



**Minimally Invasive Surgical pedagogical model
based on video Technology Enhanced - MISTELA**

Progress

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Project information

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Executive Summary

Minimally Invasive Surgery (MIS) has become the preferred alternative to open surgery. In many cases, it is due to multiple benefits that MIS offers to patients and health systems. However, acquiring surgical competence in MIS remains a challenge, since most of the existing training methods do not take into account the broad range of required skills. Besides, current surgical residency programs in Europe are **not globally standardized**, which leads to **confusion when comparing expertise** of surgeons from different regions. Therefore, various surgical organizations (including the European Association for Endoscopic Surgery and other interventional techniques (EAES)) are calling for standardization of training and assessment methods to be employed at different moments of a surgical career.

Since little is known on **what characteristics define a prepared surgeon**, there is a **lack of pedagogical frameworks** and assessment methods to train and evaluate competence of a surgeon. Although there are a number of assessment methods that have been standardized, none of them assesses **a complete proficiency** of a surgeon. As a consequence, it is quite challenging to determine whether a surgeon is a good MIS surgeon.

MISTELA's aim is to develop the fundamentals for an European MIS pedagogical framework. In particular, the framework proposes the use of Technology Enhanced Learning (TEL) as a way to standardize and support cognitive/theoretical skills training across the EU, facilitating knowledge exchange and communication between surgeons throughout the continent.



Furthermore, MISTELA aims to develop both a pedagogical model based on above mentioned framework and a tool (TEL environment) to support the pedagogical framework, and to validate both of them.

The project has already reached its half way stage. To this point, we have consolidated the project mission, its approach and scope. For that, we have distributed questionnaires and organized interviews with end users. Moreover, we have carried out an exhaustive literature review in order to gain information of current practice, medical needs and levels of knowledge. As a result, a number of project deliverables have already been produced, namely the “Clinical requirements for MIS learning model” and the “Proficiency based

criteria for the MIS learning model” reports as well as the functional and technical specifications of the TEL environment that will support the learning process.

Our current and future work heads towards the definition of a pedagogical framework to be used in MISTELA, developing pedagogical model and the TEL environment in order to get the final validation and feedback from EU MIS community.

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1. Project Objectives

Minimally Invasive Surgery (MIS) is becoming more and more relevant in the World Medical Community due to its numerous benefits: small incisions, fewer stitches, shorter hospital stays and faster recovery. Despite its great potential and advantages, there is still lack of homogenisation in Europe when it comes to standardizing training and assessment processes. As such, MISTELA aims to establish a joint initiative in the development of the fundamentals for an EU MIS pedagogical framework. In particular, it proposes the use of TEL as a way to standardize and support cognitive/theoretical skills training across the EU.

To fulfil the goal of developing a standardized framework that complies with current European training methods, the framework should:

- enable formal, regulated learning standards,
- support non-formal learning, and
- facilitate informal learning.

Unifying MIS pedagogical framework within Europe will facilitate, among others, knowledge exchange and professionals' mobility within the EU. It will also help to recognize qualifications of the surgeons from different regions.

MISTELA's consortium is, therefore, working on the definitions of the curricular training needs, objectives and means to that end.

The project is addressing three main objectives:

- **O1. Research and development of a new European MIS pedagogical framework**

In order to tackle the implementation of an EU surgical pedagogical framework, theories for adult learning are being taken into consideration. These theories include (1) conceptualizing learning as a social practice (including case and scenario based learning, collaborative learning or social constructionism), (2) cognitive theories, (3) stressing task-oriented, and (4) self-directed learning, such as constructivism or experiential learning.

To sustain a proper development of the pedagogical framework, a thorough review of the literature has been made in order to find suitable learning theories. Search criteria were chosen such that retrieved publications conceived information on **learning as a social practice**, explaining the **role of technology in them** and establishing **accreditation criteria** defining different degrees of knowledge and competence. Additionally, questionnaires were distributed and a series of interviews were carried out with expert surgeons and surgical educators to capture the requirements of what the framework should feature.

