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How to Better Qualify ICT Graduates to Support Digital Education: A contribution from CALOHEE Tuning project qualifications framework

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Abstract:

The Information and Communications Technology subject area is a broad multidisciplinary field of academic research and professional practice covering many topics ranging from electronics to system and network administration, to software development, cyber security, VR, AR, IoT and AI. Due to its nature, it cooperates closely with diverse areas, most notably eLearning and digital education. As contemporary educational institutions undergo a digital transformation, by which its processes are reengineered to take most of the possibilities offered by the emerging technologies, the contribution of the ICT field has become transversal and consequently of critical importance. The term ICT which refers to this wide multidisciplinary field differentiates from IT, which applies specifically to the management and use of computer systems to store, retrieve, transmit, and manipulate data. The continuous expansion of the field to new territories of practice such as education is requiring additional knowledge, skills and wider competences acquisition. In addition, high volatility of the job market creates the need for very adaptable professional profiles. As a result, there is a pressure from the job market for shorter and more job-oriented programmes, but also for competence frameworks which may serve as references for quality higher education and training. In this paper we present the Tuning Quality Reference Framework (QRF) for ICT which was developed as part of the CALOHEE Erasmus+ funded project. A multidisciplinary team with experts from 12 different countries (Portugal, Lithuania, Germany, Italy, Spain, Austria, Belgium, Greece, Turkey, Finland, Ireland and Romania) took part in the task. The QRF is built in a way to flexibly address all the mentioned complexity and continuously emerging new requirements including educational institutions and non-formal education organisations. The approach used also supports innovation in learning, teaching and assessment practices in ICT degrees, fostering open and digital education.

Keywords: ICT, eLearning, Digital Education; Open Education; Technology-Enhanced Learning; Qualifications Framework

Introduction

The Information and Communications Technology (ICT) subject area is a broad multidisciplinary field of academic research and professional practice covering many topics ranging from electronics to system and network administration, to software development, cyber security, VR, AR, IoT and AI. Due to its nature, it cooperates closely with diverse areas, most notably eLearning and digital education (Tikhonenko & Pereira, 2019). As contemporary educational institutions undergo a digital transformation, by which its processes are reengineered to take most of the possibilities offered by the emerging technologies, the contribution of the ICT field has become transversal and consequently of critical importance.

The term ICT which refers to this wide multidisciplinary field differentiates from IT, which applies specifically to the management and use of computer systems to store, retrieve, transmit, and manipulate data. The goals of ICT technologies are to improve the ways of creating, processing, and sharing data and information, as thus to improve human abilities in different areas of activity, including education. There is no single, universal

definition of ICT, as the field is constantly evolving with increasing emphasis on interdisciplinarity. Consequently, the demand for degrees in ICT is expanding rapidly, even if it fails to keep up with the needs of the job market and in particular educational institution's needs. It is estimated that over three hundred and fifty thousand new students enrol each year in Informatics bachelor's programs in Europe, as the total number of enrolled students exceeds one million (Tikhonenko & Pereira, 2019). The corresponding estimated figure for students enrolled in master's programs in the field is over two hundred thousand (Tikhonenko & Pereira, 2019). Regarding graduations, around one hundred and sixty thousand students graduate each year in Informatics bachelor's programs and over sixty thousand in master's (Tikhonenko & Pereira, 2019).

The Qualifications Reference Framework for the Degrees in ICT[1] designed by the CALOHEE Tuning project and published as the Tuning Guidelines and Reference Points 2023 for the Design and Delivery of Degree Programmes in Information and Communication Technology - ICT (Teixeira et al., 2024) was produced to better support higher education institutions in the design and delivery process of programmes. It was prepared by a multidisciplinary team of experts from 12 HEI representing many different European countries (Portugal, Lithuania, Germany, Italy, Spain, Austria, Belgium, Greece, Turkey, Finland, Ireland and Romania). It addresses main ICT competences, characteristic of different Computer Science Disciplines, as defined in IEEE/ACM Reference Curricula documents: Computer Science, Computer Engineering, IS, IT, Software Engineering (ACM & IEEE, 2020). In this paper, we present the QRF for ICT and discuss its main features.

