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The digital competence of academics in Spain

A study based on the European frameworks DigCompEdu and OpenEdu

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Abstract

In the field of higher education, the improvement of teaching digital competence becomes a fundamental element for the institutions themselves to be able to continue carrying out their main mission in the current social context. In order to achieve this ambitious challenge, this study, fruit of the joint work between the JRC and CRUE, analyses the level of teaching digital competence perceived by the teaching staff of the Spanish University System. To carry out this study, a questionnaire was designed for teaching staff based on the DigCompEdu and OpenEdu frameworks developed by the JRC, and 5073 lecturers from 51 different universities were surveyed. The main conclusions are that the perceived median level of teaching digital competence is at a B2 level, with B1 being the most frequent, and that, of the different variables analysed, age is the one that shows the greatest differences in the levels of self-perception, with no significant differences depending on the professional category, dedication or gender. The need for personalised training to further improve digital competence among teaching staff has also been identified. To this end, it is very important that the Autonomous Communities allocate sufficient funding for universities to be able to develop these actions, as well as continuing collaboration between CRUE, the Ministry of Universities and the European Commission.

Contents

Preface

Digital competence in teaching is key to achieving the digital transformation of society, as well as inclusive and accessible quality education, as set out in the European agenda through the Digital Education Action Plan 2021-2027 and the European Strategy for Universities (2022). Academics have a very important role to play, together with students. In this context, academics need to be able to assess their lifelong learning needs in digital competences.

From the very beginning, we at the Joint Research Centre (JRC) saw the need to start by defining what is meant by digital competence, and so in 2013 we developed the DigComp framework, which by 2016 was already in its version 2.0 and was subsequently updated in 2017 to the current version 2.1. In fact, in addition to that framework, we also continue to develop other complementary frameworks such as DigCompEdu, which was published in 2017 and focuses specifically on digital competence for educators, and the OpenEdu framework, published in 2016, which proposes a common definition for open education as well as its core practices, with a focus on higher education. Other digital competence frameworks for citizens, individuals and organisations, developed by the JRC, are available online.

CRUE Spanish Universities (CRUE) has been aware from the outset that the importance of promoting digital competence in teaching is not exclusive to the initial levels of teaching, but is also key to the digital transformation of higher education. That is why, in 2017, the Online Training and Educational Technologies (FOLTE) working group of the ICT sector of CRUE (CRUETIC) began to work on this ambitious objective of improving the digital competence of university teaching staff in the Spanish university system (SUS), and shortly afterwards the teaching sector of CRUE (CRUE-Docencia) also joined in.

It was clear from the outset that work of this scale can only be undertaken through institutional collaboration, and there is no doubt that the alliance between CRUE and the JRC has been fundamental in carrying out this study in such a large group of universities and teaching staff.

We believe that this study provides very valuable conclusions on the perceived level of digital competence in the Spanish university system (SUE), while at the same time providing important inputs regarding the next step we need to take in order to continue improving these competences. We are convinced that it will be a good starting point for other projects that are currently underway by Spanish universities, and that it will also be a useful benchmark for formulating institutional policies in this area.

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Executive summary

The improvement and development of citizens' digital competence is nowadays essential for ensuring the sustainable development of a digital society in which no one is excluded. In the field of higher education, this also applies to teaching and learning processes, where the improvement of the digital competence of educators has become of paramount importance if institutions are to continue to carry out their main mission in our current social context.

As a first step to achieve this ambitious goal, this study, the first of its kind at international level and the result of joint work between the Joint Research Centre (JRC) and the Conference of Rectors of Spanish Universities (CRUE), aims to analyse the perceived level of educators' digital competence in the Spanish university system (SUE). Our aim is for this study, aimed at the university community as well as all institutions with some degree of responsibility for the professional development of universities' academic staff in terms of digital competences, to serve as a benchmark for future professional development and to formulate accreditation processes for educators' digital competence, and also policies aimed at achieving advanced levels of educators' digital competence among university teaching staff.

In order to carry out this study, a questionnaire was designed for teaching staff based on the DigCompEdu and OpenEdu frameworks developed by the JRC, and 5073 academics from 51 different universities participated. The academics were selected using a stratified sampling process to ensure the statistical validity of the self-reflection results for each of the groups of interest (types of teaching staff, age ranges, etc.).

The levels of competence and the attitudes associated with each level are described in detail in the DigCompEdu framework, and can be summarised as follows:

- A1 (newcomer) and A2 (explorer): curiosity, willingness to learn, meaningful use, transformation.
- B1 (integrator) and B2 (expert): meaningful use, transformation, strategy, versatility, reflection, exchange.
- C1 (leader) and C2 (pioneer): reflection, exchange, criticism, renovation.

The DigCompEdu framework applies these levels to the following areas of competence:

1. **Professional engagement:** organisational communication, professional collaboration, reflective practice and ongoing professional development through digital means.
2. **Digital resources:** selection, creation and modification, protection, managing and sharing.
3. **Teaching and learning:** teaching, guidance, collaborative learning and self-regulated learning.
4. **Assessment and feedback:** assessment strategies, learning analysis, feedback, planning and decision-making.
5. **Empowering learners:** accessibility and inclusion, personalisation and active engagement on the part of learners in their own learning.
6. **Facilitating learners' digital competence:** information and media literacy, communication, resource creation, responsible use and problem solving.

