



E-learning Education and Continuing Training to Electronics Assembling Technology

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www.elect2eat.eu

Final Content Report

Elect2eat Partners:



1. OVERVIEW OF THE ACTIVITIES AND ACHIEVEMENTS

1.1 OUTCOMES AND RESULTS

Outcomes and results are described below by the tangible products R₁, R₂, R₃ and R₄, their applications during the project and by their analyses, as follows:

R₁. The Virtual EMS Factory, the virtualized, web-based version of the equipment, their parameters and operation principles, and the processes, which are now used in a typical Electronics Manufacturing Service Factory. The **Virtual EMS Factory** was implemented and put to use at the beginning of the project by establishing a direct link to the ETT-VLAB website (www.ett.bme.hu/vlab/) from the www.elect2eat.eu website of the project and the ELECT2EAT training system. In this way the coverage of the Virtual EMS Factory was extended into the wide area of electronics technology, which is larger than assembling. The **project website** became the most important communication channel between the ELECT2EAT training system and the users, as well as between the system and the project partners. The domain name of elect2eat.eu was purchased for additional three year to ensure the accessibility of the **EAT e-learning program with three modules (PCB, DfM, and AIT)** as well as the **Virtual EMS Factory** after the completion of the project.

R₂. EAT e-learning program with the most important topics of **Electronics Assembling Technology** including Components and Printed Circuit Boards (**PCB**), Design for Manufacturing (**DfM**) and CAD, and Assembling & Test Technologies (**AIT**) modules. The system is separated into 17 chapters, from which 4, 5 and 8 belong to the PCB, DfM and AIT module, respectively. Each chapter contains **Elementary Teaching Entities** (ETEs) with 4-9 slides. Each ETE is a specific web-cast with free navigation possibility, and access to more written and oral explanations, movies and videos, a photo library, self-assessment possibility, etc.

The 3 modules of the system consist of altogether 50 ETEs with more than 300 slides and access to ca a thousand of photos, movies and videos. Written and oral explanations belong to each slide, in all the 4 languages (English, Hungarian, Romanian and Slovak), so altogether there are ca 1200 slides, 1200 text files and 1200 audio files in the system. 10-15 photos, 6-8 videos and movies, 10-12 definitions of the definition matching quiz, 10-12 pictures of the picture matching quiz, and 6-8 Internet links belong to each ETE. The visual items (pictures, videos and movies) are in their original (usually English) language; however, the titles of all items as well as the quizzes have been created on all the four languages of the project.

Printable form **User Manual** of the EAT e-learning program was also edited, issued and distributed in all the four project languages.

R₃. EAT Certified Assessment Option was planned to use the self-assessment tools of '**definition matching quiz**' and '**picture matching quiz**' of the e-learning program to examine the knowledge of the trainee, who would like to acquire a certificate of the successful fulfillment of the training. The self-assessment option was completed, it is available for all users of the EAT e-learning program. Experiences showed, however, that the self-assessment process should be surpassed.

For the Train-the-Trainers courses, which were provided altogether 7 occasions in the 3 countries, a more **complex certification process** was developed by the Certifying Committee, which was established for this aim, The Certifying Committee is chaired by an independent (not belonging to the project) professor of UPB Bucharest, and committee members are professors from the three countries of the project. The certification process has three parts, namely (1) the fulfillment of the quizzes; (2) the trial lecturing and consulting of a part of the course by using the e-learning system; and (3) answer questions in writing. For the successful completion of the course and the certification process, the participant is awarded by a certificate signed by Chair and the Members of the Committee.



Moreover, according to the reviewer’s advice, an officially acknowledged **Life-Long Learning module was created and obtained accreditation** from the Hungarian authorities. The curriculum of the course also includes a certification process similar to the above one. Although, possessing the accreditation is not a proviso for running the adult training activity or the implementation of the e-learning program, yet with the expert approval of the content, the institution may ensure the uniform high professional level during the approved period of the accreditation. Furthermore: the sustainability of Elect2eat project outcome will be guaranteed in this way.

R4. Statistics of indicators and impact factors is a report on the continuous monitoring of the progress of the innovation transfer and the application of the products. Indicators were used to get measurable results on the impact of the e-learning system. **The report** is compiled from feedbacks and interviews with people concerned. Feedbacks were provided by filling out questionnaires, which included questions concerning the training, its precedents, contents, the methods, the quality of the material, that of the slides, usability etc. The overall feedback of course participants was positive, the lower marks obtained for some questions and especially a few remarks provided great help for the continuous improvement of the course contents as well as the presentation methods during the second year of the project.

The **dissemination activities** (A – awareness seminars, D – dissemination days and/or demonstrations, P – press information), as well as the **project management** (organizing M – project meetings, **running the PDCA (Plan-Do-Check-Act) cycle** including S – selection & definition, R – results, and E- evaluation & analyses of the results) were carried out according to the time and structural schedule illustrated by the Gantt chart below:

WP	Activity	Month:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	Project Management and Valorization		M		AP				M		AP			M		AP				M		AP				PM	
2	Building the Virtual EMS Factory							R1	D					D													D
3	Content transfer to EAT modules:	DFM												D	R21					D	R22						D
		PCB												D	R21					D	R22						D
		AIT												D	R21					D	R22						D
4	Train the Trainers and Trials													D						D							
5	EAT Certified Assessment Option																										
6	Monitoring, Assessment, Impact Analysis		S		S			S	E						E					E						E	R4

Finally, a general strategy was planned and some measures were taken **to ensure sustainability of the results** beyond the project life. From these, the transfer & receipt the accreditation of the LLL module and the application for projects sponsored by the Structural Funds and the SEE initiative of the EC are worth mentioning.

1.2 PROJECT ACHIEVEMENTS

Regarding its main aims and objectives, **the projects met all the set targets**: the **innovative content and results**, which already existed at some universities of the Central Eastern European (CEE) region, **were adapted and integrated into a public, multi-lingual (ENG, HUN, RUM, SLK) e-learning training system**.

By content, the training system could be used in the **electronics industry**, including especially manufacturers of electrical machinery and apparatus (NACE 31); and of radio, television and communication equipment, where there is a rapid change of the knowledge required from all technical personnel (engineers, technicians, skilled or even unskilled workers), that generates a very great need for the application of advanced and up-to-date curricula and teaching methods in life-long learning both as convergence and continuing education.

By methodology, the E-learning (or web-based distance learning) system provides the following features:



- **on-demand web cast courses** with high level visual and audio content;
- **virtual factory**, where the operation of the equipment and the processes can be studied and used in a virtual environment;
- volitional control and **self-assessment** of learning by the students.

The ELECT2EAT VET system supports:

- **participants** in the acquisition and the use of knowledge, skills and qualifications to facilitate **personal development**, employability and participation in the labor market Europe-wide;
- **training centers, vocational education schools, institutions, associations, enterprises in providing high quality, innovative e-learning courses and practices through the web;**
- the enhancement of the attractiveness of vocational education and training; and
- the mobility of employers and individuals as well as of working trainees.