In ICT, three paradigms - theory, modelling and design - are equally important and fundamental. Information theory deals with those objects and their relationships whose relevance is determined by modelling and design. Modelling deals with the correspondence of theoretical objects and relationships to the real world. Design realises model-checked objects and relationships. In ICT, these paradigms are closely related, mutually conditioning and do not exist without each other. These paradigms are distinct because they are represented by different areas of expertise. Apart from the complex and dynamical landscape of computing knowledge, as well as the multidisciplinary nature of ICT, non-ICT issues dealing with social, political, economic, and environmental concerns, as ethical issues, have become of great importance.

The continuous expansion of the field to new territories of practice is requiring additional knowledge, skills and wider competences acquisition. High volatility of the job market creates the need for very adaptable professional profiles. There is a pressure from the job market for shorter and more job-oriented programmes. The QRF for ICT is built in a way to flexibly address all this complexity and continuously emerging new requirements including educational institutions and non-formal education organisations.

The Tuning-CALOHEE model

The QRF for ICT is intended to serve as an international reference point for the academic discipline in the European Higher Education Area (EHEA), representing the current situation in such a fast-changing societal environment. The QRF applies the Tuning methodology for (re-) designing, developing, implementing and evaluating study programmes for each of the Bologna cycles. Originally validated in 2007-2008, developments have followed since. The latest version in which the QRF for ICT is based can be found in Measuring and Comparing Achievements of Learning Outcomes in Higher Education in Europe (CALOHEE) projects (2018-2023)[2].

The Tuning methodology is based on the student-centred and active learning approaches it has promoted from the start (Lokhoff et al, 2010). Graduates need to have obtained as the outcome of their learning process the optimum set of competences required to execute their future professional tasks and take on their expected roles in society. As part of their education graduates should have developed levels of critical thinking and awareness that foster civic, social, environmental and cultural engagement. Recognition is given to current and possible future developments and issues.

The Tuning reference points ensure study programmes are comparable, compatible and transparent. They are expressed in terms of learning outcomes and competences. Competences represent a dynamic combination of cognitive and meta-cognitive skills, knowledge and understanding, interpersonal, intellectual and practical skills, and ethical values. Some competences are subject area related (specific to a subject area), others are generic (relevant for many or all in degree programmes). According to the Tuning model, subject specific competences and generic competences or general academic skills should be developed together. The Tuning model values the 'dimensions' approach. They contribute to structure a particular sector or subject area and make its basic characteristics more transparent. The use of the learning outcomes and competences approach

[1] https://www.tuning-calohex.eu/information-and-communication-technology

[2] Measuring and Comparing Achievements of Learning Outcomes in Higher Education in Europe (CALOHEE). https://www.calohee.eu/

implies changes regarding the teaching, learning and assessment methods. But also, it has implications in how quality enhancement can play a critical role in the process of conceiving and reviewing study programmes.

Level Cycle Descriptors: Competences and Learning Outcomes (EQF Levels 6 and 7)

When designing the QRF for ICT, we aimed at defining a meta-profile of an ICT professional based on five critical dimensions upon which the relevant competences are organised in order to build the profile of a successful ICT graduate in the contemporary knowledge society. The five dimensions mentioned above are the following:

Dimension 1: **Knowledge and understanding.**
Dimension 2: **Design, development, and management of processes of ICT systems and related processes.**
Dimension 3: **Informed decision making and learner ethics.**
Dimension 4: **Communication and collaboration.**
Dimension 5: **Professional life-long learning and continuous personal development.**

The ICT meta-profile categorises, structures, and organises competences into recognisable clusters, illustrating inter-relations among the different aspects of the desired graduate profile. Each dimension is defined by a set of associated competences, attributed to knowledge, skill and autonomy and responsibility (wider competences) competence categories. The following international qualification frameworks were used as reference: the EQF for Lifelong Learning (European Commission, 2008), the Dublin Descriptors, and the ACM and IEEE Computing Curricula 2020 (CC2020) (ACM & IEEE, 2020).