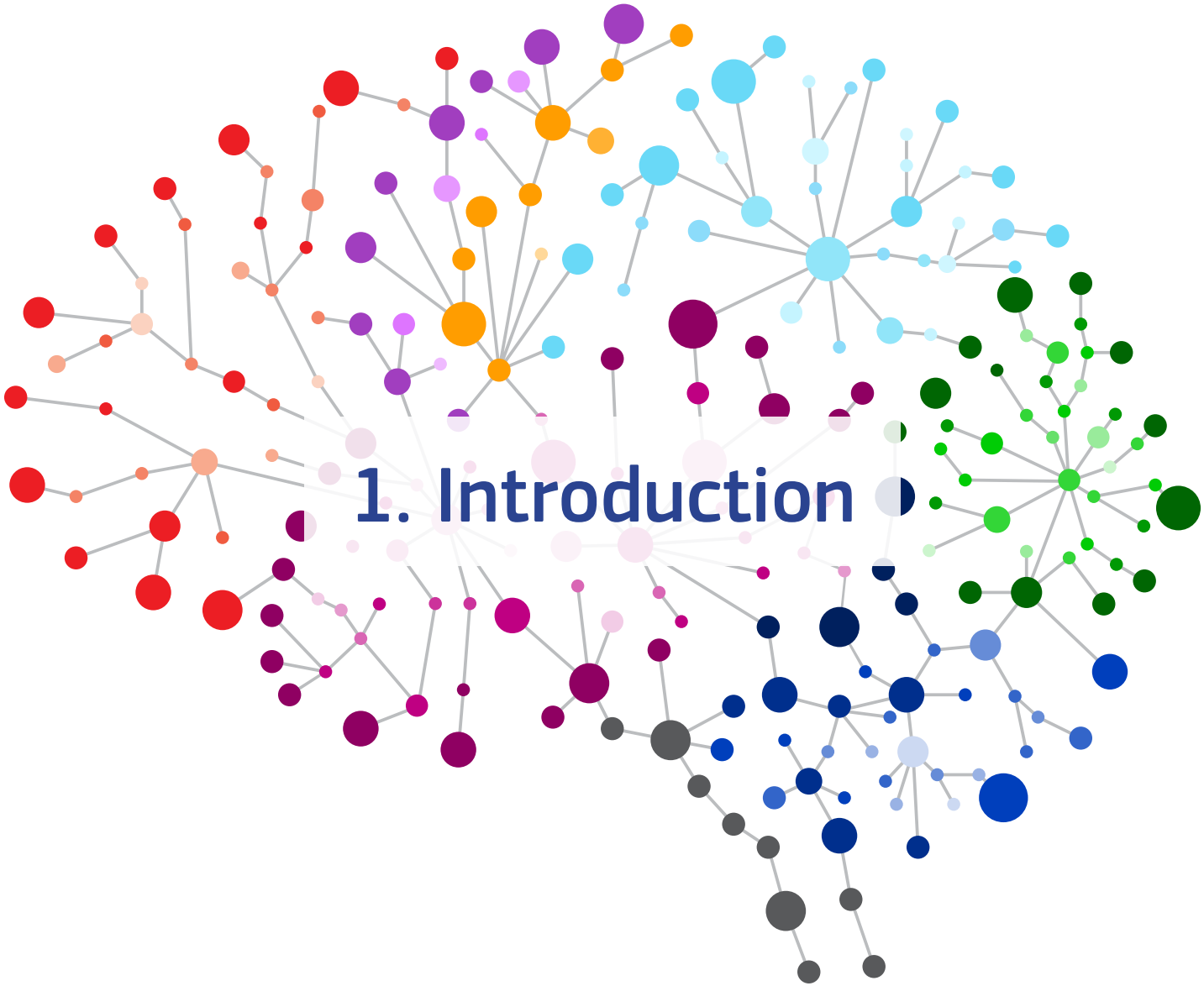
The OpenEdu framework adds a seventh area of competence: open education. This area combines some of the framework's concepts and invited self-reflection about:

7. **Open education:** use of open licences in educational resources, open educational practices for more inclusive teaching, publication of research as 'open science' and availability of research data as 'open data'.

The main conclusions of the statistical analysis of the responses show that the median level of perceived digital competence of educators is B2, with B1 being the most common, and that, of the different variables analysed, it is age that is responsible for the greatest differences in the levels of self-perception, while no significant differences are found as a result of professional category, type of contract, or gender. Furthermore, of the different areas of the reference framework used, teaching staff show a higher level of competence in 'Professional commitment' and 'Digital content' than in the rest. In these two categories, half of the respondents consider themselves to be at the 'Leader' level, while at the other extreme, the category of 'Open Education' use stands out, where most academics are in the 'Newcomer' category.

In addition to the qualitative study, the work carried out in the focus groups with the participation of collaborators from different universities has helped us to explore the results in greater depth and to identify needs and next steps for improving academics' digital competence. In particular, rigidity in academic regulations has been singled out, as well as the need for students to have better digital competence from the very start of their university studies and to continue to develop it at university. The need has also been identified for personalised training to further improve digital competence among teaching staff, and for this competence to be certified by applying homogeneous and uniform criteria at the national and European levels.