The e-learning provision of the ELECT2EAT VET system helps the participants to be integrated into the mainstream education and training in the technical field.

The distant and multi-lingual learning features of the system help to eliminate all forms of discrimination based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation.

According to the Independent Expert's opinion communicated at the Monitoring Visit, **two areas of the activities were improved and provided over-achievements:**

1. An improved **Quality Assurance Plan** with a well-defined **PDCA (Plan-Do-Check-Act) cycle** was made and applied. By having the PDCA cycle turned twice over and over, the quality of the activities was more controllable, and the quality of the results became more visible and measurable.
2. The possibilities to join official LLL programs were analyzed. As a result, the National Institute of Vocational Education (NIVE) was contacted. In Hungary, NIVE is responsible for the assessment of accreditation cases in the scope of the Adult Education Accrediting Body. NIVE keeps records of accredited institutions and programmes, issues certificates and provides control. **NIVE issued an accreditation license to the Elect2eat Train the Trainers programme** ("E-Learning Education and Continuing Training to Electronics Assembling Technology"). The accreditation is valid for ÉRÁK in the period of 22 April 2009 – 22 April 2013. Other institutions may take the license over from ÉRÁK in a separate procedure at NIVE, initiated by the beneficiary organization. **DRKK and BME already took over the license.** The accreditation of the programme made easier **to issue more valuable certificates** and **to ensure sustainability of the results beyond the project life.**

1.3 OVERALL CONTRIBUTION AND BENEFITS

By the end of the first project year the Partners of the consortium got acquainted with each other, as well as, with the possibilities, experiences and national specialties of each of them. The very **good cooperation** between them **helped to find innovative solutions for the improvement of all activities** during the second project year, especially in the fields of the application of the training system, the accreditation of the programme, the definition of a certifying process, the improvement of the quality of practical part of the training, etc.

Without the demand for completeness, each partner from the different countries contributed to the achievements of the project by the following special tangible added values:



- **ERAK from Hungary** found the right possibility for and carried successfully out the **accreditation** process of the e-learning programme.
- **DRKK from Hungary** was a pioneer in organizing **pilot trainings** to try out the e-learning material for both **primary and secondary target groups** and get feedback from them for the developers. DRKK defined the two target groups as potential trainers of the e-learning material (primary target group) and potential users of the knowledge (secondary target groups).
- **UPB-CETTI from Romania** provided extra practical values to the delivered Train-the-Trainers programmes by organizing **hands-on experiments for the trainees** with the use of their prototyping equipment, having moved to and installed at the actual sites of the training. In this way, **UPB created and applied a moving CAD design and surface mounting laboratory** at the trainings for the benefit of the audience and the project as well.
- **ARIES from Romania** contributed to the successful organization of the Train-the-Trainers courses by **recruiting participants from the industry** and teachers from secondary schools.
- **TUKE from Slovakia** improved the examination process by initiating a **trial teaching** of the participants of the Train-the-Trainers courses. **TUKE**, together with **UPB** and **BME**, made a special contribution also with the **establishment of the Certifying Committee and definition of the certifying process**.
- **SPSE from Slovakia** pioneered the delivery of the **e-learning training programme** for the secondary target group by its **inclusion into the education of their secondary technical school**.
- **STPKC from Sweden** provided a **good vision about the future** and how the results could be applied and developed further beyond the project's life.



2. RESULTS AND PRODUCTS

2.1 Result R₁:

Virtual EMS Factory – the Virtual Electronics Manufacturing Service Factory

Description of the permission for use

The Virtual EMS Factory is based on the ETT-VLAB, the Electronics Packaging Virtual Laboratory of the Department of Electronics Technology (ETT) at the Budapest University of technology and Economics (BME). The ETT-VLAB originally was developed for free educational use sponsored by the IEEE-CPMT Society and the NSF (National Science Foundation of the USA) through the Packaging research Center of GeorgiaTech. Later on, the members of ETT completed the VLAB by adding new ideas and principles to present processes and equipment using animations mostly visualized by Macromedia Flash.

Since its launching in 2000, the Department has been ensured free access to VLAB through the Internet; however, the animations have been protected against modification and downloading. The Virtual EMS Factory is an extension of ETT-VLAB, providing a special access to the same presentation of process principles and equipment operations by arranging the equipment to such a virtual layout, as they are used in a real factory. Similarly to ETT-VLAB, the access to the Virtual EMS Factory is totally free, however, through the Internet only. ETT does not intend to distribute these e-learning materials on CD-ROM or in printed format, which latter otherwise would be completely senseless. Therefore the Internet access and the Internet based use of the Virtual EMS Factory do not need any kind of permission.

Description how the result has been transferred

The Virtual EMS Factory is an extension of the freely accessible ETT-VLAB. It provides a special access to the same presentation of process and equipment operation principles of VLAB by arranging the equipment to such a virtual layout, as they are used in a real factory. In addition, starting the learning process by visiting the Virtual Factory, from place to place links are offered to the visitor to continue his or her study by entering the virtual laboratories of ETT-VLAB, or by learning the relevant ETEs (Elementary Teaching Entities) of the Electronics Assembling Technology E-learning System. The latter has the special advantage that provides written and oral explanations of the processes in four different languages, in English, Hungarian, Romanian and Slovak.

<i>Type of results</i>	Virtual EMS Factory – the Virtual Electronics Manufacturing Service Factory
<i>Target group(s)/ potential beneficiaries</i>	All people who seek for jobs; employees and unemployed professionals, entrepreneurs, distributors, trainees and teachers of vocational education schools; institutions, associations, bodies of LLL, etc.
<i>Language</i>	ENG
<i>Medium used</i>	Internet
<i>Availability (when?)</i>	Since 15/09/2008 it is available at www.elect2eat.eu , the access is free, maybe later a simple registration will be requested
<i>Number of copies</i>	User Manual in 2000 copies

Type of evaluation and testing

Results R₁, R₂ and mostly R₃ have similar Internet based feature, their evaluation were carried out in the same testing procedure, as follows:



Demonstration days were organized for an audience of general interest, and trainings were provided for both the primary and secondary target groups. The participants' opinion gave feedback for improving the contents and the methodology, in the following ways:

- The activity and the visible satisfaction or discontentment of the participants especially of the primary target group gave very good indication where and how to improve the quality.
- Questionnaire was developed and had it filled up by the participants to get more exact feedback and measurable indicators on the usability of the material. In the questionnaires the participants were asked how satisfied they were with the aims of the training, the amount of the contact lessons and the knowledge they received during the course, whether the explanations, tasks and exercises helped their learning, if they liked the method of independent studying, etc. The evaluation of the questionnaires played active part in the quality management of the project.
- Threefold assessment method was developed, which included trial teaching (of the members of primary target group only), on-line quizzes, written tests. The results of the assessment and the satisfaction with the certification process gave also useful feedback.

According to the three types of evaluation, the methods had also three types, respectively as follows:

- The level of activity and the visible satisfaction were estimated by talking to and discussing with the participants. The members of the primary target group were mostly qualified adults: active teachers, trainers, industrial engineers, who were very good partners to freely tell us their helping opinions.
- The questionnaires provided measurable indicators for the improvements.
- The results of the assessment indicated where to improve the content.