The knowledge obtained during this first stage has led us to cover the first milestones in the definition of the framework. An additional study in learning theories is being used to develop foundations for the framework. Moreover, the necessary learning outcomes related to cognitive/theoretical skills have been established, in the form of proficiency-based criteria, and an assessment model is being developed in compliance with them.

In order to validate the framework, the final task will be to build a model based on it and to implement the model within an actual TEL solution.

- **O2. Implement an ICT environment inspired in TEL solutions that support the proposed surgical model**

The second objective is being targeted in compliance with the specifications provided by the pedagogical researchers. The environment will provide a collaborative context for MIS initial training and lifelong learning, based primarily on shareable, community-developed surgical video repositories, in addition to other context relevant data and information from MIS. It will be flexible enough to accommodate diverse training initiatives.

The MISTELA TEL solution will respond to the growing amount of information and contents in the field, mainly MIS video records. Within the TEL environment, users will be allowed to access multimedia didactic contents and will have the possibility to contribute with new ideas and new edited content using an authoring tool available for use by the community in order to support the creation of new didactic contents for surgical education. In this way, a large digital library of MIS techniques will be accessible and will become a training reference in this area.

A Media Asset Management (MAM¹) system will be used to support efficient management of data repositories and MIS video libraries. It will have a modular architecture based on efficient Community, Collaboration and Content management. It will also contain processed media information and descriptors extracted for contents' reusable purposes.

The user interface (UI) will follow accepted principles on interface design (usability, functionality and accessibility). It will be sensitive to the users' method of access and security rights. An iterative implementation process will be carried out in order to comply with user-centered design principles.

- **O3. Validate the pedagogical model and the TEL solution**

In order to prove the usefulness of the results achieved, validation is required. A complete study with surgeons will be carried out to evaluate MISTELA's pedagogical model and TEL environment.

This new TEL environment will be backed by an international, multidisciplinary consortium with experience in learning theories, MIS training and ICT. It will

¹ Formerly known as the Content Management System (CMS)

serve as an implementation for MISTELA's pedagogical model, and a practical channel towards its validation.

2. Project Approach

Over the last decades, MIS has been proved to be a safer and less traumatic approach for patients than open surgery. The rapid evolution of MIS technologies and procedures, with their new concepts and skills, often counterintuitive, raises further demands for initial and lifelong surgical training.

In aviation, standard training and assessment requirements are used for testing pilot aptitudes. They are also used to cover initial appointment, progression from one grade to another, transfer between different types of aircrafts, and continuous competence assurance.

For surgery, standards still remain to be developed to:

1. **select candidates** to become surgical trainees,
2. **select residents** that are ready to move to the next training level,
3. **select surgeons** to perform specific surgeries, and
4. **perform continuous competence assessment.**

The skills involved in MIS require a demanding training period for surgeons, which must be accommodated to the limited time and available resources. Moreover, the training programmes **must ensure** that **only valid professionals are accredited** to perform MIS procedures on patients.

Technological advances help drive this new model in two ways:

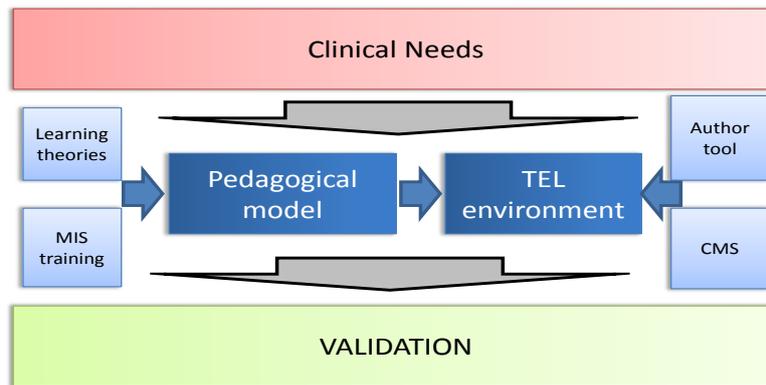
- by improving cognitive skills (through e-learning sites, multimedia material, etc.), and
- by improving motor skills (instruments' tracking, virtual reality simulators, etc.)