The complete description of the Qualifications Reference Framework for Bachelor's degrees in ICT (EQF level 6) is presented in Tables 1-5 below. A similar approach was used for Master's degrees (EQF level 7), which is not presented in full but only discussed in this paper due to word limits.

Table 1. Dimension 1: Knowledge and Understanding

(Sub)descriptor	Knowledge	Skills	Autonomy and Responsibility (Wider Competences)
L6_1. Level descriptor Knowledge and understanding	Demonstrate current understanding of core knowledge related to ICT.	Evidence the ability to contextualise, integrate and compare knowledge which is fundamental for ICT correctly applying the related terminology.	Manifest the ability to use, share and contribute to ICT-related knowledge and understanding in professional and societal settings.
Subset 1 L6_1.1 **STEM**	Demonstrate knowledge in mathematics, physics and other STEM fields which are core to ICT.	Evidence the ability to contextualise, integrate and compare STEM knowledge in solving ICT-specific problems.	Manifest the ability to identify, describe and aggregate STEM methodological knowledge required to solve problems in the ICT field.
Subset 2 L6_1.2 **ICT-related methodological-operational knowledge**	Demonstrate specialised methodological-operational knowledge in ICT systems in order to be able to design, develop and implement them.	Evidence the ability to contextualise, integrate and compare knowledge in order to design, implement and operate computer systems and networks.	Manifest the ability to acquire, prepare and critically assess specific methodological-operational knowledge in ICT to identify, formulate and solve application problems, configure and manage ICT systems of different complexity.
Subset 3 L6_1.3 **Legal aspects and organisational frameworks**	Demonstrate understanding of legal aspects and institutional frameworks of diverse types of organisations, alongside ICT-related regulations.	Evidence the ability to apply knowledge of business processes and corresponding IS in ICT professional contexts.	Manifest the ability to implement a digital strategy for a project or an organisation, being capable of starting an operation in an inclusive and sustainable manner.

Table 2. Dimension 2: Design, Development and Management of ICT Systems and related processes

(Sub)descriptor	Knowledge	Skills	Autonomy and Responsibility (Wider Competences)
L6_2. Level descriptor Design, development and management of ICT systems and related processes	Demonstrate current knowledge and understanding of the generic and ICT-related skills required to operate successfully in diversified contexts.	Evidence the ability to apply ICT-related and generic skills, which facilitate the development of critical thinking and evidence-based arguments and solving ICT related and societal problems.	Manifest an evidence-informed approach to managing technical/professional projects and activities, applying effectively ICT and societal related knowledge and skills, taking initiative, showing responsibility and leadership.
Subset 1 L6_2.1 **Methods and techniques in ICT**	Demonstrate knowledge and understanding of design and implementation of ICT systems, considering the ethical use of data and information technologies.	Evidence the ability to apply knowledge for analysing, designing, implementing, testing, maintaining and integrating ICT systems in companies and other organisations.	Manifest the ability to use appropriate methods and techniques in a target-oriented way to effectively address ICT problems.
Subset 2 L6_2.2 **Management of ICT processes**	Demonstrate knowledge of the different aspects involved in processes of ICT systems and applications development.	Evidence the ability to manage ICT processes and solve related problems.	Manifest the ability to manage ICT solutions autonomously and responsibly.
Subset 3 L6_2.3 **Transformational impact of ICT**	Demonstrate understanding of the transformational impact and implications of ICT in society, communities and work environments.	Evidence the ability to design and manage ICT solutions and systems which contribute to the needs and expectations of societies, communities, work environments, and individuals.	Manifest the ability to exercise initiative and acknowledge accountability for the executed ICT tasks.