Findings, conclusions and lessons of evaluation and testing.

In general, the participants were quite satisfied with all parts of the e-learning material.

In particular regarding R₁, they enjoyed very much the application of the Virtual Factory to get more realistic impressions about the manufacturing process, and obtain good knowledge for the practical applications of the materials, physical and chemical principles.

Partners involved

Carrying out the transfer as providing partners: BME, UPB-CETTI, TUKE

Receiving and applying the transferred e-learning content: DRKK, ERAK, ARIES, SPSE

Delivering the courses as trials for the primary target groups: DRKK, ERAK, ARIES, SPSE with the help of BME, UPB-CETTI, TUKE

Delivering and helping to provide the courses for the secondary target groups: DRKK, ERAK, SPSE

2.2 Result R₂:

EAT e-learning program – Electronics Assembling Technology E-learning Program

Description of the permission for use

EAT e-learning program with three modules (Design for Manufacturing and CAD; Components and Printed Circuit Boards; and Electronics Assembling and Test Technology), including 17 Chapters and 50 ETEs (Elementary Teaching Entities) contains the most important topics of Electronics Assembling Technology. Each ETE is a specific web-cast with free navigation possibility, and access to more written and oral explanations (in four different languages), movies and videos, a photo library, self-assessment possibility, etc.



The transferred materials were originally developed by two Partners of the Elect2eat Project, namely BME-ETT (P1) and UPB-CETTI (P4), as it is described in the next paragraph. Both Partners have been provided free Internet access to these learning materials for their students and all interested visitors, however through the Internet only, the slides and the animations have been protected against modification and downloading. BME-ETT and UPB-CETTI do not intend to distribute these e-learning materials on CD-ROM or in printed format, with the exception of a printed Manual. Therefore the Internet access and the Internet based use of the EAT e-learning program do not need any kind of permission.

Description how the result has been transferred

The learning materials which were transferred to the EAT e-learning program have two basic origins, as follows:

1. The accredited adult education program 'Technology of Electronics Products' developed by BME-ETT (Partner 1) in HUN. The original Program contains 6 Power Point supported courses, basically 4 lecture hours of each, which can be provided on-demand and with extended content. The following three of these courses are included in the **EAT e-learning program**:

- **EAT-DfM**: Design for Manufacturing of boards and selection of components
- **EAT-PCB**: Manufacturing technology of Printed Circuit Boards and substrates
- **EAT-AIT**: Assembling and Inspection Technologies: processes and manufacturing equipment

2. In the 'Train-the-Trainers' program of the Eurotraining IST Project UPB-CETTI (Partner 4) developed and lectured an intensive short course in ENG, entitled 'Design and Complex Characterization of High Performance PCB Structures'. The slides of the course are also available in RUM. The **EAT-DfM** course is based on the content of these results of UPB.

As a third source the virtual laboratories of ETT-VLAB could be mentioned, which is the basis of the Virtual EMS Factory. The EAT e-learning program with its ca 50 ETEs (Elementary Teaching Entities) has a special connection with the Virtual EMS Factory: one can study the process and equipment operation principles by navigating from one of the systems to the other. The e-learning system has the special advantage that provides written and oral explanations of the processes in four different languages, in English, Hungarian, Romanian and Slovak, while the Virtual EMS Factory presents the equipment in an almost real manufacturing environment.

<i>Type of results</i>	EAT e-learning program – Electronics Assembling Technology e-learning program
<i>Target group(s)/ potential beneficiaries</i>	All people who seek for jobs; employees and unemployed professionals, entrepreneurs, distributors, trainees and teachers of vocational education schools; institutions, associations, bodies of LLL, etc. From the point of view of R ₂ , a primary and a secondary target group can be defined, which include people who are potential trainers of the e-learning material and the others, who are potential users of the knowledge, respectively.
<i>Language of the product</i>	ENG, HUN, RUM, SLK
<i>Medium used</i>	Internet at www.elect2eat.eu ; the access is free
<i>Availability (when?)</i>	Visual content: 12 th Project Month; voice, movies, videos: 18 th Project Month. Since May 2009 it is available at www.elect2eat.eu
<i>Number of copies foreseen</i>	3 copies of set of printed slides for each partner (3 x 8 = 24 volumes)
<i>Didactical methodology</i>	self-learning, self-assessment, informal learning, certified assessment
<i>Volume</i>	12 volumes: 3 modules (EAT-DfM, EAT-PCB, EAT-AIT) in 4 languages



Type of evaluation and testing

Results R₁, R₂ and mostly R₃ have similar Internet based feature, their evaluation were carried out in the same testing procedure, as follows:

Demonstration days were organized for an audience of general interest, and trainings were provided for both the primary and secondary target groups. The participants' opinion gave feedback for improving the contents and the methodology, in the following ways:

- The activity and the visible satisfaction or discontentment of the participants especially of the primary target group gave very good indication where and how to improve the quality.
- Questionnaire was developed and had it filled up by the participants to get more exact feedback and measurable indicators on the usability of the material. In the questionnaires the participants were asked how satisfied they were with the aims of the training, the amount of the contact lessons and the knowledge they received during the course, whether the explanations, tasks and exercises helped their learning, if they liked the method of independent studying, etc. The evaluation of the questionnaires played active part in the quality management of the project.
- Threefold assessment method was developed, which included trial teaching (of the members of primary target group only), on-line quizzes, written tests. The results of the assessment and the satisfaction with the certification process gave also useful feedback.

How was the evaluation and testing carried out?

According to the three types of evaluation, the methods had also three types, respectively as follows:

- The level of activity and the visible satisfaction were estimated by talking to and discussing with the participants. The members of the primary target group were mostly qualified adults: active teachers, trainers, industrial engineers, who were very good partners to freely tell us their helping opinions.
- The questionnaires provided measurable indicators for the improvements.
- The results of the assessment indicated where to improve the content.

Findings, conclusions and lessons of evaluation and testing

In general, the participants were quite satisfied with all parts of the e-learning material.

It is important to see that the result R₂, i.e. the **EAT Electronics Assembling Technology E-learning Program** was in the focus of the transfer regarding its content and extent as well, therefore the evaluation of R₂ is the most important for the qualification of the whole project. Its evaluation according to the aspects above is as follows:

- The activity and the visible satisfaction of the participants were extremely good. Especially the secondary school teachers – the members of the primary target group – in all the three involved countries, in Hungary, Romania and Slovakia, showed very high interest and activity to acquire the knowledge and obtain the capability to teach their students with the use of the EAT e-learning program. They gave very useful feedback where and how to improve the quality of the content and methodology of the system. They stated that the e-learning system can give a very useful practical background for the everyday public education. The secondary technical school teachers also became partners in organising pilot courses for the secondary target group, where they were the trainers actually. The members of the secondary target group were also very active to acquire the knowledge that was found interesting for them, because in this way they got realistic impressions about the manufacturing process of their possible future work.
- The evaluation of the answers of questionnaires provided correct feedback and measurable indicators on the usability of the material. In the questionnaires the participants were asked how satisfied they were with



the aims of the training, the amount of the contact lessons and the knowledge they received during the course, whether the explanations, tasks and exercises helped their learning, if they liked the method of independent studying, etc. After summarizing the results we could state that the students were satisfied with the conditions and methods of training and also with the material itself. Depending on their age and previous knowledge they found the course difficult at a different rate. It should be mentioned that almost all of the Hungarian participants indicated that some parts of the CAD & DfM module were too difficult for them. Although the Slovak and Romanian participants also found this part hard to learn by the use of the Internet, in their opinions it was the most interesting part of the course. The possible reason of this difference was the difference in the teaching methods: the Slovak and Romanian colleagues delivered the course in laboratories, which were equipped with suitable CAD software; therefore the participants can use the learnt design method in practice, and can enjoy the design process.

