

# ENHANCING E-INCLUSION THROUGH INNOVATIVE REMOTE VET LEARNING SYSTEMS FOR THE DEAF. EVIDENCES FROM THE EFESTO PROJECT

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## ABSTRACT

Nowadays society heavily relies on computer technologies and knowledge. After the latest upsurge of industrialization, computer science has become a primary need for everyone interested in enjoying an active and fully integrated social life. Therefore, accessibility to modern computer technologies increasingly represents a possibility to know, learn and work. E-learning or distance learning is radically modifying the way individuals enhance their competences and is eliminating the long-standing barriers that have prevented many people, such as the deaf, from having access to formation and education. In particular, the availability of technology today has affected education too, and it can prove to be highly relevant to enhance the inclusion - and, along with it, the e-inclusion - of deaf and hard-of-hearing people by improving and/or devising new teaching modes and methods suited to teach competences and skills necessary to access the modern technological society.

## KEYWORDS

Research projects, deaf and hard-of-hearing learners, innovation, distance learning, remote control.

## 1. INTRODUCTION

Throughout 2008 the European Commission invited authorities and industries to promote Electrical Engineering competences and digital learning, which are fundamental especially for those citizens who run the risk of becoming the victims of a digital divide, thus being excluded from the modern e-society. As a matter of a fact, in Europe less than one in five disabled people is employed. Moreover, specific studies have highlighted that these employees do not use ICT solutions during their working activities.

The lowly qualified working activity of young people with disabilities, in most European countries, depends on their low education levels and the inadequate vocational qualifications attained. The *eFESTO project* ([www.efestoproject.eu](http://www.efestoproject.eu)), funded by the "Lifelong Learning Programme - Leonardo Da Vinci -

Transfer of Innovation” in 2009, aims at reaching these objectives: devising an innovative learning environment for deaf learners useful to acquire more skills in managing and using electrical and electronic equipment in different application fields, such as biomedical, telecommunications, industrial and sustainable environment areas. The system will also deliver specific English courses for deaf learners, a very important competence to possess to access the labour market.

## **2. EFESTO ARCHITECTURE**

This system operatively provides access to real remote laboratories delivering different didactic activities focused on the use of electric and electronic equipment. In this way, an innovative distance education system will be created, including experimental activities aimed at teaching subjects related to Electric and Electronic Engineering.

The eFESTO project derives from the transfer of the innovative technological results of two previous Italian national projects, led by the University of Sannio: the La.Di.Re. and the PSELDA projects. Both are based on a distributed architecture that uses a centralized server hosting a Learning Management System (LMS). The latter provides a set of didactical and administrative tools and handles the client’s requests and responses. In particular, in the La.Di.Re. system, the LMS allows not only to track the user’s progress and performance throughout all types of training activities, but it also enables users to access remote real laboratory equipments delivering different didactic activities, just by using a common Web browser (Baccigalupi A., Borsic M., Carbone P., Daponte P., De Capua C., Ferrero A., Grimaldi D., Liccardo A., Locci N., Macii D., Muscas C., Peretto L., Petri D., Rapuano S., Riccio M., Salicone S., Stefani F., 2007; Daponte P., Rapuano S., Riccio M., Zoino F., 2007; Peretto L., Rapuano S., Riccio M., Bonatti D., 2008). As to the PSELDA project, its purpose is offering deaf students the possibility of remotely accessing - through a common Web browser - a software system endowed with a series of innovative and efficient e-learning tools, specifically designed for them.

As said before, eFESTO results from the merging of the La.Di.Re. and PSELDA environments, enriched with the extension of the system obtained. The LMS used in eFESTO is “Moodle”, which has some important features concerning cooperative work that are useful for the project general aims and considerably suited to the software structure, also for future needs. In fact, being a modular and open source platform, Moodle gives the possibility to change the structure according to specific needs. Owing to its modular and flexible structure, several modules have been modified in order to manage the remote experiments. Furthermore, a new module integrated in Moodle’s architecture, devoted to handling experimental tests, has been developed *ex-novo*.

The didactic contents proposed in the eFESTO project are related to scientific subjects, English and laboratory activities. The former (i.e. the activities related to scientific subjects and English) are stored in a database accessed by the LMS. Such contents will be organized into learning objects following the standard format for e-learning content in order to grant interoperability and reusability in different LMSs. Moreover, a new didactic methodology has been devised to better support the learning process of those users who could be affected by cognitive and language disabilities.

The laboratory activities, instead, allow deaf and hard-of-hearing students and workers to access a remote and geographically distributed didactic laboratory, through a Web-based multi-tier distributed architecture centered on the LMS, that can be considered as the core component of the overall system. The module designed to manage the remote laboratory is based on a scheduling system, that manages the catalogue of available electrical apparatuses, and re-directs the user’s requests to the real laboratory involved, chosen among the partner laboratories, in which the required apparatus is currently available. Furthermore, it enables the user to control the electrical apparatus through the LabVIEW software environment without requiring the client to install it (Rinaldo N., Rapuano S., Riccio M., Zimeo E., 2005).