Table 3. Dimension 3: Informed Decision making and Work Ethics

(Sub)descriptor	Knowledge	Skills	Autonomy and Responsibility (Wider Competences)
L6_3. Level descriptor Informed decision making and work ethics	Demonstrate current knowledge and understanding of relevant theoretical frameworks, concepts and methodologies and/or practices to gather, evaluate and interpret ICT related and societal information, in an ethical, inclusive and sustainable manner.	Evidence the ability to apply appropriate theories, concepts, methodologies and/or practices and ICT related and generic skills and competences to analyse, synthesise, and make informed judgments while considering relevant social, cultural, scientific and ethical issues and challenges.	Manifest the ability to evaluate ICT and societal challenges and problems and to reflect on relevant knowledge in order to contribute to ethical decision-making, finding individual and collaborative ways to move forward, ensuring participation and inclusion.
Subset 1 L6_3.1 **Reciprocal interactions between ICT and society**	Demonstrate comprehensive understanding of the reciprocal interactions between ICT and society.	Evidence the ability to apply comprehensive understanding of the reciprocal interactions between ICT and society to planning and managing of ICT projects.	Manifest the ability to identify appropriate and relevant inclusive, sustainable and ethical approaches to responsively manage work contexts in the ICT subject area and interdisciplinary contexts.
Subset 2 L6_3.2 **Professional,**	Demonstrate awareness of the key aspects of professional, ethical and	Evidence the ability to make decisions and informed judgements on	Demonstrate knowledge of the norms, regulations and codes of ICT practice, and

ethical and social responsibilities	social responsibilities linked to management of ICT activities, in particular decision-making and judgement formulation, namely the roles and dynamics of collaboration.	issues related to ICT, exercising professional, ethical and social responsibilities.	reflects on professional, ethical and social responsibilities in taking decisions and formulating judgments, valuing diversity.
Subset 3 L6_3.3 **Methodologies for ethically collecting and interpreting data**	Demonstrate comprehensive understanding of methodologies for gathering, evaluating and interpreting data.	Evidence the ability to apply ethical principles of good practice to the retrieval, storage, analysis, management and transformation of data.	Manifest the ability to identify collaborative and proficient ways to interpret and transform data for addressing relevant societal and community challenges.

Table 4. Dimension 4: Communication and Collaboration

(Sub)descriptor	Knowledge	Skills	Autonomy and Responsibility (Wider Competences)
L6_4. Level descriptor Communication and collaboration	Demonstrate current knowledge and understanding of the appropriate means, skills, attitudes, approaches and strategies to effectively communicate and collaborate, sharing ideas, challenges and solutions related to ICT for a variety of audiences.	Evidence effective communication of different types of information, expressing ideas, problems, challenges and possible solutions by applying technical and non-technical strategies, means and skills tailoring them to a variety of audiences including ICT specialists.	Manifest the ability to communicate effectively in predictable and unpredictable workplace and/or societal situations by listening to others and making convincing arguments in order to reach a common understanding of topics and activities involved.
Subset 1 L6_4.1 **Communication methods, tools and strategies**	Demonstrate current knowledge and understanding of existing and emerging innovative communication methods, tools, strategies, and their limitations.	Evidence the ability to communicate information and express ideas, problems and solutions effectively, clearly and unambiguously, orally and in writing, including English or another relevant foreign language.	Manifest the ability to identify and justify appropriate and relevant communication and collaboration methods, tools, and strategies, both established and innovative ones.
Subset 2 L6_4.2 **ICT-related terminology**	Demonstrate current knowledge of the scientific and discipline-specific technical terminology in the ICT field, namely in international contexts.	Evidence the ability to describe activities and communicate their results to ICT specialist and non-specialist audiences in national and international contexts using appropriate communication, strategies, methods and tools.	Manifest the ability to communicate effectively in multicultural and multilingual environments, using evidence, to non-experts, peers and professionals about the application of ICT and its ethical and social impact.
Subset 3 L6_4.3 **Team Management**	Demonstrate current knowledge and understanding of responsibilities and methods to manage teams that may be composed of different disciplines and levels.	Evidence the ability to collaborate or cooperate effectively in national and international work contexts as leader or member of teams that may be composed of different disciplines and levels, contributing to meet deliverable, schedule and budget requirements.	Manifest the ability to identify and implement an appropriate strategy to lead a small or medium complexity project in the ICT-related field, applying inclusive and ethical principles of conduct.