- Especially the threefold assessment method was developed on the request of the participants and also to meet the requirements of the accreditation. The assessment included – in addition to the on-line quizzes – written tests and trial teaching (but for the members of primary target group only). The secondary school teachers were very active in preparing themselves to make a trial teaching for their colleagues. They were motivated by the special certification, which was awarded for the successful teaching. The satisfaction with the certification process gave also useful feedback for us and acknowledged our efforts.

How the recommendations of the National Agency were taken into consideration?

The most important recommendations, which were advised by the reviewer and the National Agency on the occasion of the first Monitoring visit, were **to develop an effective and clear strategy regarding the use of the materials after they are ready, to obtain official accreditation for the e-learning system, and to increase the involvement of training organizations**. These recommendations gave a good impetus to the project, and we can state that the results provided over-achievements regarding the original objectives in respect of the recommended very important questions. **The e-learning system was accredited by the Hungarian authority of NIVE as an adult education course, which itself was a successful result, and which ensured the survival of the application of the e-learning system for a minimum period of four years**. By the **increased involvement of secondary technical schools and their teachers** to the application of the system in their everyday education, the third recommendation was also fulfilled with the great satisfaction of all project partners.

There was a remark from the National Agency that **the contribution and the commitment of the RO and SK partners** were better seen than that of the HU partners (ERAK, DRKK). In the last 15 Project Months both ERAK and DRKK had large contribution to the project and big share of the over-achievements. **ERAK successfully accomplished the accreditation of the e-learning system**, was very active in the course provision for both the primary as well as the secondary group, and efficiently took part in the evaluation process. DRKK adopted the accreditation, also was very active in the course provision for both the primary as well as the secondary group, and mostly **the achievement of DRKK was the accomplishment of the valorization and evaluation process** according to the quality management plan.

The monitoring expert recommended **reconsidering the dissemination strategy**. By the successful organization of the Train-the-Trainer courses and the courses for the secondary target group; organization of demo days; involvement of the press, organization of workshops and presentations, the dissemination activity of the partners was much more intensive and successful in the second part of the project. All partners had a good share in the dissemination; nevertheless **the dissemination activity of UPB-CETTI should be underlined**.

Partners involved

Carrying out the transfer as providing partners: BME, UPB-CETTI, TUKE

Receiving and applying the transferred e-learning content: DRKK, ERAK, ARIES, SPSE



Delivering the courses as trials for the primary target groups: DRKK, ERAK, ARIES, SPSE with the help of BME, UPB-CETTI, TUKE

Delivering and helping to provide the courses for the secondary target groups: DRKK, ERAK, SPSE

2.3 Result R₃:

EAT Electronics Assembling Technology – Certified Assessment Option

Description of the permission for use

One part of the Certified Assessment Option is the self-assessment tools of 'definition matching quiz' and 'picture matching quiz' to examine the knowledge of the trainee, who would like to acquire a certificate of the successful fulfillment of the training. This part of the CAO was originally included in the material, which was transferred. Therefore – for the same reason as the EAT e-learning program, see at R₂ – the Certified Assessment Option also does not need any kind of permission, its Internet access and Internet based use are free at the www.elect2eat.eu website.

Description how the result has been transferred

EAT Certified Assessment Option was planned to use the self-assessment tools of '**definition matching quiz**' and '**picture matching quiz**' of the e-learning program to examine the knowledge of the trainee, who would like to acquire a certificate of the successful fulfillment of the training. The self-assessment option was completed and transferred to the EAT e-learning program, it is available for all users of at www.elect2eat.eu website. Experiences showed, however, that the self-assessment process should be surpassed.

For the Train-the-Trainers courses, which were provided altogether 7 occasions in the 3 countries, a more **complex certification process** was developed by the **Certifying Committee**, which was established for this aim, The Certifying Committee is chaired by an independent (not belonging to the project) professor of UPB Bucharest, and committee members are professors from the three countries of the project. The certification process has three parts, namely (1) the fulfillment of the quizzes; (2) the trial lecturing and consulting of a part of the course by using the e-learning system; and (3) answer questions in writing. For the successful completion of the course and the certification process, the participant is awarded by a certificate signed by Chair and the Members of the Committee.

Moreover, according to the reviewer's advice, an officially acknowledged **Life-Long Learning module was created and obtained accreditation** from the Hungarian authorities. The curriculum of the course also includes a certification process similar to the above one.

Type of results	EAT Certified Assessment Option
Target group(s)/ potential beneficiaries	All people who seek for jobs; employees and employers; trainees and teachers of vocational education schools; associations, institutions, bodies of LLL, etc.
Language of the product	ENG, HUN, RUM, SLK
Medium that will be used	Internet, trial teaching using the Internet based system, test in writing
Availability (when?)	The threefold Certified Assessment Option was established in the 13 st Project Month and since then it has been in use
Number of copies foreseen	3 copies of set of printed questions and answers for each partner
Didactical methodology	self-learning, informal learning, certified assessment



Type of evaluation and testing

Results R₁, R₂ and mostly R₃ are similar Internet based feature, their evaluation were carried out in the same testing procedure, as follows:

Demonstration days were organized for an audience of general interest, and trainings were provided for both the primary and secondary target groups. The participants' opinion gave feedback for improving the contents and the methodology, in the following ways:

- The activity and the visible satisfaction or discontentment of the participants especially of the primary target group gave very good indication where and how to improve the quality.
- Questionnaire was developed and had it filled up by the participants to get more exact feedback and measurable indicators on the usability of the material. In the questionnaires the participants were asked how satisfied they were with the aims of the training, the amount of the contact lessons and the knowledge they received during the course, whether the explanations, tasks and exercises helped their learning, if they liked the method of independent studying, etc. The evaluation of the questionnaires played active part in the quality management of the project.
- Threefold assessment method was developed, which included trial teaching (of the members of primary target group only), on-line quizzes, written tests. The results of the assessment and the satisfaction with the certification process gave also useful feedback.

How was the evaluation and testing carried out?

