Modernization and internationalization of Iranian HEIs via collaboration in TEL-based curriculum development in engineering and STEM

GUIDELINES FOR MODERNIZING HEIS ENGINEERING AND STEM STUDIES CURRICULUM BY INTEGRATING NEW PEDAGOGICAL AND DIGITAL LEARNING APPROACHES

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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 improve 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 program countries. The report also tries to present guidelines and recommendations on the various aspects of TEL in Iran and Eu universities partners. According to the findings Iranian Universities and Eu universities partners have no similar status in TEL. although many Iranian universities have e-learning facilities and structure but have no long background in TEL and mainly they implemented or enhanced their e-learning during covid 19. In contrast, some of the Eu universities' partners are specifically virtual universities. Iranian universities consider TEL courses as traditional and face-to-face teaching thus, they follow the same strategy for TEL courses. It is needed to reconsider TEL courses and include them in the university's strategic plan. Some guidelines and recommendations are presented in this report.

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 program countries. Design, develop and implement TEL courses need consider several components. This report covers almost all components of TEL courses. Such components included existing practices for curriculum planning, designing and implementing and a TEL course, industry relevance, TEL quality practices and support, and opportunities and challenges for adoption of TEL practices. for each one, guidelines and recommendations are presented.

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 and curriculum committees are suggested.

- In IR report 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.

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

According to the survey Iranian teachers believe TEL is part of the university's strategy, the majority of professors take part in short-term seminars or specific workshops to enhance their skills in designing TEL-based courses. EU partner universities also emphasize on TEL strategies.

Guideline: TEL needs to be as a practice at institutional and national level. The institutions put the TEL as a practice priority. TEL needs to be addressed within the planning of the curriculum and department's action plan in addition to training workshops and seminars.

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.

Technology in use

According to the survey, in Iran, platforms such as Adobe Connect, Big Blue Button and Skyroom are used for online and synchronous communication, and usually Moodle is used for asynchronous communication and uploading files. In contrast, EU partner universities use a wide range of platforms and tools. USGM uses (SHARING, CO-BROWSING, WHITE-BOARD, SURVEY, RECORDING) which represents a wider range of tools and platforms available. In UAB University, a customized version of Moodle is also used, and Web 2 and related tools such as LimeSurvey, Zoom, Power BI, NVivo, SPSS, LaTeX, Urkund, H5P plugins are used.

Guideline: Lessons and courses can be created using interactive platforms and tools, in which simultaneous classes can be held easily. It is also possible to use platforms to upload all kinds of files. It seems that there are many differences in the use of these platforms and tools among universities.

Recommendations:

It is suggested that in Iranian universities, the use of more powerful and interactive tools in institutions and universities, such as partner universities of the European Union, should be put on the agenda to enable collaborative and interactive learning online.

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

In Iranian universities, course design is mainly done from top to bottom, and after preparing and implementing the course, based on the feedback received from the students, the course is modified and redesigned, but in partner universities of the European Union, in addition to receiving feedback from the students after the implementation of the course, by using the presence of the representative in various bodies: such as the curriculum council, the educational council, the general meetings of the groups, the program advisory committee, the faculty committee and by providing feedback on the courses and programs before the design The course aims to involve students in designing the course. In Iranian universities, the content of the course is mostly the same face-to-face content that has been in electronic form, but in the European Union partner universities, some universities are designing a special e-learning course from the very beginning. Regarding technical support in Iranian universities, there is an office or center called the Teaching Development Center or the Office of Educational Planning in universities that organizes workshops and training courses, but in There is no special support at the faculty level.

European Union partner universities accept students in two ways: 1. Having a representative in various bodies: such as curriculum council, educational council, general meetings of groups, program advisory committee, faculty committee, and 2. Engage by providing feedback on courses and programs. In the partner universities of the European Union, they provide technical support in a better way and in various activities such as programming, audio/video productions and graphic design services. Regarding the support of learners in the Iranian partner, there is no facilitation system at the university or college level, and the lecturers perform this task, but in the partner universities of the European Union, the lecturers act in two ways: 1. Educational lecturers who focus more

on helping the course content is focused and 2. Technical instructors who are responsible for the technical support of learning. This feature is not available in all EU universities.

Guideline: stakeholders can be involved in the course process in different ways. This process includes parts such as participation in course design, technical support for instructors, and facilitators who support learners. In this process, students and lecturers are engaged in different ways.