For all of the above reasons, we believe it is important that universities continue to formulate policies that enable the development of digital teaching skills among their teaching staff, offering the necessary tools and training, as well as appropriately recognising their acquisition. To this end, it is very important that the regional governments allocate sufficient funding for universities to be able to undertake these actions, and that there is continued collaboration between the different agents, especially CRUE, the Ministry of Universities and the European Commission, so that appropriate policies can be introduced to promote and recognise digital competence in teaching in a homogeneous and coherent fashion that looks beyond individual projects.



1. Introduction

The European Strategy for Universities[2] and the Digital Education Action Plan 2020-2027[3] identify digital transformation as one of the challenges facing Europe. The well-being of future generations will depend on our responses to these challenges, including that of digitisation. The Digital Decade programme[4] sets very ambitious targets for this.

At the same time, for the European 'Connected Universities' initiative to become a reality, universities will need digital capacity and infrastructure, and faculty and students will have to be able to work effectively in this new environment.

European universities need to equip their students with the digital skills necessary to function effectively in the new cultural and working environment. To achieve this goal, we need university teaching staff to possess these skills at the level required to enable them to train their students to acquire these skills.

Knowledge about the digital competences of teaching staff is key to deciding what actions universities should take in order to achieve these objectives. This project represents a first effort in this direction. There is limited empirical background on the level of digital competence in teaching at the national university level. In 2018, the Working Group on Online Training and Educational Technology (FOLTE) of CRUE-TIC presented the "Report on the state of educational technologies in Spanish universities", the first such study of the adoption of the technologies considered in the Spanish university system. This research, in which 47 universities participated, identified deficient digital teaching skills as one of the biggest challenges for the integration of digital technologies for learning at the institutional level.

On the other hand, in 2020 MetaRed (Universia and Santander Universities) presented the report "UDigital2020. Study of digital maturity in Ibero-American university systems", which listed the development of digital skills as one of the main challenges for the digital transformation of universities. In this regard, the study highlighted the need for the university community to develop an adequate level of digital competence in order to successfully exploit the available technologies, and made three key recommendations: (1) Universities should plan the professional development of different groups so that they acquire the appropriate digital competences for their profile; (2) So far, universities have been mainly concerned with providing institutional environments for teaching (classrooms, virtual classrooms, laboratories, computer rooms, libraries...), and less so with understanding the students' personal learning environments (learning approaches, equipment, connectivity...); and (3) Universities should provide professional development opportunities to their own staff so that they are able to tackle innovative and transformative projects.

Spanish universities have been working for years, to a greater or lesser extent, on the training and development of their teaching staff's digital competences by means of various training activities. This training has generally been provided within each institution and has included both technological (linked to the field of technological tools) and methodological aspects. However, given the advances in digitisation, these activities need to go beyond the institutional sphere of each university and general actions need to be considered.

CRUE Universidades Españolas is the non-profit association made up of all Spanish universities. The acronym CRUE stands for Conference of Rectors of Spanish Universities. It is currently made up of 50 public universities and 26

2. European Commission, Directorate-General for Education, Youth, Sport and Culture, 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a European strategy for universities and the Commission Proposal for a Council Recommendation on building bridges for effective European higher education cooperation'. SWD/2022/6 final Strasbourg, 18.1.2022. Accessible at https://bit.ly/european-universities-strategy
3. See the European Commission's Digital Education Action Plan 2021-2027: Digital Education Action Plan (2021-2027)
4. For the full programme, see: Europe's Digital Decade: digital targets for 2030.
See the full report at: https://tic.crue.org/publicaciones/#folte
See the full report at: https://www.metared.org/global/estudios-informes/udigital-2020.html

private universities. This association speaks on behalf of the universities, both nationally and internationally.

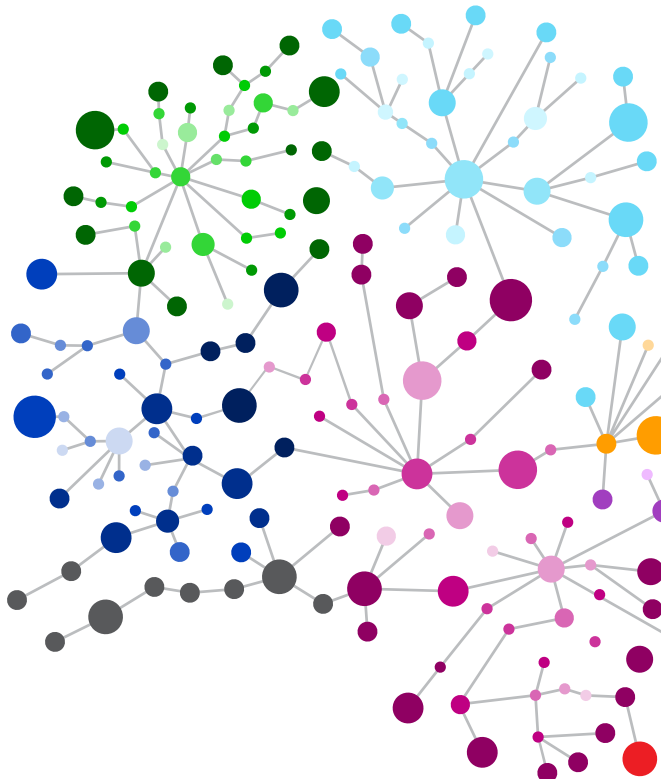
Its main objective is to contribute to the progress of society by improving university education, research and knowledge transfer. In order to achieve this objective, CRUE carries out different actions. These include leading projects for the progress of the Spanish university system, which are reflected in publications, agreements with other institutions and studies and reports, and so on. Among the bodies that make up the CRUE organisation are the so-called Sectorial Commissions. These are advisory and working bodies, created to support the governing bodies in decision-making and to promote activities of common interest to all universities.