According to the three types of evaluation, the methods had also three types, respectively as follows:

- The level of activity and the visible satisfaction were estimated by talking to and discussing with the participants. The members of the primary target group were mostly qualified adults: active teachers, trainers, industrial engineers, who were very good partners to freely tell us their helping opinions.
- The questionnaires provided measurable indicators for the improvements.
- The results of the assessment indicated where to improve the content and also the assessment process.

Findings, conclusions and lessons of evaluation and testing

In general, the participants were quite satisfied with all parts of the e-learning material, including the self-assessment tools of '**definition matching quiz**' and '**picture matching quiz**'. Experiences – especially **the feedback from the participants** from the primary target group, and the new requirements, which were set by accreditation – **showed that the self-assessment process should be surpassed**.

For the Train-the-Trainers courses, which were provided altogether 7 occasions in the 3 countries, a more **complex certification process** was developed by the **Certifying Committee**, which was established for this aim. The certification process has three parts, namely (1) the fulfillment of the quizzes; (2) the trial lecturing and consulting of a part of the course by using the e-learning system; and (3) answer questions in writing. For the successful completion of the course and the certification process, the participant is awarded by a certificate signed by Chair and the Members of the Committee.

In addition, according to the reviewer's advice, an officially acknowledged Life-Long Learning module was created and obtained accreditation from the Hungarian authorities. **The curriculum of the accredited course also includes a suitable certification process** similar to the above one.

How the recommendations of the National Agency were taken into consideration?

The most important recommendations, which were advised by the reviewer and the National Agency on the occasion of the first Monitoring visit, were to develop an effective and clear strategy regarding the use of the



materials after they are ready, **to obtain official accreditation for the e-learning system**, and **to increase the involvement of training organizations**. The e-learning system was accredited by the Hungarian authority of NIVE as an adult education course and the accredited course set special requirements against the certification process. By the **increased involvement of secondary technical schools and their teachers** to the application of the system both for teaching the secondary target group and in their everyday education, initiated the development of special certification process.

It was the Hungarian partner **ERAK**, who **successfully accomplished the accreditation of the e-learning system**, including the certification process.

By the successful organization of the Train-the-Trainer courses and the courses for the secondary target group, the certification process was tried in practice. All partners had a good share in this activity; nevertheless **the role of ERAK and UPB-CETTI should be emphasized**.

Partners involved

Carrying out the transfer as providing partners: BME, UPB-CETTI, TUKE

Receiving and applying the transferred e-learning content: DRKK, ERAK, ARIES, SPSE

Delivering the courses as trials for the primary target groups: DRKK, ERAK, ARIES, SPSE with the help of BME, UPB-CETTI, TUKE

Delivering and helping to provide the courses for the secondary target groups: DRKK, ERAK, SPSE

2.4 Result R₄:

Statistics of indicators and impact factors

Description of the permission for use

This result contains reports about the statistics of the courses provided by using the EAT e-learning system as well as about the impact of the transfer, therefore the permission for the use is not applicable in the case.

Description how the result has been transferred

This result was not part of the transfer. It contains the evaluation and impact analysis of the transfer process as well as the transferred content.

The report of statistics of indicators and impact factors refer to the continuous monitoring of the progress of the innovation transfer during the project and the evaluation of the applicability of the products. For the monitoring of the progress of innovation transfer the Quality Assurance Plan was developed, which was based on adoption of the Plan-Do-Check-Act model. The PDCA cycle was rolled over the project duration to monitor the quality progress of the innovation transfer process, in particular regarding the transfer of the learning contents, which concluded in the high quality Results (R₁ – R₃). An evaluation system with exact indicators to measure the progress and the quality of the process and the expected results was used. The main indicators were as follows:

- the quality (number and extent) of the Results (R₁ – R₃), the number of trained people, number of visitors of the website, the learning time
- the satisfaction rate of the visitors/attendees
- the number of direct trainings in the train the trainers action
- the number of attendees at the awareness events
- percent of the participants pass the tests of the certificating option



The attached reports contain the details on the statistics of indicators and impact factors. The measures took to ensure sustainability of the products after the project duration are also the part of the reports.

<i>Type of results</i>	Statistics of indicators and impact factors
<i>Target group(s)/ potential beneficiaries</i>	Training centers, educational institutions, associations, bodies of LLL, teachers of vocational education schools
<i>Language of the product</i>	ENG, HUN
<i>Medium that will be used</i>	CD and printed copies
<i>Availability (when?)</i>	24 th Project Month
<i>Didactical methodology</i>	Feedback from the applicability and impact

Type of evaluation and testing

For the monitoring of the progress of innovation transfer a Quality Assurance Plan was developed, which was based on adoption of the Plan-Do-Check-Act model. The PDCA cycle was rolled over the project duration to monitor the quality progress of the innovation transfer process, in particular regarding the transfer of the learning contents, which concluded in the Results (R₁ – R₃). An evaluation system with exact indicators to measure the progress and the quality of the process and the expected results was used. The main indicators were as follows:

- the quality (number and extent) of the Results (R₁ – R₃), the number of trained people, number of visitors of the website, the learning time
- the satisfaction rate of the visitors/attendees
- the number of direct trainings in the train the trainers action
- the number of attendees at the awareness events
- percent of the participants pass the tests of the certificating option

How was the evaluation and testing carried out?

Each of the consortium partners' research team focused on the quality management system of Elect2eat project and some additional innovative solutions were proposed and used:

- integration of the development of courses and trainings with quality enhancement procedures;
- improvement of the involvement of partners, groups of specialists and professional associations from the countries involved in project in development of the courses and Q&A processes, in order to be matched with industrial needs;
- developing processes for identifying, disseminating and embedding good practice the countries involved in ELECT2EAT project;

Findings, conclusions and lessons of evaluation and testing

An officially acknowledged **Life-Long Learning module was created and obtained accreditation** from the Hungarian authorities. Although, possessing the accreditation is not a proviso for running the adult training activity or the implementation of the e-learning program, yet with the expert approval of the content, the institution may ensure the uniform high professional level during the approved period of the accreditation, which extends beyond the project duration. The sustainability of Elect2eat project outcome is guaranteed in this way. The Swedish Partner STPKC and Romanian Partner ARIES provided good inputs to the surviving strategy of the project by reports entitled: **Learning Service Development Trends and Education on innovation and lifelong learning supporting the knowledge based society**, respectively.



How the recommendations of the National Agency were taken into consideration?

The most important recommendations, which were advised by the reviewer and the National Agency on the occasion of the first Monitoring visit, were **to develop an effective and clear strategy regarding the use of the materials after they are ready, to obtain official accreditation for the e-learning system**, and to increase the involvement of training organizations. These recommendations gave a good impetus to the project, and we can state that the results provided over-achievements regarding the original objectives in respect of the recommended very important questions. **The e-learning system was accredited by the Hungarian authority of NIVE as an adult education course, which itself was a successful result, and which ensured the survival of the application of the e-learning system for a minimum period of four years.**

There was a remark from the National Agency that **the contribution and the commitment of the RO and SK partners** were better seen than that of the HU partners (ERAK, DRKK). In the last 15 Project Months both ERAK and DRKK had large contribution to the project and big share of the over-achievements, which are mostly in connection with this Result R₄. **ERAK successfully accomplished the accreditation of the e-learning system**, was very active in the course provision for both the primary as well as the secondary group, and efficiently took part in the evaluation process. DRKK adopted the accreditation, also was very active in the course provision for both the primary as well as the secondary group, and mostly **the achievement of DRKK was the accomplishment of the valorization and evaluation process** according to the quality management plan.