Nevertheless, **there is no European consensus** on a MIS learning framework and it is up to national/regional agencies to establish the criteria or, at the least, guidelines for accreditation.

The project's main ambition is to establish and facilitate a joint initiative in the development of the fundamentals for an EU MIS pedagogical framework. It should **comply with the specific learning needs of surgical professionals** in order to enhance their competence in MIS skills.

This particular project orientation was selected due to its current importance in the field of MIS education. While research in MIS has focused on the development of training tools and systems (e-learning sites, virtual simulators, etc.), their application has been localized, dispersed and based on different criteria.

To centralize and unify these criteria, the approach established at the beginning of the project and maintained along the past year has been the following:



1. Understand what the **clinical needs** are. This insight has been provided by the clinical and technological experts within the countries that conform the consortium, and has been the basis to define the outcomes of the project.
2. Start working on the final **project outcomes**:
 - a. **Pedagogical MIS training model**: the clinical and pedagogical partners have provided the necessary foundations for developing a European MIS training framework. Obtained knowledge has been further complemented with both a thoughtful literature review compiling current trends and interviews with end users. Based on all gathered information, the corresponding deliverables have been proposed and currently work is being carried out in the development of the framework.
 - b. **TEL environment**: After the first year, the functional and nonfunctional requirements and the technical specifications have already been established. Work is now being carried out towards the implementation of the solution.
3. Validate the outcomes: As established in the MISTELA working plan, validation of the MISTELA pedagogical framework and the TEL environment will be carried out with subjective and objective measurements during the second year of the project.

3. Project Outcomes & Results

The main expected outcomes of the project are:

- **Pedagogical framework:** A pedagogical framework will be delivered for MIS cognitive skills training using TEL solutions. Moreover, a MIS learning model will be proposed based on it to support it and validate it., making interfaces independent of the underlying hardware, operating system or language.
- **TEL environment:** A TEL solution will be provided supporting the MIS learning model. The solution will heavily rely upon the efficient use of existing video repositories to create and share didactic contents. It will be structured in three different parts: (1) the authoring tool for content creation; (2) the media asset management for content storage and retrieval and (3) the TEL environment for content playback and other assessment functionalities.
- **Validation:** The proposed pedagogical framework will be validated with end users (MIS surgeons and residents) by means of the TEL environment supporting the MIS learning model

The TEL environment will be validated using objective and subjective metrics. Usability validation will be done by web analytics methods, eye-tracking and checklists. Content validation will be performed by questionnaire-based methods and Internet contents' quality measurements. Functionality validation will be done by checklists, questionnaires and a benchmarking process.

During the first period of the project, an intense work has been done in order to develop both the pedagogical model and the TEL environment to support the designed training. Validation of the outcomes will take place in the second period of the project.

Though final outcomes are not available yet, several intermediate results have already been obtained. These will be used to guide the consortium towards meeting the final goals and their validation.



So far the project's outcomes are:

- literature review of available learning theories,
- clinical needs compendium gathered from over 300 publications and 16 interviews with professionals, and
- the functional and technical specifications of the TEL environment that will support the learning process.

Partners are well aware that a successful exploitation of the MISTELA's outcomes depends on their acceptance by the MIS community. The dissemination activities are, therefore, of great importance and are carried out mostly by the partners who already have established contacts with organizations, institutes and/or medical centers in the MIS field. Validation of the outcomes will have an indirect impact in raising public participation and awareness in the three countries the evaluation takes place (Spain, the Netherlands and Norway). This indirect impact will be further strengthened by addressing target audiences in Europe through presentations, publications in relevant research, professional journals, and mass media.

To this end, dissemination material has been developed and is being distributed to the end users through the partners' daily activities, during the conferences and via the project webpage (www.mistelaproject.com).