Fully aware of its importance, CRUE Spanish Universities (CRUE) began to work on this issue in 2017, when, at the June meeting of the Online Training and Educational Technologies (FOLTE) group of the ICT sector, held at the University of Seville, the foundations were laid for the subsequent collaboration with the Joint Research Centre (JRC) of the European Commission; as well as with the CRUE-Docencia committee, which joined the team at the joint meeting held in July 2018 at the University of Cantabria, which was followed by the FOLTE meeting in July 2019 at the University of Granada, and a meeting of the working team in January 2020 at the University of Seville, where the final approach was agreed.

Although the initial schedule was suspended due to the COVID-19 pandemic, in autumn 2020 an initial phase of a pilot self-reflection restricted to a group of universities was completed in order to validate and revise the questionnaire that was finally used in spring 2021 to complete the self-reflection that is the basis of this report.

To evaluate educators' perception of their digital teaching competence in the Spanish university system, we have relied on the JRC's DigCompEdu and OpenEdu reference frameworks. These frameworks are fundamental as they are, respectively, European and international benchmarks for the definition of digital competences and open education.

In addition to being the first study of these methodological characteristics ever carried out at European level in the field of digital competences and open education, we believe that this study provides important conclusions to help define the next steps and policies to be developed in the university context in order to improve the digital competence of university teaching staff in Spain.



2. Methodology

2.1 Instrument

2.1.1. Instrument review

Based on the DigCompEdu[5] framework (DigCompEdu, 2017), the JRC designed a questionnaire-based instrument for self-reflection on the level of digital competence of educators: the **DigCompEdu Check-In Self-reflection Tool**. This tool was intended for all educational stages, but with proposals for terminological adaptation to each one. It was published via an online tool as a pilot project (Check-In), and initially validated for school education, with validations for higher education and other educational levels pending (Caena and Redecker, 2019). The instrument was written in English and contained 22 questions related to the six areas of the model: 1. professional engagement; 2. digital resources; 3. teaching and learning; 4. assessment and feedback; 5. empowering learners; and 6. facilitating learners' digital competence. All questions had six response options, from the lowest to the highest level of perceived confidence. The tool was designed not only to assess the level of digital competence based on educators' reflections (set at six proficiency levels, from A1 to C2, following a similar pattern to the CEFR) but also to provide specific guidance, based on the responses, for improving each of the **22 competences included in the DigCompEdu Framework**.

In 2018, the JRC started to revise the DigCompEdu Check-In self-reflection tool for higher education with the aim of validating it, so that it could be aligned with the specific terminology and needs of this educational level. As part of this process, it also reviewed the instrument's progression levels and included the area of 'Open Education' as a seventh area, in view of the importance of this issue for universities and their teaching and student communities. Three questions related to the OpenEdu[6] framework were included, with the aim of introducing the Open Education dimension into the reflection process and its relation to the level of digital competence. The final questionnaire therefore consisted of a **total of 25 questions** (22 related to the DigCompEdu framework and three to the OpenEdu framework).

In December 2018, collaboration commenced between the JRC and CRUE Spanish Universities, through the Working Group on Online Training and Educational Technology of the CRUE-ICT Committee, which was later joined by the Teaching Committee, for the instrument's revision. Subsequently, the CRUE-ICT group joined the JRC in revising the instrument, with the aim of translating it into Spanish and adapting it to the Spanish university context, as well as fine-tuning the JRC revision through a qualitative and quantitative validation of the new instrument, so that it would be possible to pilot its implementation in Spain.

In the first phase of the project, the working group in charge of collaborating in the adaptation of the instrument by the CRUE-ICT analysed and translated the revised master document in English, the *DigCompEdu Check-In Self-reflection Tool*. This translation included **the description of each competence area, the complete questionnaire, the feedback for each of the answers, the final report on the results** (with the interpretation of the results by levels) and a **glossary of terms**. In 2020, this translation was aligned with the Spanish translation of the European Framework for Digital Competence of Educators (DigCompEdu) carried out by Fundación Universia and the National Institute of Educational Technologies and Teacher Training (INTEF) on behalf of the Ministry of Education and Professional Training.