Partners involved

Delivering the courses and giving feedback as rolling the PDCA cycle of the quality management: DRKK, ERAK, ARIES, SPSE assisted by BME, UPB-CETTI, TUKE

Accomplishment of the accreditation of the e-learning system: ERAK

Taking over the accreditation: DRKK, BME

Delivering the reports of Statistics of indicators and impact factors: DRKK, ERAK

Developing a report on Education on innovation and lifelong learning supporting the knowledge based society: ARIES

Delivering a report on Learning Service Development Trends: STPKC



3. FEEDBACK RECEIVED FROM THE TARGET GROUPS

In general, the members of the target groups were quite satisfied with all parts of the e-learning material.

It is important to see that the result R₂, i.e. the **EAT Electronics Assembling Technology E-learning Program** was in the focus of the transfer regarding its content and extent as well, therefore the evaluation of R₂ is the most important for the qualification of the whole project. Its evaluation according to the aspects above is as follows:

- The activity and the visible satisfaction of the participants were extremely good. Especially the secondary school teachers – the members of the primary target group – in all the three involved countries, in Hungary, Romania and Slovakia, showed very high interest and activity to acquire the knowledge and obtain the capability to teach their students with the use of the e-learning program. They gave very useful feedback where and how to improve the quality of the content and methodology of the system. They stated that the e-learning system can give a very useful practical background for the everyday public education. The secondary technical school teachers also became partners in organising pilot courses for the secondary target group, where they were the trainers actually. The members of the secondary target group were also very active to acquire the knowledge that was found interesting for them, because in this way they got realistic impressions about the manufacturing process of their possible future work.
- The evaluation of the answers of questionnaires provided correct feedback and measurable indicators on the usability of the material. In the questionnaires the participants were asked how satisfied they were with the aims of the training, the amount of the contact lessons and the knowledge they received during the course, whether the explanations, tasks and exercises helped their learning, if they liked the method of independent studying, etc. After summarizing the results we could state that the students were satisfied with the conditions and methods of training and also with the material itself. Depending on their age and previous knowledge they found the course difficult at a different rate. It should be mentioned that almost all of the Hungarian participants indicated that some parts of the CAD & DfM module were too difficult for them. Although the Slovak and Romanian participants also found this part harder to learn by the use of the Internet, in their opinions it was the most interesting part of the course. The possible reason of this difference was the difference in the teaching methods: the Slovak and Romanian colleagues delivered the course in laboratories, which were equipped with suitable CAD software, therefore the participants can use the learnt design method in practice, and can enjoy the design process.
- Especially the threefold assessment method was developed on the request of the participants and also to meet the requirements of the accreditation. The assessment included – in addition to the on-line quizzes – written tests and trial teaching (but for the members of primary target group only). The secondary school teachers were very active in preparing themselves to make a trial teaching for their colleagues. They were motivated by the special certification, which was awarded for the successful teaching. The satisfaction with the certification process gave also useful feedback for us and acknowledged our efforts.



4. DISSEMINATION AND EXPLOITATION OF RESULTS

Regarding its main aims and objectives, **the projects met all the set targets: the innovative content and results**, which already existed at some universities of the Central Eastern European (CEE) region, **were adapted and integrated into a public, multi-lingual (ENG, HUN, RUM, SLK) e-learning training system.**

By content, the training system could be used in the **electronics industry**, including especially manufacturers of electrical machinery and apparatus (NACE 31); and of radio, television and communication equipment, where there is a rapid change of the knowledge required from all technical personnel (engineers, technicians, skilled or even unskilled workers), that generates a very great need for the application of advanced and up-to-date curricula and teaching methods in life-long learning both as convergence and continuing education.

By methodology, the E-learning (or web-based distance learning) system provides the following features:

- **on-demand web cast courses** with high level visual and audio content;
- **virtual factory**, where the operation of the equipment and the processes can be studied and used in a virtual environment;
- volitional control and **self-assessment** of learning by the students.

According to the Independent Expert's opinion communicated at the Monitoring Visit, **two areas of the activities were improved and provided over-achievements:**

1. An improved **Quality Assurance Plan** with a well-defined **PDCA (Plan-Do-Check-Act) cycle** was made and applied. By having the PDCA cycle turned twice over and over, the quality of the activities was more controllable, and the quality of the results became more visible and measurable.
2. The possibilities to join official LLL programs were analyzed. As a result, the National Institute of Vocational Education (NIVE) was contacted. In Hungary, NIVE is responsible for the assessment of accreditation cases in the scope of the Adult Education Accrediting Body. NIVE keeps records of accredited institutions and programmes, issues certificates and provides control. **NIVE issued an accreditation license to the Elect2eat Train the Trainers programme** ("E-Learning Education and Continuing Training to Electronics Assembling Technology"). The accreditation is valid for ÉRÁK in the period of 22 April 2009 – 22 April 2013. Other institutions may take the license over from ÉRÁK in a separate procedure at NIVE, initiated by the beneficiary organization. **DRKK and BME already took over the license.** The accreditation of the programme made easier **to issue more valuable certificates** and **to ensure sustainability of the results beyond the project life.**



5. MPACT AND SUSTAINABILITY

1) The European dimension of the project offers a solid contribution for development of a proper environment destined to promotion of innovative companies. Since the Central-East-European countries joined the European Union, the borders do not hinder creating contact with other European nations, and sharing our experiences makes the solution of problems easier. The surveys of requirements measure the demands of more nations at the same time, the participants of training programmes get a marketable knowledge, with which they have a greater chance for jobs not only in their mother country but also in the neighboring ones. The consistent, uniform training means a great advantage for the companies coming to our region, because the lack of skilled workforce or the differences in the training systems of different countries will not hinder their cross-border investments.

2) A kind of **impact** regards the training centers, industrial associations and vocational schools, which are able to provide the self-learning, web-based, EAT courses for all people of the region who are seeking for jobs in this field or are interested in continuing or convergence education for any other reasons. Students and potential employees can be invited to take a learning tour in the Virtual EMS Factory, and get acquainted with equipment and processes as well. The certification, which can be acquired by the successful fulfillment of the CAO (certified assessment option) of the training system, could help teachers in the examination of their students, and the human resource managers of the enterprises in the selection of the new employees.

Another kind of impact refers to the improvement of the quality and attractiveness of the knowledge and skill of the employees of the regions in the European labor market. The web-based training system has a short-term impact on both convergence education (retraining of already graduated professionals/engineers to a new area) and continuing education (training for field professionals/ engineers according to their employer/industry needs).

The most important impact of the application of the e-learning system can be on the living standard and general happiness of the people, who are able to acquire a good knowledge, high skill and strong courage to apply for and obtain good jobs for the benefit of their families and the enterprises as well.

