

**Guidelines for Modernizing HEIs engineering and STEM studies curriculum**

**by**

**integrating new pedagogical and digital learning approaches**

| Project | UNITEL |
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| WP | WP1: Baseline Analysis |
| Deliverable | Del 1.2 Guidelines for modernizing HEIs engineering and STEM studies curriculum by integrating new pedagogical and digital learning approaches |
| Date | 20.4.2022 |
| Authors and Editors | Shahid Chamran University of Ahvaz (P10)  University of Turku (P2) |
| Dissemination Level | ☒ Institution  ☒ Local  ☒ Regional  ☒ National  ☒ International |
| Version | Ver 1.0 |

# Abstract

This report is tackling the identified developmental needs, gaps, and the aspects for curriculum modernization and harmonization through integration of contemporary ICT-based solutions, innovative pedagogical approaches, and tools. The aim is to support an expanded access to education and improvement the quality of teaching and training in line with the ECTS, Diploma Supplement, ET2020, and Modernization Agenda. The report is based on the documentary research, conducted surveys and interviews with the target groups (HEIs, business, and society; UNITEL project, State of art reports). It is also considering the expertise and best practices provided by the involved programme countries.

\*\* MAIN RESULTS WITH A COUPLE OF SENTENCES

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# Introduction

The aim is to support an expanded access to education and improvement the quality of teaching and training in line with the ECTS, Diploma Supplement, ET2020, and Modernization Agenda.

The report is based on the documentary research, conducted surveys and interviews with the target groups (HEIs, business, and society; UNITEL project, State of art reports). It is also considering the expertise and best practices provided by the involved programme countries.

\*\* A BIT MORE OF THE STATE OF ART REPORTS / DEL 1.1

# Curriculum planning

## Policies and guidelines in use for curriculum planning

In the institutional reports, some Iranian universities list internationalization and prioritization of labor market needs as strong policy recommendations for curriculum planning. Curricula needs to be adapted to the current and future needs of the engineering profession and those of the society at large. Institutional review and development of curricula is mentioned as a key process in education. Curriculum planning is seen as a method of promoting social responsibility and improving the university-business collaboration. Some universities invite stakeholders to review and share their foresight in curriculum planning. In some cases, the period of renewing curriculum can be quite lengthy, up to five years.

In Finland, e.g., curriculum is updated every two years. Universities collect feedback from graduates and their employers, and make the results visible in a national database for transparency. Results from these studies are followed-up and brought to attention of all stakeholders at the process of curriculum planning.

Guidelines: Creating a culture of university-business collaboration in curriculum planning needs investment from all parties. Better understanding of the benefits can create motivation for stakeholders. The industry can recruit better professionals with less need for updating and upskilling at the workplace. The educators can renew their own knowledge, skills and attitudes. Students feel more motivated in their studies and are assured that their competences enable them to find employment and be employable in the long term.

Recommendations:

* To renew and update curriculum, frequent meetings with stakeholders from the world of work is suggested.
* In IR report is was mentioned: Universities offices such as Industry relations and planning and academic supervision are responsible for identifying business and society needs.

=> At least in Finland it is sometimes a problem, that there are not enough links between different offices inside university. Should we recommend something about this?

## Curriculum planning in practice

In the surveys conducted with teachers in Iranian universities, teachers believed that TEL is fitting both hard and soft skills development of students. However, opinions in the case of hard skills were more scattered than in the case of soft skills. Furthermore, respondents saw that TEL does not fit uniformly to any skills development. Instructional videos, simulations and virtual or remote laboratories were seen as opportunities to include in the curricula modalities of learning that enhance the learning experience, and allow the students to learn engineering skills. In Finland, Italy and Portugal, where the universities use TEL extensively, no significant divide is seen between the different skills and how they lend themselves to learning online. In Iran, respondents to surveys saw that curricula should be revised and developed more in line with the online environment of HEIs.

Guideline: Digitalization of education needs to be brought to the process of curriculum review and development at institutional and national level. Working-life relevance and student engagement in practice development need to be addressed within the planning of curriculum, in addition to theoretical knowledge.

