



**Modernization and Internationalisation of Iranian HEIs via collaborative TEL-based curriculum development in engineering and STEM**

## **GUIDELINES FOR RESEARCH**

# **STATE OF THE ART OF HE FOR TEL**



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UNITEL WP1  
Guidelines for Researching the State of the Art of HEIs in  
Engineering and STEM studies for TEL

**1.4. Addendum for Skills and competences of the Universities' lecturers in line with the digital education era**

Project	UNITEL
WP	WP1: Baseline Analysis
WP Activity	<p>1.1. Analysis and synthesis of data - State of the Art of HEIs in Engineering and STEM studies (Institutional level)</p> <p>1.2. Analysis and synthesis of data - State of the Art of HEIs in Engineering and STEM studies (National level)</p> <p>1.3. Analysis and synthesis of data - State of the Art of HEIs in Engineering and STEM studies at EU level</p> <p><b>1.4. Addendum for Skills and competences of the Universities' lecturers in line with the digital education era</b></p> <p>1.5. Comparative analysis of state of the art in PC and EU for harmonization of curriculum development purposes</p> <p>1.6. Preparation of Guidelines with recommendations about current practices in partner countries for curricula modernization</p> <p>1.7. Roadmap on industry-relevant Skills and competences</p>
Date	April 12, 2022
Authors and Editors	<p>University of Turku (P2), Timo Halttunen</p> <p>University of Marconi (P1), Monica Fasciani</p>
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## Methodology

Digitalization is one of the change drivers of our societies, incrementally changing the way we work and organize production of goods and services. In this change, digitalization becomes central also to the way we organize learning and teaching. Technology-enhanced learning (TEL) has been widely used by education providers and paving a way to this transformation. However, the COVID-19 pandemic rapidly accelerated the global transition to digitally mediated learning and teaching.

Examining the teacher and student experiences during this change process within the Iranian higher education system, this transition to online learning and teaching has been to a large extent a process of delivering synchronous teaching and offline content to students. Both students' and teachers' experiences call for systematic, pedagogically sound and technically manageable learning designs. One of the key challenges detected has been student motivation, which is a common concern when interaction is channeled as one-way communication, from teacher to student and back, with a lack of proper engagement between learners and with the digital material in the virtual learning platform.

In order to maintain a learning process that is free from the limitations of time and space, asynchronous learning modalities are suggested to be developed and integration of digital laboratories is encouraged. With the blended learning design teachers are also able to foster greater student self-regulation and engagement with digital content at their own pace. Furthermore, we acknowledge the need for development of more fit-for-purpose learning assessment methods.

In this Report, we propose a framework for teacher digital competences in Iranian universities using the European Framework for The Digital Competence of Educators DigCompEdu (Redecker, 2017), as a starting point. The Framework, or DigCompEdu in short, encompasses a large spectrum of competences in digital learning and teaching, making connections between the teachers and learners. With the Addendum, the UNI-Tel project aims to contribute to the DigCompEdu framework by contextualising the university teachers and students digital competence development within the professional domain of engineering and STEM. Hence, teachers' and students' digital competence are seen both inside and outside academia, through the perspective of lifelong and lifewide learning. In this perspective crucial aspects are conceptions of and approaches to a) facilitating development of industry-relevant soft skills, b) engineering skills development and c) university-business collaboration. By using the surveys and interviews conducted with teachers, students and business professionals, we contextualize the DigCompEdu framework to engineering and STEM subject domains and suggest teacher digital competence descriptions in three proficiency levels.

In the proficiency levels A1 and A2 the focus of attention is on the level of an experienced university teacher who is building awareness and interest towards greater integration of TEL in his or her teaching profession. In the proficiency levels B1 and B2 the focus is in the teacher to teacher collaboration in



department level, and active development of new pedagogies and practices in teacher-student interaction. In the levels C1 and C2 the focus is on faculty and university level, and in innovation and development of strategies for TEL in the organization. The mentioned proficiency levels form a loop of development in the sense that policies and practices designed by the experienced actors in proficiency levels C1 and C2 are introduced to newcomers, the users and in A1 and A2 level. The learning and teaching practice development initiated by newcomers is further enhanced by intermediate users in levels B1 and B2, and shared with peers for feedback, mutual modeling and co-creation. In the final stage of the process, teacher digital competences are strategically developed with the aim of creating a digital learning and teaching culture, with an explicit connection to the HE Quality assurance system.

