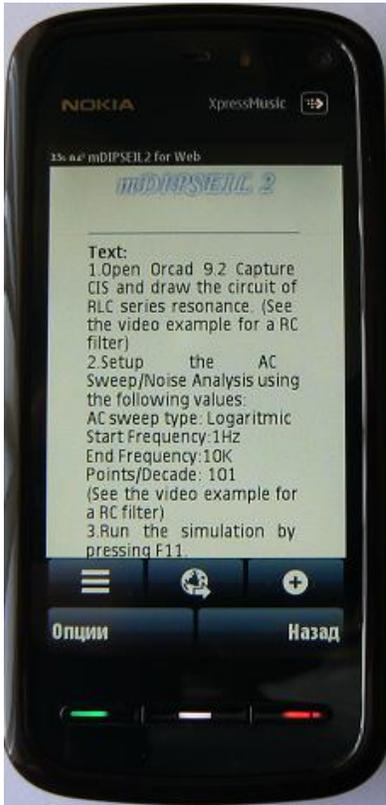


Fig.7. Instructions how to perform



Fig.8. Instructions how to perform



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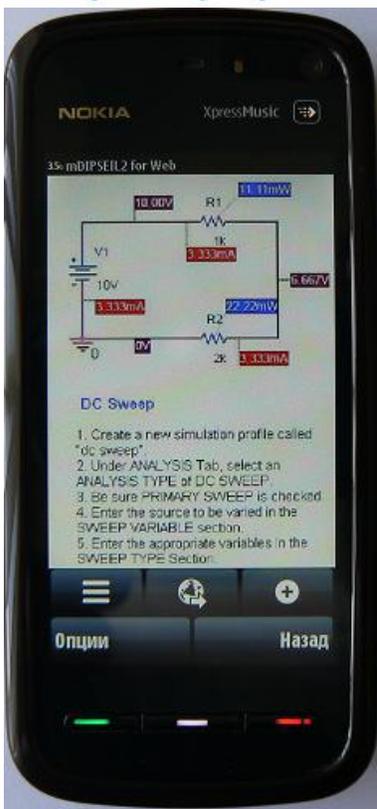


Fig .9. Instructions how to perform

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

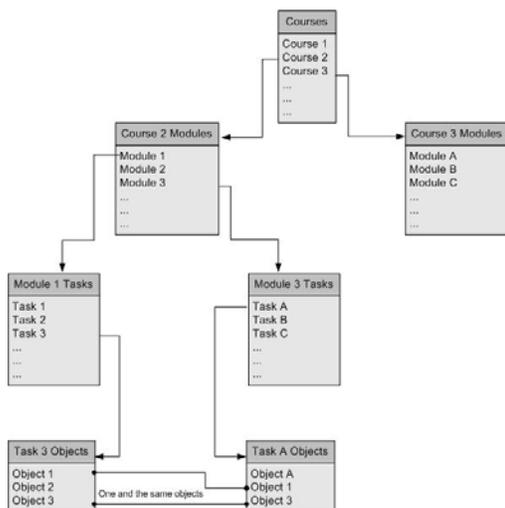


Fig.10 Structure of the Educational Content

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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 brings the greatest power of the system – the sharing of objects. For example if one tutor has created a Module for "Electronic Design" and another wants to develop a task for "Operational Amplifiers", he may use objects from the module. 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

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 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 system then offers the learner content that has been designed to match the specific needs of the learner.

The system also interrogates the mobile device to identify its characteristics, the quality of mobile services at Mikes' 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



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other teachers, for building his task. A second tree structure is now shown, which displays all the uploaded, but still unused objects.