Table 5. Dimension 5: Professional Lifelong Learning and Continuous Personal Development

(Sub)descriptor	Knowledge	Skills	Autonomy and Responsibility (Wider Competences)
L6_5. Level descriptor Professional lifelong learning and continuous personal development	Demonstrate knowledge and understanding of the learning process and methods required for self-directed continuous learning and development in a variety of formats and settings.	Evidence learning skills and appropriate strategies to advance the continuous learning and development of self and others in order to reflect on, update, and upgrade knowledge, skill and competencies in ICT, and societal developments.	Manifest motivation and initiative to organise, manage, and evaluate learning and development activities for oneself and others in order to continually update and upgrade ICT related knowledge, skills, competences, taking into account societal developments.
Subset 1 L6_5.1 **Professional self-assessment**	Demonstrate knowledge and understanding of self-assessment methods needed for personal development.	Evidence the ability to continuously evaluate personal knowledge and skills.	Manifest the ability to conduct continuous self-assessing of own professional competences.
Subset 2 L6_5.2 **Autonomous learning**	Demonstrate knowledge and understanding of learning methods needed for personal development.	Evidence the ability to organise one's own study and/or learning process, using different kinds of learning methods and materials.	Manifest the ability to identify and justify appropriate learning strategies and methods in independent lifelong learning.
Subset 3 L6_5.3 **Continuous personal development**	Demonstrate advanced knowledge and understanding of learning methods necessary to follow developments in ICT subject area and within broader or multidisciplinary and societal contexts.	Evidence the ability to follow new developments in the ICT-related field, search for relevant information and seek appropriate support.	Manifest the ability to undertake further studies in emerging technologies in ICT also within trans- or multidisciplinary contexts.

The first dimension of the ICT QRF for EQF level 6 concerns knowledge and understanding as indicated in level descriptor 6.1. In this context, subset 6.1.1 highlights the importance of Mathematics, Physics, and other STEM as foundational knowledge in the field of ICT. However, given the broad spectrum of the field, as described in the previous sections, subset 6.1.2 also indicates the contribution of operational knowledge which is relevant for ICT. In fact, it is expected that a graduate in this field can acquire and mobilise knowledge competences to design, implement and operate computer systems and networks. For that purpose, a graduate should be able to critically assess specific methodological-operational knowledge to solve problems and configure and manage systems.

As a graduate in ICT typically operates in diverse work environments given the broad nature of the field, this QRF adds competences related to ability to understand the organisation, strategy and policies of institutions and business companies. In fact, a graduate in ICT should be also prepared to start and manage a project in a given organisation or a startup company.

These competences are also included the ICT QRF for EQF level 7. The main difference is the level of knowledge required, which at the Master level should be of an advanced and more specialised nature. Also, the problems related to ICT systems configuration and management which postgraduates are expected to solve should be of higher complexity. At both levels 6 and 7 attention was given to ensuring that graduates and postgraduates in ICT clearly understand the importance of designing inclusive and sustainable processes in ICT.

The second dimension of the QRF for ICT concerning EQF level 6 is related to the design, development and management of ICT systems and related processes. Here, subset 6.2.1 ensures that graduates can apply appropriate methods and techniques at the different phases of integration of ICT systems in companies and other organisations. At the same time, it also emphasises the need for graduates to be prepared to consider all

aspects related to the ethical use of data and IT in these processes. This is an increasingly relevant topic in contemporary ICT work environments.

Following up on the need to ensure the integrity of graduates, subset 6.2.2 includes competencies which highlight their capacity to demonstrate autonomy and responsibility when managing ICT solutions. In the same direction, subset 6.2.3 focuses on the need for graduates to be aware of the transformational impact of ICT and to be able to address the concrete needs of people and organisations.