In addition to the extensive data collection in the UNI-Tel project, the suggested Addendum framework is inspired by recent research on the adoption and use of online and blended learning in HEIs. Following the model of innovation adoption, Anthony et. al (2019) investigated the role of students, teachers and managers in embracing the use of online learning and blended learning modalities. Following the steps of awareness and exploration, early adoption, and mature adoption the researchers confirmed that teachers need to gradually broaden and share their use of online and blended learning pedagogies in their community, while engaging learners and colleagues to a culture of experimenting and sharing practices of digital learning. In order to facilitate learner engagement, and reduce drop out of education, Estrada-Molida and Fuentes-Cancell (2022) encourage use of individualized tutoring, interactivity and feedback in online learning. Manca et al. (2017) suggest that purposeful pedagogies in technology-enhanced learning help to increase student participation and engagement in the learning process and in their communities. New digital media may enable student empowerment, allowing them to take more participative roles in education, take responsibility for their learning and the learning of others, and support development of a collaborative learning environment. To conclude the brief review of scholarly articles on the topic, Serrano et. al (2019) confirms that evaluation of the effectiveness of various pedagogies and practices are needed in order to enhance both the learner and teacher experience in TEL, hence supporting the idea of a systematic follow-up system of pedagogies used in online and blended learning.



## Table of Competence Descriptors

Competence Descriptors of University Teachers TEL Skills in STEM subjects			
	DigCompEdu Proficiency Levels		
	<i>teacher personal level, student - teacher interaction</i>	<i>department level, teacher peer interaction</i>	<i>faculty and university level, organizational development</i>
<b>Educators' Digital competences by Area</b>	<b>A1 &amp; A2</b> <i>develops positive attitudes and interest in personal level, to</i>	<b>B1 &amp; B2</b> <i>participates actively in development of practices, to</i>	<b>C1 &amp; C2</b> <i>provides support for others and shares good practices, in order to:</i>
<b>Professional Engagement</b>	-develop awareness and make basic use of TEL for communication -use TEL for collaboration, engaging in basic use of TEL -identify and become aware of development needs in TEL update knowledge on TEL in personal level	-use TEL for effective and responsible communication, in a structured and responsive way -share and exchange practices with peers, -engage in collaborative knowledge construction -experiment and learn with peers to develop a repertoire of TEL practices -identify and explore continuous professional opportunities	-evaluate, discuss and re-design communication strategies, -reflect on and enhance innovative practices -collaboratively reflect, enhance and innovate pedagogic practice educational policies and practices -critically and strategically use TEL for continuous professional development, and provide support for peers
<b>Digital resources</b>	- awareness of basic digital resources for teaching and learning - basic selection of digital resources to use for improving	- select openly-licensed or create digital resources based on learning objectives and context - start co-creation / co-adjustment practices	<ul style="list-style-type: none"> <li>● use accuracy and quality criteria to assess the relevance and benefits of digital resources</li> </ul>



	<p>collaboration and students' engagement</p> <ul style="list-style-type: none"> <li>- sharing resources keeping in mind basic access rules and rights</li> </ul>	<p>with peers to develop digital resources repositories</p> <ul style="list-style-type: none"> <li>- knowledge of basic procedure to protect sensitive digital contents and share with peers</li> </ul>	<ul style="list-style-type: none"> <li>● integrate different levels of digital resources into common practices with colleagues</li> <li>● understand the use and creation of open licenses and open educational resources, including their proper attribution</li> </ul>
Teaching and learning	<ul style="list-style-type: none"> <li>- develop understanding of the use of digital tools in line with learning objects and content for instruction</li> <li>- expand the perspectives of teacher and learner roles in digital learning and teaching to foster collaborative and self-directed learning</li> <li>- broaden the view of learning environment to different contextual learning affordances</li> </ul>	<ul style="list-style-type: none"> <li>- integrate digital tools meaningfully to existing course offering to offer methodological variation and to engage students in collaborative and self-directed learning</li> <li>- develop pedagogic strategies to diversify use of digital tools in engineering and STEM contexts</li> <li>- integrate the use of digital tools into the learning process, involving both academia and professional contexts</li> </ul>	<ul style="list-style-type: none"> <li>- enhance engaged learning experience by developing strategies for teacher-led and learner-led digital activities and interaction</li> <li>- invite peers to experiment and develop strategies for varied use of digital tools in learning and teaching</li> <li>- innovate and share strategies to develop use of digital tools and learning environments that connect academia to professional domains</li> </ul>
Assessment	<ul style="list-style-type: none"> <li>- integrate digital assessment to traditional assessment methods</li> <li>- develop understanding on the use of digital tools for diagnostic, summative and formative</li> </ul>	<ul style="list-style-type: none"> <li>- select and develop meaningful and fit-for-purpose digital assessment methods in engineering and STEM</li> <li>- diversify digital assessment methods to enable student professional development, including</li> </ul>	<ul style="list-style-type: none"> <li>- innovate and share strategies for digital assessment that actively engage students in the learning process</li> <li>- create follow-up systems of digital student assessment data and develop educational process accordingly</li> </ul>