## **3. EFESTO METHODOLOGY**

The methodological approach underlying the making of the eFESTO teaching contents takes into account the special educational needs and communicative modalities of deaf people. It thus focuses on three basic elements in the education of the deaf (King C.M. & Quigley, S.P., 1985; Volterra V., 1994; Domagala-Zysk E., 2004; Janáková D., 2002; Stokoe W.C., 2001):

1. deaf people are the end users of the eFESTO project; therefore, the first criterion used considers the communicative difficulties that the deaf typically face in a hearing society as well as the complex acquisition process of correct language competences that characterizes the educational actions addressed to these students;

2. using suitable technological solutions in order to devise efficient e-learning activities inevitably impacts, on a methodological level, both the process architecture and the shape of the products to be planned;

3. the peculiarity of each type of subject contents to be devised forcefully leads to the choice of a specific methodology, in compliance with the structure of the subjects chosen. The three elements described above have played the role of guidelines in shaping the methodology adopted by the eFESTO project. This applies not only to the didactic choices made, but also to the communicative choices underlying the content presentation and organization as well as each stage in the platform development.

The subject contents to be devised for the eFESTO project have been selected on the basis of the structural and vehicular values of the subject areas they relate to. As already specified, the focus will be particularly centered on English, scientific subjects (Maths and Information Technology), and the use of lab advanced electronic equipment. For each of them some basic criteria have been fixed as reference points: the choice of the most appropriate didactic methodology; the modality of the contents presentation; the competence levels required in the learning process.

It is worth pointing out that each content will be translated in the national language of every country participating in the project. This means that whenever the user sees the expression “national language” in a content tab, there will be a complete translation of that specific content in all the languages of the partner countries. Besides being translated in national sign language, contents will be also accompanied by a video translation in international sign language. The latter is optional as the user can decide to watch it or not; the aim of this facility is to give the deaf an occasion to know the development of the international signs, originating from reference to signs in BSL (British Sign Language) and ASL (American Sign Language). For each subject a set of reinforcement activities will also be offered as a support to the comprehension of the topics explained. The national sign language translation will be synchronized with the written text, that will be highlighted by changing its colour as the video is being played. Synchronization is made on the basis of single sentences and not of single words, because of the well-known reasons of structural, lexical and grammar differences between sign and vocal languages.

As to the teaching of scientific subjects, users will benefit from a glossary of scientific terms too, aiming at giving the deaf an explanation, in both spoken and signed national languages, of the most frequently used terms.

Lab activities, instead, are presented through three stages: 1. the text of the subject content supporting the understanding of the lab exercises and translated in English to favour the sharing of information; 2. the video-tutorial recorded by the teacher in the lab (accompanied by synchronized subtitles), illustrating the use of the equipment and the experiment modalities; 3. the experiments themselves to be done remotely.

### **3.1 Applying the eFESTO methodology to the subjects involved**

#### **3.1.1 English language teaching**

The European standards fixed by the CEFR (Common European Framework of Reference) will be used as a reference point for the teaching of the English language. The objectives of the English language activities are to know and acquire a basic competence in English.

Here follows an explanation of the structure designed for the activities taken into account. The **text** will be written in English for reading, analysis and comprehension activities and it will be associated to a video containing the **translation in international sign language** to reinforce the understanding of the written text (this video will be a default support to the content). The text in written English will be accompanied both by the **translation in the national and international sign languages**; the aim of this facility is to provide the deaf with a tool and an occasion to know, in a similar language context, the development of the international

Signs. The video of the international Sign language translation is optional as the user can decide to watch it or not. In this case, the national Sign language will be synchronized with the English written text, that will be highlighted by changing its colour as the video is being played. As explained before, synchronization is made on the basis of single sentences and not of single words because of the structural, lexical and grammar differences between the two languages. An **audio track** of the English written text will be offered to all deaf users (specifically, to the deaf who have a certain hearing capacity thanks to either a prosthesis or to a cochlear implant). This content as well is optional and can be activated through a specific button. From the text window it will be possible to click on a scroll bar listing the **grammar rules** contained in the written text. These rules will be explained in written national language and accompanied by some reinforcement activities.

### 3.1.2 Teaching of scientific subjects (Maths and Information Technology)

The didactic methodology used to teach scientific subject contents will be supported by the following elements:

- a **text** written in national language, describing the subject content;
- the **English translation of the written texts**, allowing to share the didactic activities among the members of the eFESTO project;
- an optional **video translation in national sign language** associated to the written text;
- the text and the national sign language translation will be **synchronized**, which means that the text colour will change as the sign language translation moves on;
- an optional **video translation in international sign language** associated to the text along with translation in national sign language to provide all the deaf from the participating countries with a common vehicular reference;
- a **glossary of scientific terms** will be created in order to provide the deaf with an explanation in national language (both spoken and signed) for the terms most frequently used in the lectures and not widely used in common language;
- a set of **exercises** will be prepared for each subject content as a support to the comprehension of the topics explained.