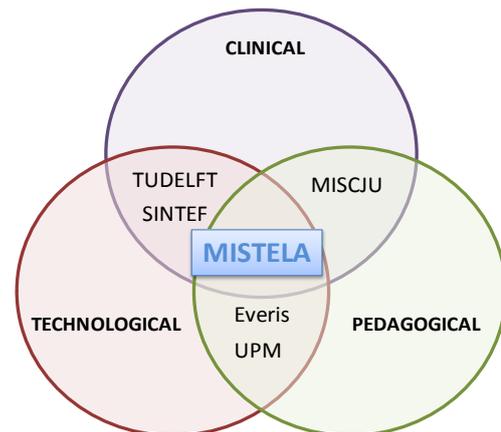
In terms of specific deliverables originated during MISTELA project, the following outcomes have been reached for five work packages:

Work package	Deliverable
WP1 Management	D1.1. Coordination Manual
	D1.2. Internal Document Repository
	D1.3. Mailing List
	D1.4. First Progress Report
WP2 Quality Actions	D2.1. Quality Plan
WP3 Design of MIS learning model	D3.1. Clinical Requirements for MIS Learning Model
	D3.3. Proficiency-based Criteria for the MIS Learning Model
WP4 Functional Analysis and Technical Design	D4.1. Functional Analysis
	D4.2. Specification of Architecture of the TEL Environment
	D4.3. Software Development Definition
WP7 Dissemination	D7.1. Project Presentation and Press Release
	D7.2. Dissemination Plan

4. Partnerships

The project's approach benefits the diverse members of the consortium in several ways according to their institutional roles. Partners with a clinical profile profit from their shared knowledge and the output of the project – a common MIS pedagogical framework that they will be able to apply in their training programmes. Partners with technological profile, on the other hand, explore new application fields related to MIS learning either for research or commercial purposes.

To this end, a consortium was sought in order to cover required **clinical, pedagogical and technological** expertise. With the longstanding collaboration in MIS education, such as the SINERGIA and TELMA projects, **Universidad Politécnica de Madrid (UPM)** and **Jesús Usón Minimally Invasive Surgery Center (JUMISC)** established the main guidelines to follow in the project, along with the pedagogical and consultant expertise of **everis consultancy Ltd. (EVR)**. Two other partners were invited based on their prestigious international recognition and experience in MIS training: **SINTEF** with its clinical and educational experience from the St. Olav's hospital and the National Centre for Advanced Laparoscopic Surgery; and **Delft University of Technology (TUDELFT)** with its technical experience in MIS training systems and the partnership with the Leiden University Medical Centre.



The five partners and their contributions to the MISTELA project are listed below:

- **UPM** (www.gbt.tfo.upm.es): GBT-UPM has a consolidated experience in biomedical engineering and telemedicine research in MIS. It has been in charge of the scientific coordination of projects such as SINERGIA (development of a VR simulator for MIS training) and TELMA (TEL-based cognitive skills training). With its ICT background, UPM is involved in both the definition of the pedagogical framework and the development of the ICT authoring tools for content creation and edition. It is at the same time the Scientific Coordinator of the project, and one of the main links between technological and clinical partners.
- **JUMISC** (www.ccmijesususon.com): With its more than 20 years of experience in MIS surgical training and research, JUMISC plays an important role on the formative aspects of the project, acting as one of the clinical partners in charge of the definition of MIS pedagogical models endowing with the Spanish pedagogical expertise. JUMISC is also an important provider of surgical didactic contents. Moreover, it will lead the clinical validation (O3).
- **EVR** (www.everis.com): Everis has a wide experience in the management of international projects. As the main company in the consortium, EVR consultant's experience is determining in the financial and management aspects of the project. EVR is also involved in defining the pedagogical framework offering its wider experience in e-learning training processes and

tools and developing the e-learning environment. More precisely, EVR will provide the media asset management system as well as important manpower on the development of the TEL environment.