At the EQF level 7, the QRF for ICT adds to these competences a higher degree of complexity. This involves application of advanced and highly specialised knowledge as well as evidence-informed skills in the design, development and management of ICT systems and related processes in multi-dimensional and differentiated work and societal settings. Also, the ICT QRF for EQF level 7 adds innovation, entrepreneurship dimension, research, accountability and leadership dimensions to the graduate capacity to manage complex technical and content related activities, effective ICT solutions and applications.

The third dimension of the ICT QRF for EQF level 6 deals with informed decision making and work ethics. This is another emerging major concern when taking into consideration the expanding landscape of the ICT field of practice. In fact, the rise of Data Science has changed the perception of ICT resulting in an increased relevance of ethics. ICT is being recognised as the main knowledge centre in the digital transformation of society (Di Nitto et al., 2019). As such, subset 6.3.1 addresses the reciprocity of interaction between ICT and society. This subset highlights how graduates should be prepared to identify and apply inclusive, sustainable, and ethical approaches to planning and managing ICT-related tasks considering the interdisciplinary contexts in which they are expected to operate. The preparation of graduates to operate in such complex environments is also addressed by the competences included on subset 6.3.2. It focuses on the need for graduates to understand the norms, regulations and codes ruling the professional practice in ICT. However, the competences are formulated in a way to stress an autonomous, ethical, and socially responsible conduct by graduates. This focus on ethical responsibility is reinforced in subset 6.3.3 which concerns the capacity of graduates to identify and apply the best methodologies and practices to manage data.

On the ICT QRF for EQF Level 7, the competences of informed decision making, work ethics, understanding of norms, regulations and codes as well data management level are augmented. This is achieved by strengthening the capacity of graduates to reflect on new specialised knowledge and skills, as well as on professional, ethical and social responsibilities in taking decisions and formulating judgments. The ICT QRF for EQF level 7 tries to ensure that graduates can identify relevant inclusive and sustainable approaches as well as understand the value of diversity in their activities.

The fourth dimension of the ICT QRF for EQF level 6 concerns communication and collaboration. Again, the increasingly multinational and multicultural nature of work environments in ICT stresses the importance of communication. As such, subset 6.4.1 includes competences related to communication tools and strategies, including the ability to express in English or another relevant foreign language, as subset 6.4.2 focusses on the capacity to address effectively diverse and multicultural environments, including the knowledge of ICT-related terminology. Finally, subset 6.4.3 is related to collaboration competences, highlighting the capacity of graduates to lead and conduct simple or medium complex tasks in multidisciplinary and/or multinational teams.

The ICT QRF for EQF Level 7 strengthens and broadens the communication and collaboration competences, adding the capacity to communicate proficiently, to employ different sophisticated communication strategies, media, means and skills, to lead complex projects in ICT-related field.

The fifth and final dimension of the ICT QRF for EQF level 6 concerns an ever more important aspect of current and future ICT practice which is professional lifelong learning and continuous personal development. Subset 6.5.1 addresses the need for graduates to be able to continuously assess their own professional competences bearing in mind how their own work trajectory is evolving and technologies also changing. On subset 6.5.2 the QRF highlights the capability of graduates to organise and conduct autonomous informal or non-formal learning activities and on section 6.5.3 to pursue further studies, namely more advanced levels of qualifications.

At the EQF Level 7, the competences of professional lifelong learning and continuous personal development included in the QRF for ICT are broadened by adding the capacity to demonstrate advanced knowledge and understanding of the learning process and methods. In addition, postgraduates are expected to manifest continuous personal and professional development in individual, team-based and societal settings.

Learning, teaching and assessment innovation in ICT degrees

ICT as a subject or course of study has a very complex content and interdisciplinary context. Therefore, the challenges of transferring knowledge and skills in this area are very high. In terms of learning theory and didactics, several theories, methods, concepts and tools are used in combination to ensure the optimisation of teaching and learning processes, including assessment, both physically and digitally. This means that the transfer of knowledge and skills is based on multidimensional, hybrid models and concepts, which is also reflected in the forms of assessment. ICT cannot be regarded primarily as a technical study, but as preparation for a highly effective social practice. Accordingly, the learning activities required of students are extremely diverse.