### 3.1.3 Lab activities

As to the lab activities, the main subject content consists of three different and sequential stages (the subject contents supporting the understanding of the lab exercises; the video-tutorial recorded by the teacher in the lab, illustrating the use of the equipment, the modalities of the experiment; the experiment themselves to be carried out remotely).

For each stage and subject content the suggested methodology contains:

- a **text and a related translation in national sign language**: theoretical contents will be written in national language and visually illustrated by the national sign language translation;
- an **English translation of the written texts**, to facilitate the sharing of the didactic proposals on the platform among all members of the eFESTO project;
- a **tutorial**, consisting in the video of the lecture given by the teacher in the lab and explaining in detail how to use the equipment, how they connect to each other and how the experiments associated with them are to be done;
- a recorded **translation** of the tutorial **in national sign language** to better understand the lecture;
- **subtitles in national language** that refer to the spoken tutorial and, therefore, to the spoken lesson;
- subtitles will be **synchronized** with the national sign language;
- the text in the national language will be translated also in **international sign language**. This optional facility aims at creating a common reference for all the deaf from the countries involved in the project.

## 4. CONCLUSION

Exploring and devising new teaching methods, through the mediation and support of technology, can help make the exchange of information and communication easier for hearing-impaired students while they are studying, which seems to be one of the basic conditions for them to enjoy a higher education as their hearing peers. ICT can be successfully used to enhance the potentialities of deaf learners by devising specific e-learning environments capable of helping them bridge the communication gap they are often forced to struggle with and that can prevent them from fully participate in the world they live in.

The availability of technology today has affected education too, and it can prove to be particularly relevant to enhance the inclusion of deaf and hard-of-hearing people by improving and/or devising new teaching modes and methods. In particular, the relevance of technology lies in its ability to: help improve communication; help reduce dependence on others; translate spoken words into visual cues.

New technologies can indeed broaden the communication opportunities of deaf and hard-of-hearing people and provide opportunities for distance learning and communication with the world outside the classroom. This is exactly the aim pursued by eFESTO: paving the way to deaf people's e-inclusion in the technologically advanced modern society.

## REFERENCES

[www.efestoproject.eu](http://www.efestoproject.eu)

### Books

King C.M. & Quigley, S.P., 1985. *Reading and Deafness*, College-Hill Press, San Diego (CA).

Volterra V., 1994. *Linguaggio e sordità. Parole e segni nell'educazione dei sordi*, Firenze, La Nuova Italia Editrice.

### Journals

Baccigalupi A., Borsic M., Carbone P., Daponte P., De Capua C., Ferrero A., Grimaldi D., Liccardo A., Locci N., Macii D., Muscas C., Peretto L., Petri D., Rapuano S., Riccio M., Salicone S., Stefani F., 2007. "Remote didactic laboratory "G. Savastano": the Italian experience for the e-learning at the technical universities in the field of the electrical and electronic measurements: architecture and optimization of the communication performance based on thin client technology". *IEEE Transactions on Instrumentation and Measurement*, vol. 56, No.4, ago. 2007, pp.1124-1134.

Baccigalupi A., Borsic M., Carbone P., Daponte P., De Capua C., Ferrero A., Grimaldi D., Liccardo A., Locci N., Macii D., Muscas C., Peretto L., Petri D., Rapuano S., Riccio M., Salicone S., Stefani F., 2007. "Remote Didactic Laboratory "G. Savastano": the Italian experience for the e-learning at the technical universities in the field of the electrical and electronic measurements: overview on didactic experiments". *IEEE Transactions on Instrumentation and Measurement*, vol. 56, No.4, ago. 2007, pp.1135-1147.

Domagala-Zyśk E., 2004. "Teaching the Deaf English as a Foreign Language - Polish Experiences", Catholic University of Lublin, Poland.

Janáková D., 2002. "On Improving Study Conditions of the Deaf", *The Unie Journal* 11 - 12/2002, 17.

Stokoe W.C., 2001. "The Study and Use of Sign Language", *Sign Language Studies - Volume 1*, Number 4, Summer 2001, Washington, [Gallaudet University Press](http://www.gallaudet.edu).

2001. "Teaching Students who are Hard of Hearing", Henderson State University, The Disability Resource Center, Faust, August 2001.

### Conference papers or contributed volumes

Beck K. and Ralph J., 1994. "Patterns Generate Architectures". *Proceedings of the European Conference of Object-Oriented Programming*, Bologna, Italy, pp. 139-149.

Daponte P., Rapuano S., Riccio M., Zoino F., 2007. "Remote didactic laboratory in electronic measurements: quality of system testing". *Proceedings of the IEEE IMTC 2007 convention (on CD)*, Warsaw, 1-3 May 2007.

Peretto L., Rapuano S., Riccio M., Bonatti D., 2008. "Distance learning of electronic measurements by means of measurement set-up models". *Measurement*, vol. 41, No.3, Mar. 2008, pp. 274-283.

Rinaldo N., Rapuano S., Riccio M., Zimeo E., 2005. "A thin-client approach for distance learning of measurement instrumentation". *Proceedings of the IASTED International Conference on Web-Based Education 2005*, Grindelwald, Switzerland, 21-23 Feb. 2005, pp. 649-654.