- **SINTEF** (www.sintef.no): One of SINTEF's main research expertise in MIS is the design, development and validation of new training methods. Its close collaboration with St. Olav's hospital and active role in the development of a Norwegian accreditation scheme defines their clinical role within the project. SINTEF's main objective in MISTELA is to lead and coordinate tasks for the definition of MIS learning. Moreover, SINTEF will provide the necessary surgical didactic contents to the TEL environment and participate in the validation process.
- **TUDELFT** (<http://www.misit.nl>): One of the most important European research groups in technology applied to MIS (especially surgical skills' training), MISIT-TUDELFT is responsible, amongst others, for validation of the VR simulator SIMENDO or the development and validation of the TrEndo tracking system. TUDELFT's experience and collaboration with the Leiden University Medical Centre will help to consolidate the project's clinical and pedagogical board contributing with the Dutch pedagogical expertise; while its technological background will give support to the ICT aspects of MISTELA.

With the aim of developing a common pedagogical framework for MIS training, the consortium, as shown, was constituted with a wide territorial reach across Europe including countries from the south (Spain), centre (the Netherlands and United Kingdom) and the north (Norway) of Europe.

5. PLANS FOR THE FUTURE

Once the project is finished, MISTELA will provide (1) a MIS pedagogical framework, and (2) a TEL environment for MIS skills' learning that supports a model based on above mentioned framework.

This TEL environment will be made available to surgeons across Europe. Moreover, clinical partners will be able to include the MISTELA's tools into their formative programmes. By this, it will be possible to disseminate, consolidate, and exploit MISTELA's tools.

Two main assets of the MISTELA's TEL environment are:

- creation and access to new multimedia didactic contents, and
- communication channels with other surgical professionals.

The possibility of using an ad-hoc authoring tool will give an extra didactic value to digital objects based on surgical videos and sound pedagogical methods.

The exploitation plans of the project are, however, not restricted to the local area of influence of each partner. During various workshops and exhibitions, the consortium intends to make several demonstrations of the tool showing its potential application to various medical centers, research institutions, public health care systems, and other groups of interest.



MISTELA's consortium has started to define the plan for using and disseminating knowledge that will define the tasks and activities to achieve the dissemination objectives. Such goals will include the presentation of results in associated hospitals in order to increase the number of surgeons who are aware of the MISTELA pedagogical framework and its model-supported TEL environment.

The project's ultimate objective is to make the MISTELA tool attractive and immediately viable. The achievement of this objective requires a difficult process of analysis and planning, which will guide the consortium to the most successful strategic choice.

After the conclusion of the project, the creation of an organizational/legal solution is appointed to develop a plan to launch the product on the market immediately. The objective of the exploitation tasks within the project (starting on the second year) will be to explore alternative solutions in order to choose the most suitable one regarding the characteristics of the partnership and the commercial objectives, making the

necessary preparations to enable the project to transform the idea into a commercial reality.

6. Contribution to EU policies

The lack of a common EU surgical training theory leads to the existence of **multiple local MIS learning programmes** with different accreditation standards if any. This makes it difficult for surgeons to work within the different countries of the European Union.

A new, common European framework for training and assessment of surgical proficiency would provide the means to tackle these issues. It will also have psychological benefit for patients who would be less unwilling to receive surgical treatment in another country than their own one.

In order to contribute to the development of the EU MIS pedagogical model, it is necessary to acquire and integrate the relevant expertise of several international institutions in the field of application. The combined knowledge of partners with clinical and formative experience will establish the foundations of this new training paradigm.

TEL-based solutions will have an important role within. These solutions, when supported by a validated training framework, will shorten surgical learning curves by offering ubiquitous and always available access. They will provide the means to create integrated training networks and will bring together MIS knowledge at an EU level.

The implementation of a TEL environment will enable surgeons to facilitate the transfer of specialized expertise and knowledge in MIS techniques. Moreover, it will implicitly help to disseminate and establish the proposed pedagogical framework, thus reinforcing and strengthening it.