Recommendations:

* Vice-rectors in charge of education and educational development need to align curriculum planning processes with institutional and national strategies on digitalization of education.
* In planning curriculum, knowledge, skills and attitudes in a certain professional context need to be balanced, to allow both acquisition of theory and its application to practice.

# Designing and implementing a TEL course

## TEL as a practice in your institution

## Technology in use

## Course development process

According to the surveys for teachers, a majority of teachers have employed a set framework for their course development. Rationale for this development is a shared understanding on how TEL changes the roles of teachers and students in the educational process. Majority of teachers understood that their traditional role of transmitting knowledge to students had altered to one of directing and facilitating students' learning processes. Teachers also saw that TEL allowed students to better manage their learning. A strong motivation for improving TEL skills was visible in the teachers’ survey answers.

Guideline: Teacher professionalization in TEL can be supported with frameworks and models for course design. Design principles can be collected to organizational internet and intranet pages for ease of retrieval and sharing amongst colleagues. However, both general and specific pedagogical training is needed to ensure support for teachers' paradigm change from traditional to blended and online delivery of teaching and learning.

Recommendations:

* Pedagogical training to be organized, with a support of online learning materials on course design and teaching principles.

## Stakeholders involved and their roles and tasks

## Protocol of course assessment

In the UNI-Tel project baseline analysis, carried out with surveys to teachers and students, learning assessment was seen as an area of development. This could be seen both in diagnostic assessment, understanding the baseline of the students, as well as in summative assessment, in evaluating meeting the intended learning outcomes of the course. Teachers reported transition to TEL during the pandemic resulting in an unclear picture of the individual interests and abilities of the students. Students reported that the assessment methods in use haven not been able to capture the entire spectrum of their learning.

Guideline: Technology-enhanced learning (TEL) encompasses a variety of learning affordances, with teaching, instruction and use of educational resources. Learning assessment can be used in the beginning, during and at the end of the course. Hence, course assessment should employ a variety of methods to assist diagnostic, formative and summative learning assessment.

Recommendation:

* Student self-regulation should be enhanced by introducing self-evaluation of interests and abilities in the beginning of the course, with a follow-up at the end of the course.
* Fit-for purpose learning assessment methods need to be designed for TEL, with a broad perspective of student learning and engagement.
* Utilization of evaluation results: A lot of information is gathered, but is it used? Should we recommend something?
* Identification of TEL /online quality practices or patterns of quality

## Process of continuous improving of educational provision

## Professional development of teachers and instructional designers

# Industry relevance

## Policy and action plan for industry-relevance

## Infrastructure

## Assessment of learning

## Functionalities of the technical infrastructure

## Use of virtual and remote laboratories

## TEL quality practices and support

### Staff professionalization

## Adoption of TEL practices

Is this national level of guidelines also a UNITEL-theme?

# National Policies and guidelines

## TEL practices in Higher Education

## Approaches and Methods for Quality Assurance

## Mission statement and strategy of the National Evaluation and Accreditation Agency

## Future National Policies practices, efforts, initiatives, frameworks that relate to TEL quality

## Needs for National Policies practices, efforts, initiatives, frameworks that relate to TEL quality

Experiences from Finland on national level educational development speak for a strong commitment from rectors and vice rectors in setting the stage for exchange of good practices between higher education institutions. Rectors’ council networks or faculty-level committees can give direction and importance to pedagogical development, enabling staff in HEIs to understand the need for continuous development of quality in education. Participation in national-level policy programmes from institutions can be reviewed and promoted by the rectors, within the autonomy of HEIs.

Guidelines: Peer-to-peer exchange of good practices need to be promoted by university top leadership. Rector-level support to educational development enhances alignment between institutional strategies and application to policies and practices in use at institutional level.

Recommendations:

* A national network to be established under governance of vice-rectors in charge of education and educational development.
* Exchange of good practices to be facilitated with frequent meetings between practitioners on a national level.

## Training for TEL Quality