Very good qualitative impressions can be reported on the basis of the feedback got from the attendees of the dissemination events. Measurable indicators of the report **Statistics of indicators and impact factors (R₄)** showed also high impact of the expected results (products) of the transfer of innovation.

Institutions/organisations have expressed interest in using the results

The following groups of institutions expressed interest in the exploitation of the results:

- Public Employment Services
- Secondary Technical Schools and Professional Schools of Electronics (like "Dénes Gábor" and "Pál Beregszászi" in Debrecen)
- Universities and Colleges
- Industrial Associations
- Industrial companies, small enterprises

They Have been mostly from the three countries of the Partners, but also from other countries, like Bulgaria and Turkey.

Target groups that will use /benefit from the project result s

It is very difficult to estimate the number of people who will benefit from the results, mainly because in all of the European countries the educational systems as well as the employment services are directed by very rigorous



and country-specific rules, and, consequently, the possibility of the local institutions with direct contact to the people to receipt innovations are very low. However, if each of the nearly 200 trainers, who got certification for the accomplishment of the Train-the-Trainers course in 2009, makes his or her 20-50 trainees acquainted with the use of the EAT e-learning system, then ca 4000-10000 members of the secondary target group would benefit from the results of the Elect2eat innovation transfer project, in each of the next years.

The activities and results that are planned to be maintained

There were three kinds of partners in the project, as follows:

- Receiving Partners (training centers, industrial associations and schools), who identified and analyzed targeted user requirements, selected the innovative content to meet these requirements and made the training system feasible;
- Providing Partners (universities), who updated, transferred, integrated and adapted their innovative training content to an e-learning system, including a virtual factory, meeting the identified national and regional requirements with socio-cultural and linguistic contexts;
- Consultant (a skilled pedagogic knowledge centre), who was requested to advise advanced methods and control the process of transfer.

The www.elect2eat.eu website became and will be the most important communication channel between the e-learning training system and the users. It is emphasized that the system works independently and automatically, with free and easy access to the website. The website is and will be located on the server of BME-ETT and on back-up servers at UPB-CETTI and TUKE, and – in this way by the maintenance of the website – the Providing Partners contribute to the sustainability of the system.

The EAT e-learning program with three modules (DfM, PCB and AIT) is the learning tool for the most important topics of Electronics Assembling Technology. Each module is a specific web-cast with free navigation possibility, and access to more written and oral explanations, movies and videos, a photo library, self-assessment possibility, etc. The system can be beneficially used in the all forms of vocational education, especially in technical secondary schools, in universities and colleges, and any kind Life-Long-Learning means.

Very important guarantee of the sustainability and further exploitation of the system is the **accreditation license to the Elect2eat Train the Trainers programme** (“E-Learning Education and Continuing Training to Electronics Assembling Technology”) issued by the National Institute of Vocational Education (NIVE), the Adult Education Accrediting Body in Hungary. It was ERAK, one of the Hungarian Receiving Partners, who acquired the license of accreditation, which is valid for ERAK in the period of 22 April 2009 – 22 April 2013. Other institutions may take the license over from ERAK in a separate procedure at NIVE, initiated by the beneficiary organization. **DRKK and BME already took over the license.** The accreditation of the programme made easier **to issue more valuable certificates and to ensure sustainability of the results beyond the project life.** The Certified Assessment Option is also a good possibility with which the user is able to prove his/her knowledge and acquire a certificate.

All performers of the sector (individuals, and representatives of schools, training centers, enterprises, associations, magazines, journals, etc), who defined their activity area using the word of ‘electronic’ in public databases of associations, ministries and ministerial institutions and centers, can use beneficially the system for the guaranteed next four years.

The annual conferences, where Partners are always present as participants and/or organizers, like ISSE, SIITME, ESTC, will remain the most important dissemination forums for the global public.

During the execution of the project we made the system maintainable without any financial support. The cooperation of universities and training centers resulted in a really marketable e-learning system, which was a breakthrough in the field of e-learning, and which guarantees the sustainability.



The sustainability of the program is ensured

- from financial aspects
 - through the efforts of the partners to make the training programme available to the general public (especially for employees) so as to realize revenues for the maintenance of the Partnership and for the education of unemployed people,
 - through the participation in further EU and international programmes.
- from institutional aspects
 - because after completing the implementation, the institutional infrastructure will still be at the disposal of the Partners, we ensure the development of the educational materials and the diversity of the teaching methods, and
 - because the additional development of the services can be realized by the expert staff of the partners. In the framework of the partnership our stressed aim is to increase the number of specialists taking part in the activities.

The sustenance of the e-learning system is in the partners' own interests, especially at vocational schools, since

- it provides experiences on the qualification of the educational staff at the educational institutions,
- the multilateral transfer and multi-lingual feature of the products can be exploited in each case for the training of the ethnic minorities of the other countries,
- the didactics of the training system and the assessment, and in some cases the content as well, can be adapted and implemented to other high technology areas (sectoral transfer),
- the high dynamism of the development of knowledge and of market requirements continuously generates new knowledge at universities as well as at enterprises and this rapid developments drive the knowledge transfer to each other and to the vocational training institutions as well,
- the improvement of the qualification of teachers and trainers by vocational education and training supports the generation of innovations in knowledge-intense small and medium enterprises.

Impact on the national VET system of the country

The transfer of the knowledge to a **newly established website of www.elect2eat.eu** has made the most **significant impact** on the national, European and global VET systems. It is the communication channel between the e-learning training system and the users. The system works independently and automatically, with free and easy access to the website. The e-learning program with three modules (DfM, PCB and AIT) is the learning tool for the most important topics of Electronics Assembling Technology. Each module is a specific web-cast with free navigation possibility, and access to more written and oral explanations, movies and videos, a photo library, self-assessment possibility, etc. The system can be beneficially used in the all forms of vocational education, especially in technical secondary schools, in universities and colleges, and any kind Life-Long-Learning means.

A large impact on the national VET system was made by the **accreditation of the Elect2eat Train the Trainers programme** ("E-Learning Education and Continuing Training to Electronics Assembling Technology") at the National Institute of Vocational Education (NIVE), the Adult Education Accrediting Body in Hungary. The accreditation provides the most important guarantee of the sustainability and further exploitation of the system. It was ERAK, one of the Hungarian Receiving Partners, who acquired the license of accreditation, which is valid for ERAK in the period of 22 April 2009 – 22 April 2013. Other institutions may take the license over from ERAK in a separate procedure at NIVE, initiated by the beneficiary organization. DRKK and BME already took over the license. The accreditation of the programme made easier to issue more valuable certificates and to ensure sustainability of the results beyond the project life. The Certified



Assessment Option has also made the impact larger, because it is a unique possibility for the users to prove his/her knowledge and acquire a certificate.

By their reports entitled: "Learning Service Development Trends" and "Education on innovation and lifelong learning supporting the knowledge based society", which provided good inputs to the surviving strategy of the system, the Swedish Partner STPKC and Romanian Partner ARIES made also a significant impact on the VET systems, in particular regarding the future.