5. Fundación Universia and the National Institute of Educational Technologies and Teacher Training (INTEF), on behalf of the Ministry of Education and Professional Training, translated the DigCompEdu framework into Spanish in 2020. The complete Spanish version can be downloaded here: https://sede.educacion.gob.es/publiventa/d/24685/19/0
6. Spanish translation of the OpenEdu framework: https://metared.org/content/dam/metared/pdf/GuiaEducacionAbierta2022.pdf

In addition to the translation, some **further adaptations of the instrument** were carried out without changing the orientation and focus of any of the questions. On the one hand, although the 25 questions were kept, some adaptations were made to tailor each of them (and their answers) to the context of higher education in Spain. The process of translation and instrument adaptation coincided, in its final phase, with the COVID-19 pandemic. Given the impact of the pandemic and the situation of confinement in educational institutions, it was decided to include three additional questions, apart from the reflection, to find out how the teaching staff had perceived the adaptation of their institution to the situation and its impact on the perception of the level of educators' digital competence.

Finally, in order to carry out the study that is the subject of this report, **some demographic questions have been adapted in relation to the teaching profile of the participants**. In this way, questions related to the following are included: university where they teach; professional teaching category (simplified to 'permanent/not permanent'); type of contract (full-time/part-time); gender; age; academic area; years of teaching experience; and profile of the students they teach (age and type of course – unndergraduate, postgraduate or lifelong learning).

The second phase of the project concerned the development of a quantitative methodology for the validation of the instrument through a pilot implementation with 500 participants, followed by a psychometric analysis, described in section 2.1.3. The final goal was for the instrument to be applied in a representative way in Spain. The third phase of the project focused on the representative application of self-reflection through sampling for each of the 51 universities participating in the study. Finally, in the fourth and last phase of the project, the qualitative method, based on focus groups, was applied to discuss the results and propose policy recommendations at various levels.

The four phases of the project are detailed in the sections that follow.

2.1.2. Structure. Dimensions

The instrument for self-reflection on the level of educators' digital competence at university level is organised into three main blocks:

Block 1: Description and initial assessment of competence level

The first block includes a brief description of the tool for self-reflection, as well as the initial assessment of the level of digital competence prior to completing the questionnaire. The proficiency levels included are taken from the DigCompEdu Model: A1 (Newcomer); A2 (Explorer); B1 (Integrator); B2 (Expert); C1 (Leader) and C2 (Pioneer).

- **Newcomer (A1):**
  Newcomers are aware of the potential of digital technologies for enhancing pedagogical and professional practice. However, they have had very little contact with digital technologies and use them mainly for lesson preparation, administration or organisational communication. Newcomers need guidance and encouragement to expand their repertoire and to apply their existing digital competence in the pedagogical realm.

- **Explorer (A2):**
  Explorers are aware of the potential of digital technologies and are interested in exploring them to enhance pedagogical and professional practice. They have started using digital technologies in some areas of digital competence, but without following a comprehensive or consistent approach. Explorers need encouragement, insight and inspiration, e.g. through the example and guidance of colleagues, embedded in a collaborative exchange of practices.

- **Integrator (B1):**
  Integrators experiment with digital technologies in a variety of contexts and for a range of purposes, integrating them into many of their practices. They creatively use them to enhance diverse aspects of their professional engagement. They are eager to expand their repertoire of practices. They are, however, still working on understanding which tools work best in which situations and on fitting digital technologies to pedagogic strategies and methods. To become *Experts*, Integrators just need some more time for experimentation and reflection, complemented by collaborative encouragement and knowledge exchange.

- **Expert (B2):**
  Experts use a range of digital technologies confidently, creatively and critically to enhance their professional activities. They purposefully select digital technologies for particular situations, and try to understand the benefits and drawbacks of different digital strategies. They are curious about and open to new ideas, knowing there are many things they have not yet tried out. They use experimentation as a means of expanding, structuring and consolidating their repertoire of strategies. Experts are the backbone of any educational organisation when it comes to innovative practice.

- **Leader (C1):**
  Leaders have a consistent and comprehensive approach to using digital technologies to enhance pedagogic and professional practice. They rely on a broad repertoire of digital strategies from which they know how to choose the most appropriate for any given situation. They continuously reflect on and further develop their strategies. Exchanging with peers, they keep up to date with new developments and ideas. They are a source of inspiration for others, to whom they pass on their expertise.

- **Pioner (C2):**
  Pioneers question the adequacy of contemporary digital and pedagogical practices, in which they themselves are Leaders. They are concerned about the constraints or drawbacks of these practices and driven by the impulse to innovate even further. Pioneers experiment with highly innovative and complex digital technologies and/or develop novel pedagogical approaches. Pioneers are a unique and rare species. They lead innovation and are a role model for younger academics.

Block 2: Questionnaire[7]

Block 2 is based on the self-reflection questionnaire and is organised into six areas (the six areas of the DigCompEdu framework, and a seventh corresponding to the OpenEdu framework):

- **Area 1: Professional engagement.** Use of digital technologies for communication, collaboration and professional development (4 questions).
- **Area 2: Digital resources.** Search, creation and exchange of digital content. (3 questions).
- **Area 3: Teaching and learning.** Managing and organising the use of digital technologies in teaching and learning (4 questions).
- **Area 4: Evaluation and feedback.** Use of digital technologies and strategies to improve assessment (3 questions).
- **Area 5: Student empowerment.** Use of digital technologies to enhance inclusion, personalisation and active engagement of students in their own learning (3 questions).
- **Area 6: Facilitating learners' digital competence.** Enabling students to creatively and responsibly use digital technologies for information, communication, content creation, well-being and problem solving (5 questions).