Evidence collected by the CALOHEE project shows that European higher education institutions make use of almost every conceivable type of learning activity. However, the focus of the intellectual and social activities must always lie with the students if higher-level learning outcomes are to be achieved. The decisive consequence of this is that consumable learning situations such as lectures and presentations are beginning to be minimised in favour of active, product- and solution-oriented and creativity-based forms of learning. In fact, the dissemination of technology-enhanced learning is allowing to overcome most possible economic and organisational restrictions.

For students and teachers in the field of ICT, connectivism is becoming increasingly important alongside traditional learning theory perspectives of constructivism. Professionals who are ICT-affine and highly qualified in the field of ICT have a low entry threshold for networked and thus hybrid learning and teaching as a combination of formal and informal learning. At the same time, attempts are being made to optimise the variety of options through models of hybridization to ensure the best possible teaching and learning success. ICT professionals are predestined for this per se.

The guiding principle is that teaching concentrates on creating situations in which students can acquire knowledge, develop skills and build up complex competencies with a high level of cognitive and social participation. Teaching ICT in European higher education institutions is nowadays clearly less about providing information and increasingly more about organising opportunities for constructing knowledge and personal development. Confrontation with open questions, problems and tasks are therefore the means of choice - especially if they do not take place in the lecture hall, but in authentic environments such as companies or organisations.

Accordingly, assessment must also meet the challenges of the field. The first consequence of this is the need to apply practically all known forms of assessment, exploring the affordances of digital tools. Intended learning outcomes, learning activities, teaching methods and forms of assessment must harmonise if the best possible result is to be achieved (constructive alignment). For this reason, it is not possible to provide more detailed information on which assessment would be appropriate when. These decisions can only be made by the curriculum planners in close consultation with the lecturers. However, the principle is generally valid: the higher ranking the learning outcomes, the more complex the tasks to be completed must be within a range from a one-day task to a multi-semester project.

Conclusions

In such a rapidly evolving field as ICT, it is of the utmost importance that degree programs not only be academically sound but also relevant. For that, they must be adaptable and responsive to the dynamic nature of the ICT field, remaining updated with society and industry trends, tools, and emerging technologies. This relevance is vital for ensuring the credibility and reputation of degrees and HEI both at national and international level.

By aligning qualifications with European industry as well as digital education institutions and other organisations needs and standards, the QRF for ICT ensures graduates possess skills relevant in a rapidly evolving ICT landscape, enhancing employability across the continent. They aid in the development and review of curricula, ensuring that programs cover essential knowledge, skills, and competencies required in the ICT field today. By using these frameworks as a guide for accreditation processes, European HEI may ensure that their programs meet established standards, as the ones set by EQANIE (Equanie, 2015), and are recognized as reputable and valuable by relevant accrediting bodies.

We recognise the fact that HE students increasingly tend to follow complex trajectories. These trajectories include changing courses, taking breaks, combining subject areas, or moving between different courses or modalities (distance, hybrid and face-to-face). HEI must adapt their policies to this emerging phenomenon. As such, this QRF enables the creation of clear pathways for lifelong learning, allowing professionals to upskill, reskill, or pursue further education in ICT based on standardised levels and qualifications.

We believe that the QRF for ICT contributes to ensure that HE degrees meet defined standards, align with societal needs, facilitate international recognition, and promote ongoing learning in a rapidly evolving field such as this one. They may serve as a roadmap for HEI across Europe to deliver high-quality education and for students to acquire valuable skills and knowledge. In recent years, quality assurance bodies have been setting quality standards for the accreditation of HE provision which share many similar elements. Accordingly, the QRF for ICT can be used as a set of directrices for quality assurance national and international bodies, as EQANIE, in their reviewing processes on ICT-related programs given the specific nature of these frameworks. The same may apply to professional associations who issue standards for the ICT field of practice and the practitioners.

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