Recommendations:
Learners should be participated more in the process of designing the course and try to see this participation before the implementation of the course. it is also necessary to use assistants alongside the lecturers to help the lecturers and learners in the technical and content production department in order to reduce the workload of the lecturers and at the same time the learners have the opportunity to solve their problems.

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.
- Identification of TEL /online quality practices or patterns of quality

Process of continuous improving of educational provision

In Iran, due to its nascent nature of TEL, an accurate assessment of its success has not yet been reported, but in partner universities of the European Union, the evaluation is done based on the quality manual of the institute.

In Iran, in order to benefit students with special needs, in addition to the welfare organization activities, the universities also provide some facilities. In all Eu partners, meeting the needs of students with special educational needs is considered as an important goal. Also, according to the findings, in Iran and Eu universities partners, criteria and strategies have been considered to prevent academic plagiarism and observe ethical practice.

Guideline:

Considering the importance of the subject and the advanced mechanisms, it is hoped to comply with the principles required by students with special needs. In the same way, the existence of standards for compliance with ethical principles and standards for preventing academic plagiarism will pave the way to some extent.

Recommendations:

The existence of rules and regulations alone does not guarantee their compliance. A mechanism to monitor the implementation of these rules should be put on the agenda so that students, in addition to access to the same education, also consider scientific and ethical points.

Professional development of teachers and instructional designers

During the covid-19 pandemic, webinars and training workshops on designing/developing/evaluating TEL/online programs were held in partner universities in Iran, so professors are more or less familiar with the topics.

Both UAB and USGM are online universities, so the people involved in the design/development/evaluation of TEL/online programs have received advanced training in the use of media technology for academic purposes, and most of them conduct regular research and innovation activities in this area. In Iranian universities, competencies such as teaching methods, motivating students, evaluating learning outcomes, writing lesson

plans, creating lessons on the Moodle platform, interaction in e-learning, etc. are frequently available. European Union partner universities provide several workshops such as technology as a support in hybrid education, technology in face-to-face education, online education design (training workshop), activities and discussions in Moodle, important points in the production of video and audio content, and assessment methods. In the partner universities of Iran, there are centers that are responsible for identifying the needs of the teaching staff. Eu university partners constantly assess the training needs of personnel based on procedures.

Guideline:

In all universities of Iran and some partner universities of the Eu, there are trainings in the field of working with virtual education systems, content creation, course design, teaching methods, educational evaluation, writing lesson plans, supporting the teaching process by technology, electronic evaluation and so on. In general, there is a blended education that takes into account the task of professional development of instructors and course designers.

Recommendations:

Due to the continuous change in the technologies used and the emergence of new technologies, the training should be continuously revised and modified, and the process of holding training workshops should be continuously followed up according to the modifications made so that the virtual training support process can be carried out without any challenge.

Industry relevance

Policy and action plan for industry-relevance

In Iranian universities, every department has its own methods to cooperate with the industry. The approaches chosen may be based on organizational or personal relationships. One approach is an industry-related research opportunity which all newly recruited faculty members are required to participate. Another way is to have a center for communication with industry in universities. EU partner universities have different ways of considering the needs of industry. These methods may range from using a professor specializing in an industrial field to the existence of special departments in universities to communicate with the industry and to conduct doctoral theses in connection with the industry sector.

Guideline:
In both Iranian universities and partner universities of the European Union, this issue is given importance, and it can be said that the effort to connect with the industry is on the right trend, but due to the nature of the disciplines, this connection is not possible in all fields.

Recommendations:
Communicating with more graduate students in addition to doing theses in the form of courses and internships will be good opportunities to lead students to the industry. delivering online courses may help to better connect the university and the industry.

Infrastructure
technical infrastructure at Iranian partner universities has improved recently occurrence with pandemic, meanwhile some universities had founded desire technical infrastructure before covid 19. Many e-learning tools are aligned with teaching methodology, learning activities, and e-assessment methods. However, evaluation methods are limited due to the technical infrastructure provided and there is a possibility of fraud in these methods. UAb and USGM a functioning infrastructure including e-assessment methods is a prerequisite for successful action. Also, UTU as a traditional university has added flexibility and increased possibilities for planning the studies, electronic exams are used.

Guideline:
teaching and evaluation of the courses can be modified by improving the infrastructure. In Eu universities partner, this process is on the right trend, but in some Iranian universities, it is needed to upgrade the infrastructure, especially for applied courses.