7. Appendix 1 reproduces the full questionnaire.

- **Area 7: Open Education:** use of open licences in educational resources, open educational practices for more inclusive teaching, publication of research as 'open science' and availability of research data as 'open data' (3 questions).

Block 3: Relationship with technology, the institutional response to COVID-19, demographic data and final appraisal

The last block is devoted to three types of questions. It includes questions about the respondents' relationship with technology (how long they have been using technology in their classes, what digital tools they use in their teaching, etc.). Three questions are included that are related to the institution's response to the situation created by the COVID-19 crisis – whether the university has provided the necessary equipment, the appropriate tools to work with digital resources, or the resources needed to achieve methodological adaptation. Finally, there are questions about the demographics and profile of the participating teaching staff.

2.1.3. Pilot scheme

Before releasing the questionnaire to all universities, a pilot scheme involving 12 universities was carried out between 21 September and 16 October 2020. Since the aim was to test the correct functioning of the tool and validate the questionnaire, the pilot scheme coordinators at each university were asked to select participants from among staff attached to teaching innovation units or similar services. The idea was to test the questionnaire's design rather than to evaluate the perceptions these individuals had of their level of teaching competence. It was more important, therefore, for us to obtain the maximum number of responses for the purposes of analysis than to have a significant sample of participants. The participating universities and the number of academics appointed to answer the questionnaire were as follows:

- Universidad de Alcalá (50)
- Universidad Carlos III de Madrid (30)
- Universidad Complutense de Madrid (100)
- Universidad Francisco de Vitoria (30)
- Universidad de Granada (100)
- Universidad Internacional de Andalucía (30 from universities other than Granada and Seville)
- Universidad de La Rioja (30)
- Universidad Nebrija (30)
- Universidad Politécnica de Madrid (100)
- Universidad Politécnica de Valencia (100)
- Universidad Rey Juan Carlos (50)
- Universidad de Sevilla (100)

Of the 750 people invited, 554 gave valid answers. The responses received were used to validate the questionnaire, which confirmed the overall usefulness of the instrument as designed. On the basis of this validation, together with the comments received, some of the questions and answers were rewritten in order to generate the final questionnaire. The validation process of the form is described in the following section.

2.1.4. Instrument validation

The responses received in the pilot were analysed to validate the instrument through a psychometric analysis. The main findings of the validation are summarised below.

Consistency

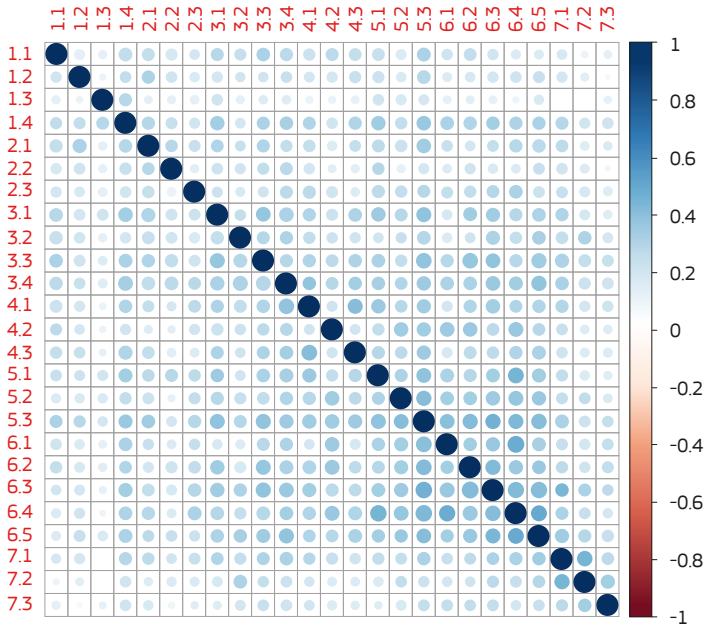
The internal consistency of the results received was verified by means of Cronbach's alpha coefficient and a result of 0.87 was obtained. Taking into account that results above 0.7 are considered acceptable in most cases related to social sciences, a value close to 0.9 suggests that the consistency of the results obtained by the questionnaire was relatively high.

Correlation

As can be seen in Figure 1, the cross-correlation between items in the questionnaire showed values that were:

- Relatively low, so that the items can be considered sufficiently different from each other.
- Always positive, so that the variables correlate in a directly proportional manner.

Figure 1. Matrix of correlations between questions, with heatmap



Discrimination

Since the items on the instrument had more than two possible responses and there was no right or wrong answer, but they ranged from very low (0) to very high (6), within the field of Item Response Theory (IRT) the Graded Response Model (GRM) (Samejima, 1997) was used to validate the discrimination between responses, i.e. the relationship between the choice of one or other response level and the measurement of the latent variable behind the responses (in this case, the perception of the educator's digital competence). The results were satisfactory in all respects, which meant that there was good discrimination between responses. The main results are presented in more detail in Appendix 2.

Scale

The original **DigCompEdu Check-In Self-reflection Tool** questionnaire consisted of a range scale to convert the numerical score results to its corresponding category, based on an approximation using the mean and standard deviation from the pilot conducted with educators in Germany (Ghomi and Redecker, 2019). The instrument used on this occasion, however, included an additional area, so that the maximum obtainable score was higher. For this purpose, the ranges were expanded proportionally to the original instrument as shown in Table 1.

