

# **NEED ANALYSIS REPORT (Bulgaria)**

## **Introduction**

To respond to the needs of the industry for training new skills of the engineers and technicians in the multidisciplinary microsystems technology, the mSysTech project was designed and an Electronics Performance Support System (EPSS) will be adapted and transferred both, for training in companies and for educational purposes in the two new members of the EU Romania and Bulgaria.

The preliminary need analysis showed that in this most rapidly developing science which represents the basis of the e-economy and the e-society the continuous training is crucial and that the partnership between SMEs and universities for delivering training in microsystems technology is very important.

This report identifies and analyses the specific requirements of Bulgarian engineers, students, technical university teachers with regard to the content and techniques for delivery of training materials in the mSysTech system.

## **Background**

The project is aimed at adapting and integrating innovative performance-centred training approach and courses from previous Leonardo da Vinci and Socrates/Minerva projects, into vocational education and training organisations and SMEs in Microsystems Technologies. The focus is on the transfer of innovation in two new countries: Romania and Bulgaria and in the multidisciplinary area of microsystems.

The preliminary need analysis showed that the shortage of engineers in micro- nanosystems and the systematic decrease of students in electronics at the university can be a threat to the European economy competitiveness. In the 21st century the high level research is increasingly complex and interdisciplinary. There are very few individual research teams, laboratories or companies that can reasonably claim to be able to respond to the technological challenges.

Its first objective is to identify and analyse user requirements of managers, engineers, students and technical staff in the multidisciplinary science of Microsystems Technologies. Based on the need and requirement analysis, the experts in different aspects of microsystems will determine the training content and develop the presentation scenarios of the training courses.

## **Purposes**

The results of the problem definition and preliminary need analysis were summarised above. The first activity in the project will be a more precise user need analysis to provide the most appropriate training resources for meeting them, i.e. the feasibility of the virtual environment in particular SMEs, training organisations and universities, and identification of more potential users of the courses.

The needs analysis is undertaken in order to identify and analyse user requirements of managers, engineers, students and technical staff in the multidisciplinary science of Microsystems Technologies. The purposes are:

- to identify and analyse user requirements and training needs on innovative eLearning materials and problem-based learning skills in microsystems design and fabrication in Bulgaria;
- to undertake job analysis of microsystem engineering to collect information directly related to the nature of the interactive multimedia products in microsystems technologies under development.

## **Limitations**

The well known problem with questionnaires is the non-responsiveness. To overcome it, interviews have been used as well.

## **Questions**

- What knowledge and skills should provide the course in microsystem engineering?
- What delivery method to use?
- Do the students in microelectronics need on-line courses with in an EPSS?

## **Sample**

The target groups concerned are:

- professionals from SME in microsystems, electronics packaging and communication, students in engineering education and colleges, educated but unemployed people (e.g. engineers, physicists, chemists) looking for additional training and retraining for employment;
- trainers in HRD departments and university teachers, managers in SME, universities and colleges, experts in public unemployment and social work institutions, producers of training materials.

The samples included engineers and managers from SMEs, students and teachers at the Technical University of Sofia:

- professionals from SMEs in microsystems, electronics packaging and communication: EPIQ, MASHO, Hybrid Systems;
- students at the Faculty of Electronic Technique and Technology;
- teachers in microelectronics and mechanics;
- social workers of the regional employment services.

### **Instrumentation**

Questionnaire and interviews.

### **Results**

The questionnaire "Attitude to Learn by Computer Questionnaire" was published on the Web site of the Faculty of Electronic Technique and Technology, printed versions were distributed to the students during the lectures. Only 5 on-line questionnaires were answered, and 21 paper-based.

Teachers at the Faculty of electronics made non-structured interviews with some students (8-10). The questions of the interviews were the same as in the questionnaire and additional questions on the content of the courses in microsystems were asked. The dean, the head of department Microelectronics and four professors teaching courses with topics in microsystems technology were interviewed as well.

Most of the answers were that the planned in the proposal courses in Microsystem design and technology, Packaging technologies, Thermal management of microsystems are the most important.