Recommendations:
New technologies should be used to make the virtual education conditions similar to real conditions, especially for applied courses. By using modern tools and technologies, the evaluation of the courses should be made more objective. it is also suggested to use continuous evaluation, instead of cumulative evaluation.

Assessment of learning
Despite organizing several workshops on e-assessment, designing and implementing e-assessment as well as formative assessment across Iranian Universities, there is not any formal data about the success or failure of e-assessment. At Eu universities, some

principles are considered crucial e.g., assessment must be aligned with the intended learning outcomes, multiple forms of assessment methods are encouraged, and feedback given to the student is important in the assessment process.

Guideline:
assessment is an important component that plays a prominent role in completing the teaching process. Improving the quality of evaluation will make students' attitudes positive towards fair evaluation and assure teachers that the grades received from the evaluation are real.

Recommendations:
Using new approaches of assessment such as e-portfolio, peer assessment, self-evaluation, situational assessment and group assessment. It is also recommended to use technologies to monitor students' performance during assessment.

Functionalities of the technical infrastructure
Existing VLE in Iranian Universities supports only direct pedagogical methods. The platform used to create a virtual learning environment in most universities is Moodle and how it is used depends to a large extent on the skills and knowledge of professors in this field.
Moodle is also widely used in EU partner universities**.** It is up to the individual teacher and his/her skills and knowledge of pedagogy and tools how Moodle and its different elements are used.

Guideline:
VLE plays an important role in creating and maintaining quality interaction with students. Considering the needs of students with special needs during creating VLE is another issue that must be taken into account.

Recommendations:
The use of course delivery platforms with personalization and customization capabilities is recommended for any institution or university. If there are no facilities for people with special needs in the existing platform, it is necessary to consider additional facilities to compensate for the system's shortcomings, such as video content with subtitles for the deaf or special audio content for the blind. It is also possible to prepare a guide instruction for teachers to help these students.

Use of virtual and remote laboratories

According to the survey Students in all Iranian and Eu partners have access to e-Library, but Majority of Iranian partners have no virtual labs. In contrast Eu partners have virtual labs.

Guideline:

Accessing virtual laboratories and using these technologies are essential for many STEM courses.

Recommendations:

It is recommended to set up virtual and remote labs in all Iranian universities. accessing digital electronic resources, the lack of access to first-hand resources such as the physical library can be solved.

TEL quality practices and support

Practices and support are two integrated components of effective technology-enhance learning environments. In all Iranian partner universities, TEL is part of the university's strategy, the majority of professors take part in short-term seminars or specific workshops to enhance their skills in designing TEL-based courses. Some Iranian universities have support systems that may provide useful information for professors and students. TEL is strongly represented in the strategies of all EU partner universities. They frequently try to enhance the quality of TEL practice and support through effective approaches.

Guideline:

implementing successful TEL courses needs providing and updating effective support systems.

Recommendations:

- Updating support systems so that could provide needed information.
- Monitoring quality of TEL practice and support.
- Developing theoretical and practical models designed to ensure a continuous improvement of the learning environment.

Staff professionalization

Iranian partner universities follow similar procedures for recruiting and hiring teaching staff Iran ministry of science and technology has regulated some procedures for all universities and also each university has its own for recruiting and hiring teaching staff. Eu partner universities have systematic procedures for recruiting teaching staff. International recruiting has become more and more important and it's encouraged.

Guideline:

Continuous and professional training of teaching staff is one of the prevailing actions of all higher education institutions. By conducting a consistent needs assessment and identifying real teachers' needs and having a regular program in this field, the quality of teachers' education can be guaranteed.

Recommendations:

- Conducting continuous need assessment and try to identify teachers and student's needs.
- Designing and developing a comprehensive instructional plan to cover all teaching and learning needs.
- Designing and developing a framework to Monitor and control the training quality.

Adoption of TEL practices

Many Iranian universities succeed to adopt TEL during covid 19. Although they have faced a lot of challenges, especially in instructional quality and infrastructure, it is hoped to revise their practices and increase the TEL course's quality. In contrast EU universities partners have a long and good background in TEL practices.

Guideline: Adoption of TEL practices needs prerequisite activities and facilities. Managers and stakeholders should take all of them into account.

Recommendations:

- Designing and developing preservice and interservice training for all TEL staff.
- Iranian universities need to Periodically Revise the present approaches, strategies, and activities.