Table 1. Adaptation of the DigCompEdu scale (Ghomi and Redecker, 2019) to the instrument adapted for the study

Categoy	DigCompEdu Check-In Self-reflection Tool (original)	Instrument adapted for the study
A1	[0, 19]	[0, 22]
A2	[20, 33]	[23, 38]
B1	[34, 49]	[39, 56]
B2	[50, 65]	[57, 74]
C1	[66, 80]	[75, 91]
C2	[81, 132]	[92, 150]

Validation

In view of the tests carried out and the results obtained in the psychometric analysis, the instrument was considered valid and adequate for its purpose.

In addition, Figure 2 shows the distribution of overall scores obtained by the participants in the pilot, which, as can be seen, have a distribution similar to normal.

Figure 2. Distribution of the overall score of the pilot results

2.2 Design of quantitative study

2.2.1. Expanding the project to the Spanish university system

Once the pilot scheme had been carried out and the instrument validated by psychometric analysis, the project was extended to the entire Spanish university system through CRUE. To this end, through the ICT and teaching committees, the heads of the vice-rectors' offices dealing with the digital competences of teaching staff were convened, and around 60 universities initially joined the project.

In each university, a co-ordinator was appointed to manage the fieldwork. As described in the following section, the data is drawn from a representative sample of different sectors of university teaching staff. For this reason, the project co-ordinators at each university selected the sample of people who were invited to answer the questionnaire. During the time the questionnaire was open, participation by sector was monitored periodically in order to increase the response rate and try to maximise the representativeness of the sample.

The fieldwork was carried out during the months of May and June 2021.

In the end, 5073 valid observations were obtained from 51 universities, which is a very significant sample for CRUE as a whole.

2.2.2. Obtaining the sample

Population

The analysis was carried out at the national level. According to data from the Integrated University Information System (SIIU), for the 2018-2019 academic year the teaching population in this area comprised a total of 118,875 academics, of whom 99,194 (83.4%) worked at public institutions and 19,681 (16.6%) at private ones. The total number of universities is 81, 48 of which are public and 33 private.

Initially, the levels specified in Table 2 were determined as relevant for the study and for the sample calculation.

Table 2. Analysis levels used in study

Level	Description
Total	Total teaching staff in Spanish universities
University	Each institution
Academic area	Sciences Social and Legal Sciences Engineering and Architecture Health Sciences Arts and Humanities
Professional status	Permanent Non permanent
Gender	Male / Female / Other

As the aim was for the study to be statistically significant at the university level (implying, therefore, that it would also be significant at the global level), the sample size required for each of the institutions involved was determined.

Determination of sample size

Considering that the questions in the DigCompEdu questionnaire are answered on a Likert-type scale with 7 options, the appropriate sample size was calculated using the approximation proposed by Park and Jung (2009). Park and Jung note that, in general, the results of a survey using such a scale are not independent, but correlated. This makes sense, since in the case of DigCompEdu it is likely that an academic who scores highly on one question in a block will also score highly on other questions (Tastle and Wierman, 2007). In this case, the equation would be as follows:

$$n = \frac{z^2_{al2} \cdot C^2}{kD^2}(1+(k-1)\rho)$$

Where k is equal to the number of items in the scale (7 in this case), C is the variation coefficient (variance divided by the mean), Del is the relative tolerable error (5%) and rho (ρ) is the correlation coefficient. The values of rho and C are not known in advance, so an estimate is needed, which, moreover, should ideally be conservative. Park and Jung (2009) themselves recommend the use of C=0.5 and ρ=0.5 as these are the upper ranges of the values typically found in most surveys of this type.

Thus, depending on the relative error to be tolerated and the desired alpha for the confidence interval, the total sample sizes per university are shown in Table 3.

Table 3. Sample sizes required according to set parameters

(ρ=0,5, C=0,5, k=7)	alpha = 0,05 (95% confidence)	alpha = 0,1 (90% confidence)
D=0,05	220	155
D=0,1	55	39

It should be noted that the assumptions about rho and C were verified through the pilot test, in which more than 500 responses were obtained from several partner universities. This test, conducted by convenience sampling, provided information on the actual rho and C parameters that might be expected. In this case, the mean for typical C was close to 0.6 (somewhat higher than assumed) while rho was 0.25 (much lower than assumed). The sample required for a D of 0.05 and an alpha of 0.05 would therefore be approximately 200 responses. As this is fewer than the proposed 220 responses, the proposed sample size was validated.

Correcting for finite population

After determining the overall sample size for each university, it was nonetheless necessary to take into account that populations, in general, cannot be considered infinite at this level. To allow for this, in all cases a correction factor was applied according to the following equation:

$$n = \frac{n_0 N}{n_0 + (N-1)}$$

This correction yielded a significantly lower number for smaller universities, although they still invited a higher percentage of their total academic staff to participate. The correction was negligible for larger universities. Several examples of the resulting correction for the total number of academics are presented in Table 4:

Table 4. Example of the effect of correcting for finite population

Teaching staff	100	250	1000	2500	10000
Base sample	220	220	220	220	220
Corrected sample	69	117	180	202	215

The interpretation is as follows: for a university with 250 academics, with the base sample of 220 (n0), the correction implies that 117 completed surveys are sufficient to ensure representativeness at the same level.