	assessment during the learning process	self-assessment and peer assessment	
<b>Empowering Learners</b>	<ul style="list-style-type: none"> <li>- develop understanding on digital tools to motivate and engage learners</li> <li>- select digital tools that support accessibility and inclusion in the learning process</li> <li>- develop approaches for active learning with appropriate digital tools</li> </ul>	<ul style="list-style-type: none"> <li>- develop pedagogies that enable learners to personalize their learning process , offering differentiated learning methods and content fit to the learning modality</li> <li>- select and develop strategies for learner engagement across the courses in engineering and STEM</li> </ul>	<ul style="list-style-type: none"> <li>- innovate and share strategies for accessibility and inclusion in the operational environment</li> <li>- invite peers to experiment and develop strategies for differentiation and p—ersonalization</li> <li>- innovate and share strategies for active learning</li> </ul>
<b>Facilitating Learners' Digital Competence</b>	<ul style="list-style-type: none"> <li>- incorporate aspects of digital and media literacy to encourage critical thinking and judgement in learners</li> <li>- encourage learners to develop digital communication strategies to interact productively with other learners, teachers, faculty members and external stakeholders</li> <li>- inform students on the guidelines on how copyright and licenses are applied on data, information and digital content</li> </ul>	<ul style="list-style-type: none"> <li>- develop and share digital pedagogies that consider and respect cultural and social diversity</li> <li>- develop pedagogical strategies for information and media literacy across the curricula</li> <li>- integrate use of digital content in guidelines for citation and referencing in academic work</li> <li>- integrate skills for giving and receiving feedback in digital platforms in the curricula</li> </ul>	<ul style="list-style-type: none"> <li>- develop and share strategies for digital communication and collaboration between academia and the professional domain</li> <li>- develop and share strategies for learner-centred digital content creation in learning and teaching</li> <li>- develop and share guidelines on how copyright and licenses are applied on data, information and digital content</li> </ul>
<b>Facilitating industry-relevant soft</b>	<ul style="list-style-type: none"> <li>- support development of basic skills in</li> </ul>	<ul style="list-style-type: none"> <li>- support development of intermediate skills in communication,</li> </ul>	<ul style="list-style-type: none"> <li>- support development of advanced skills in communication,</li> </ul>





skills / transferable skills development	communication, teamwork, adaptability, problem-solving, creativity, work-ethics, interpersonal skills, time management skills in classroom simulations	teamwork, adaptability, problem-solving, creativity, work-ethics, interpersonal skills, time management skills in projects, assignments, internships and other industry-related practices	teamwork, adaptability, problem-solving, creativity, work-ethics, interpersonal skills, time management skills in diverse, authentic work-life settings customary at the university
Facilitating engineering skills development	- develop working methods of integrating industry-relevance to education, in addition to carry out research in engineering practices	- connect theory with practice and application in education, and participate in development of pedagogical methods in faculty level	- advocate sharing of good practices and adoption of industry-relevant teaching practices in university level
Supporting curriculum development for university-business collaboration	- to create structures for use of alumni speakers in the university, company visits, joint Masters' thesis assignments at companies, project assignments, and job placements or internships in department level  - to develop positive attitudes for adopting necessary networking and entrepreneurial mindset for high-impact industrial engagement initiatives in department level	- to develop and streamline use of alumni speakers in the university, company visits, joint Masters' thesis assignments at companies, project assignments, and job placements or internships in faculty level  - to share and discuss ways of working for increased networking and entrepreneurial mindset for high-impact industrial engagement initiatives in faculty level	- to follow-up and evaluate use of alumni speakers in the university, company visits, joint Masters' thesis assignments at companies, project assignments, and job placements or internships in university level  - to develop collegial support for adopting necessary networking and entrepreneurial mindset for high-impact industrial engagement initiatives in university level



Template for competence description and descriptors of proficiency levels, in accordance to the DigCompEdu framework <https://ec.europa.eu/jrc/en/digcompedu>

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