6. CONTRIBUTION TO EU POLICIES

To support participants in training and further training activities in the acquisition and the use of knowledge, skills and qualifications to facilitate personal development, employability and participation in the European Labour Market

To support improvements in quality and innovation in vocational education and training systems, institutions and practices

The main aims and objectives of the projects were to adapt and integrate the innovative content and results already existing at some universities of Central East European region acquired partly from previous Leonardo da Vinci Projects and partly from other innovative projects into a **public, multi-lingual training system**. Institutions and organizations, whose obligation is to provide lifelong learning opportunities in the region, benefit from the Leonardo grant by using the innovative e-learning courses and web-based virtual training tools, which have been transferred and adapted. **Trainees and teachers** of vocational education schools; institutions, associations, enterprises working in the electronics assembling field, as well as, bodies providing guidance, counseling and information services relating to lifelong learning **can make good use of the virtual training facilities**.

The most important tangible outcomes are that the training centers, industrial associations and schools are able to provide the **self-learning web-based courses for all people** of the region **who are seeking for jobs in this field** or are interested in continuing or convergence education for any other reasons. Students and potential employees can be invited to take a learning tour in the virtual factory, and get acquainted with equipment and processes as well.

Another important tangible outcome and large impact on the national VET system was made by the **accreditation of the Elect2eat Train the Trainers programme** ("E-Learning Education and Continuing Training to Electronics Assembling Technology") at the National Institute of Vocational Education (NIVE), the Adult Education Accrediting Body in Hungary. The accreditation provides the most important guarantee of the sustainability and further exploitation of the system. The accreditation of the e-learning programme made easier to issue more valuable certificates. The Certified Assessment Option is a unique possibility for the users to prove his/her knowledge and acquire a certificate.

The objectives that the project directly addressed

1. To facilitate the development of innovative practices in the field of vocational education and training other than at tertiary level, and their transfer, including from one participating country to others
2. To support the development of innovative ICT-based content, services, pedagogies and practice for lifelong learning.

There is a rapid development of microelectronics devices and their assembling technologies at the electronics manufacturing companies, and this development is accompanied by the dramatic change of the knowledge required from all technical personnel employed in this field. Therefore the preparation of the technical staff for the rapidly growing requirements is a real challenge for today's education that generates a very great need for



the application of advanced curricula and teaching methods not only in traditional education, but also in life-long learning both as convergence and continuing education. E-learning (or web-based distance learning) is considered to be the right solution.

The rapidly growing electronics industry in the involved CEE countries need well-trained, creative and flexible human capital, whose number will certainly exceed half million within a few years. By the transfer of innovative learning materials and integration in an advanced e-learning system, the prior field, i.e. the quality of the vocational education training (VET) and practices will be improved.

By methodology, E-learning (or web-based distance) learning with the following features is considered to be the right solution:

- on-demand web cast courses with on-line consultation possibility;
- virtual factory, where the operation of the equipment and the processes can be studied and used in a virtual environment;
- volitional control of learning by the students, as well as, professionally acknowledged and officially certified examination possibility.

European priorities that the project addressed

1. Quality of VET systems and practices
2. Continuous training of teachers and trainers

The ELECT2EAT VET system supports:

- **trainees** – all participants and students – in the acquisition and the use of knowledge, skills and qualifications to facilitate personal development, employability and participation in the labor market Europe-wide;
- **teachers and trainers** at training centers, vocational education schools, institutions, associations, enterprises in providing high quality, innovative e-learning courses and practices through the web;
- the enhancement of the **attractiveness of vocational education and training**; and
- the **mobility of employers** and individuals as well as of working trainees.

Some important benefits the users would acquire from the training system are as follows:

- **improved knowledge**, acquaintance in electronics assembling technology;
- **easy learning methods in attractive modern virtual environment**, from anywhere at any time, with all benefits what the Internet provides;
- **volitional control of the acquired knowledge**, with no consequences or disgrace;
- certification of the successful fulfillment of the training if the trainee undertook the procedure of the **CEO Certified Assessment Option**.

Horizontal issues that the project directly addressed

1. Promoting awareness of the importance of cultural and linguistic diversity and multiculturalism within Europe, as well as of the need of combat racism, prejudice and xenophobia
2. Promoting equality between men and women and contributing to combating all forms of discrimination based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation

The main aims and objectives of the project are to transfer, adapt and integrate the innovative content and results of education and training, which already exist at some universities of the Central Eastern European region in the field of electronics assembling technology, into a **public, multi-lingual vocational training system**.



The multi-lingual feature of the system will provide possibility for the people of the three CEE countries to train themselves by using their native languages, as well as, to be acquainted with the English equivalent of the technical vocabulary, since English is accepted as a usual communication language in electronics, in particular at multinational companies.

The e-learning provision of the ELECT2EAT VET system helps the participants to be integrated into the mainstream education and training in the technical field. **The distant and multi-lingual learning features of the system help to eliminate all forms of discrimination** based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation.

Lisbon Key Competences that the project directly addressed

1. Communication in the mother tongue
2. Communication in the foreign languages
3. Mathematical competence and basic competences in science and technology

The main aims and objectives of the project are to transfer, adapt and integrate the innovative content and results of education and training, which already exist at some universities of the Central Eastern European region in the field of electronics assembling technology, into a **public, multi-lingual vocational training system.**

The multi-lingual feature of the system will provide possibility for the people of the three CEE countries to train themselves by using their native languages, as well as, to be acquainted with the English equivalent of the technical vocabulary, since English is accepted as a usual communication language in electronics, in particular at multinational companies.

7. GENERAL COMMENTS

The most important **recommendations, which were advised by the reviewer and the National Agency** on the occasion of the first Monitoring visit, **gave a good impetus to the project,** and we can state that the results provided over-achievements regarding the original objectives in respect of the recommended very important questions.

- **The e-learning system was accredited by the Hungarian authority of NIVE** as an adult education course, which itself was a successful result, and which **ensured the survival of the application of the e-learning system for a minimum period of four years.**

- By the **increased involvement of secondary technical schools and their teachers** to the application of the system in their everyday education was also fulfilled with the great satisfaction of all project partners.

- There was a remark from the National Agency that the contribution and the commitment of the RO and SK partners were better seen than that of the HU partners (ERAK, DRKK). **ERAK successfully accomplished the accreditation of the e-learning system,** was very active in the course provision for both the primary as well as the secondary group, and efficiently took part in the evaluation process. DRKK adopted the accreditation, also was very active in the course provision for both the primary as well as the secondary group, and mostly **the achievement of DRKK was the accomplishment of the valorization and evaluation process** according to the quality management plan.

- The monitoring expert recommended reconsidering the dissemination strategy. By **the successful organization of the Train-the-Trainer courses and the courses for the secondary target group; organization of demo days; involvement of the press, organization of workshops and presentations, the dissemination activity of the partners was much more intensive and successful** in the second part of the project. All partners had a good share in the dissemination; nevertheless the dissemination activity of UPB-CETTI should be underlined.