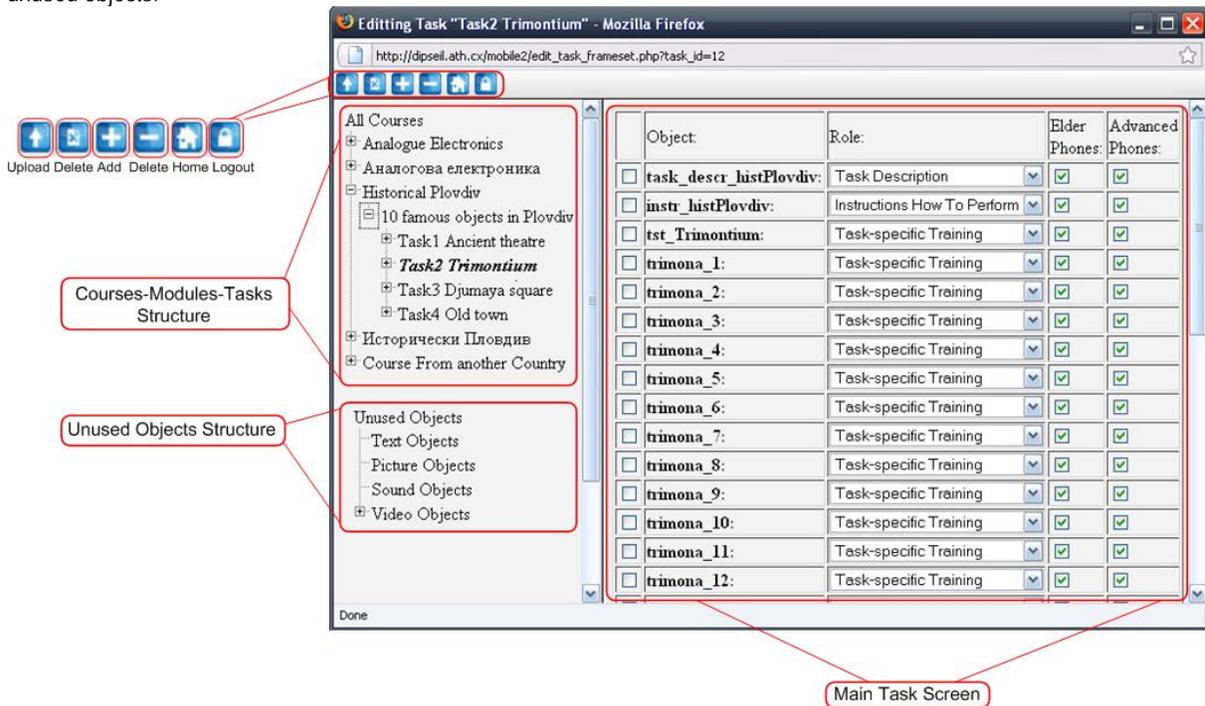


Fig.11 Task Edit Screen

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

Course content

The title of the course

"Analogue Electronics"

We developed in this workpackage under Scenario 2. Our learners from the "Center of qualification and certification" (CQC) at Physic Faculty, Plovdiv University, are working people, unemployed people, adults for prequalification and certification in other job role. We have students after bachelor degree, which are interested in a certification in a second, or third specialization (subject). We are teaching engineering courses and courses in ICT at CQC. Usually our learners have physic and/or technical (electronic, electrical) background. For example, in WP4 case three of them were with engineering background – finished bachelor degree at Plovdiv University, Physic engineers, the others were technicians – electronic professional secondary degree, received from the professional schools. Four of them were unemployed, the others were working people.

For learners with this background and according to the subjects learned, the course "Analogue Electronics" is very important.

Course content

Module 1 Passive circuits

Task1 Resonance of a series RLC circuit

Task description: For the resonance circuit shown on the figure make the following:

1. Draw the schematic using Orcad 9.2
2. Make simulation using the built-in SPICE and find the Frequency Response of the series resonance circuit.
3. Find the quality factor Q

The content is in two languages – English and Bulgarian, for two types of phones – advanced (with audio and video) and legacy (only with pictures and text)

Module 2 Semiconductors

Task2 I-V of PN diode

Task description: For the circuit shown on Figure make the following:

1. Draw the schematic using Orcad 9.2
2. Make simulation using the built-in SPICE and find ON voltage, where the diode starts to conduct. The analysis type must be DC SWEEP.

Sweep Variable:

Voltage Source: V1

Sweep type: Linear

Start Value: - 0.2 V

End Value: 1V

Increment: 0.01V.

The content is in two languages – English and Bulgarian, for two types of phones – advanced (with audio and video) and older (only with pictures and text)

Course outcomes

- We asked our learners to perform the task from the course using mobile devices:
 - We bought mobile devices, SIM cards. Learners used them 2 hours per week in DIPSEIL Lab



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- Ask them to go through the material using mobile devices
- They performed the tasks on PC
- We have two versions of the materials – for advanced devices with audio and video support, 3G and WiFi - for legacy phones with text, graphics, 2G
- mDIPSEIL identifies the device and automatically presents the correspond version
 - we had 3 old phones, others were advanced
- 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

Results

- More than half of our responders were male
- All our responders own at least one mobile device
- Half of the group uses the mobile devices for telephone calls, the other half –for calls, Internet, chat and SMS
- Half of the responders finds learning by GSM interesting, small part thinks that it's necessary
- More of responders will recommend learning by GSM to others and agree that learning was easy
- Almost all will take another m-learning course
- More of the responders think that mobile learning doesn't increase quality of learning although they think that the learning outcomes were met
- The learners are satisfied from communication with tutor, other learners
- Interface for them is good
- All agree that more illustrations, graphics are necessary
- Learners working with the old mobile devices were not satisfied using them, they found the screens too small, the download too long, although the graphics and text were enough clear

Conclusions

- It's necessary to use advanced mobile devices (big screen, 3G, with operational system, browser etc.) for learning purposes
- The device characteristics need to be matched to requirements of content
- Learners prefer to work with their own mobile devices
- Less text, large font size, more illustrations and graphics. Animation and video are the best solution
- 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
- Mobile learning is interesting: "To use mobile phone for learning – why not!!!!"
- Using DIPSEIL via mobile devices is not an alternative to using DIPSEIL via PC – it is an option!

Lessons learned

- 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
- It is not a good solution to experiment new technology, new system, on new devices, with the content in different from native for the learners language. We will perform the next test of mDIPSEIL with the course in Bulgarian
- More strong experimental design is needed
 - more learners, preliminary questionnaires
 - comparative analysis: for example Control group working with DIPSEIL; Experimental group working with mDIPSEIL
 - stronger control on using only mobile devices: the scheme "last minute content-fix working time-knowledge test" is appropriate



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VET focus

We developed under the second scenarios:

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Our "Mike"s were learners from the "Center of qualification and certification" at Physic Faculty, Plovdiv University. We had nine learners. Three of them were with engineering background – finished bachelor degree at Plovdiv University, Physic engineers, the others were technicians – electronic professional secondary degree, received from the professional schools. Four of them were unemployed, the others were working people.