The representatives from SMEs suggested to include in the Master degree curriculum an elective course in Thermal management of microsystems in Bulgarian language because of the existing problems with heat evacuation and the lack of experts in the field.

Regular students in Bulgaria, most of which must work and learn, need alternative providing more flexible learning. They need a high-quality educational materials, and what is the most important, continually brought up-to-date courses. Without simulation effective Web-based instruction in microelectronics is impossible, so the learners are interested in both, the quality of the simulation facilities of the learning environment and the simulation-based tutorials and assignments.

The administrative staff (which are lecturers, too) interests are directed to the organizational impact of the teleteaching on the organization. They are interested in how the courses taught at distance will fit in the regular curriculum, how the telelearning will be organized with the available equipment, the students and tutors background, whether the presence of tutor will be necessary during the course. These questions were posed by the dean of the faculty of electronics which part the department of chemistry is, the head of department and the teachers when they consented to participate in the first evaluation activities of the project. They expressed fears for the accessibility of course materials, especially the synchronous communication, because of the, very rarely, but still occurring interruptions in the telecommunications.

Bulgaria has strong traditions in microelectronics (in 1989 the foundry in Botevgrad worked on a technology of 2 $\mu$ m which was the top technology at that time) and the last 5 years a number of new SMEs in the field are created (HIC, EPIQ, Milexis, Centillion, NanoToolShop, etc.) and MSysTech project is designed to meet their needs of qualified end trained personnel.

The interviews with managers of SMEs and social workers of the regional employment services in the region of Botevgrad specialised in microelectronics for years showed that there are more than 30% of jobless people and at the same time the enterprises need a lot of low qualified workers but with a minimum competencies in sciences and technology. Similar is the situation in the chemical industry. So, there is a need of training of those jobless people but in a close collaboration with the enterprises.

All these adults need training to obtain/master the basic skills for a better personal fulfilment. But the aging people rarely feel confident in a class room with younger learners, e.g. 45 with 25 years old learners. The e-learning may be a good solution for them.

### **Recommendations**

Before the prototype EPSS could be designed and built, the hardware and software requirements of the proposed system have to be identified. Based upon our previous studies of both stand-alone and distributed EPSS tools, it was decided that an Internet-based system would be the most advantageous.

A fundamental requirement of an electronic performance support system (EPSS) is that it should increase a user's on-the-job performance within a given task domain. This can be achieved in two basic ways. First, through the provision of 'automated aids'; and, second, by providing various mechanisms to support 'on-the-job', 'just-in-time' training - which will enable users of any given

system to 'learn as they do'. Naturally, within an educational context, the emphasis on teaching and learning activities will change the underlying design emphasis that is employed. Therefore, we believe that an EPSS facility that is designed to fulfil an educational need should accommodate the following three basic requirements. First, it should act as a pedagogic agent to assess skill and knowledge requirements for a given task sequence and 'fill in' the gaps relating to a user's capability. Second, it must function as a transfer agent to develop skills and knowledge using 'on-demand' and/or just-in-time mechanisms. Third, it should act as an augmentation aid to improve human performance - over and above an individual's (or a group's) innate natural abilities.

Recommendations related to the training content which is focused by the mSysTech project were to regularly up-date the training materials because of the rapid development of electronics including the medical electronics.

## **Summary**

This report presented the analysis of specific requirements of Bulgarian engineers and students in microelectronics with regard to the content and techniques for delivery of training materials in microsystem technology in the mSysTech system. It was made with samples of the project target groups:

- professionals from SME in electronics and microsystems, who permanently wish to develop their competencies through recurrent education, working on projects and inspiring networks of peers, i.e. the knowledge workers;
- students in engineering education and vocational schools, who need education related to their further work as well as learning competencies necessary for the workers in an 'intelligent organisation';
- educated but unemployed people (e.g. engineers, physicists, chemists) looking for additional training and retraining for employment.

The need of courses defined after the preliminary analysis was confirmed. The performance support approach was adopted by both, the SMEs and the Technical University. New requirement was identified: the need of a course in Bulgarian on Thermal management to be added to the MSc degree curriculum.