2.2.3. Performance of sampling

Performance of sampling

The sampling was performed for each university using the composite stratified sampling method. Therefore, each university (through its coordinator) carried out the following steps:

1. The complete list was obtained of academics and their strata, by:
   - Academic area
   - Professional category
   - Gender
2. The total (corrected) sample was divided proportionally between the weight represented by each stratum.
3. A random sample was selected within each stratum until the required number of self-reflections was achieved in that stratum.
4. The self-reflection tool was sent only to the academics who had been selected to take part.
5. In case of absence, inability to respond or similar, another person was chosen at random and the survey was sent to that person.

Table 5 (in the following page) shows an example of the distribution in numerical terms:

Table 5. Example of sample distribution across the various strata

Sample base 220		Social and Legal Sciences		Engineering and Architecture		Arts and Humanities		Health Sciences		Sciences		Branch not specified		Totals		
University	Category	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	TOTAL
(NAME)	Total															249
	PERMANENT	20	25	4	7	13	12	12	13	18	20	0	0	67	77	144
	NON PERMANENT	17	19	1	2	8	7	19	20	4	4	3	1	52	53	105

It should also be noted that rounding (always upwards) resulted in a final sample size higher than the base figure, due to the proportions and the intention to ensure representativeness while upholding the conservatism principle.

Significance

Given the required base sample of 220 responses, any filter or combination containing more than 220 items was considered significant (with a 95% CI and a relative margin of error of 5%). If it contained fewer, it would have a lower level of significance. Requesting 220 (corrected) responses from each of the universities therefore ensured that their individual results were significant; that their aggregation at the national level was, by a large margin, significant; and that each of the strata (e.g. women who are permanent staff in the arts and humanities) could also be significant at the national level, although there was no guarantee of this as it depended on the universities' participation.

2.3 Design of the qualitative study

2.3.1. Objectives

After conducting the self-reflection exercise based on the DigCompEdu and OpenEdu frameworks, as indicated above, both CRUE and the JRC considered it necessary and appropriate to add a qualitative dimension to the study by means of focus groups, in order to further explore some of the quantitative results obtained. This approach makes for a richer interpretation and contextualisation of the phenomena analysed, as well as a natural and holistic point of view (Hernández-Sampieri, Fernández-Collado and Baptista, 2010), based on participants' experience (Marshall and Rossman, 1999). The focus-group qualitative technique involves bringing together a group of people to explore attitudes and reactions to a particular topic (Juan and Roussos, 2010). Focus groups are based on discussions that are structured to varying degrees and oriented towards a particular topic of interest or relevance to both the participant group and the researcher (Edmunds, 1999). Focus groups are not simply a way of eliciting individual accounts but a way of generating the negotiation of meanings through intra- and interpersonal debates (Cook and

Crang 1995). In that way they are a research tool that gives a 'voice' to those who have participated in the research, giving them the opportunity to decide what is relevant and important to the understanding of their experiences (Liamputtong, 2011).

The main objective of the application of this qualitative technique in the study was **to understand some of the self-reflection exercise results and to outline concrete and feasible national, institutional and inter-institutional policy recommendations to enhance the development of digital competence in higher education**.

2.3.2. Group composition

The focus groups were constituted by deliberately selecting participants on the basis of criteria aligned with the research, taking into account the profile of respondants in relation to the object of study. In this way, expert profiles were selected from Spanish public and private universities in the field of university teaching, the professional development of academics, educational innovation, educational technology, digital education, academic management and the development of digital competences for teaching, learning and training. For the selection process, the universities participating in the study were consulted directly through the coordinating offices involved in the project, which proposed up to a maximum of two members of staff per institution. In this way, a total of **32 members of staff from 26 Spanish universities participated in the discussion**, organised into various groups. In order to achieve a proper dynamic and interaction between participants (Noaks and Wincup, 2004), and taking into account their total number, **three groups were organised, comprising between 9 and 11 participants**. The universities involved in the focus groups and the participants' profiles can be found in Appendix 3.

2.3.3. Implementation of the focus groups

Once the quantitative data had been analysed, the process of designing and forming the three focus groups began in July 2021. These groups met for discussion between 22 and 27 October 2021. In order to facilitate the participation of all the people involved, and the collection and analysis of the data, the three groups met virtually and were conducted via videoconference. The synchronous sessions lasted 90 minutes and were recorded for later viewing and transcription.

In order to stimulate the communicative process of debate, participation, group self-reflection and dialogue building, which is essential for data collection in the application of this qualitative technique, the three groups were moderated on the basis of pre-established lines of debate. These lines of discussion, based on the quantitative results, were divided into six axes:

- **Axis 1:** Development of the competence areas with a lower level of perception by university teaching staff: Assessment and Feedback, Student Empowerment and Development of Students' Digital Competence.
- **Axis 2:** Development of Open Education in Spanish universities.
- **Axis 3:** Relationship between the investment made by Spanish universities in digital technologies (equipment, tools and methodological adaptation) in response to COVID-19 and the level of educators' digital competence.
- **Axis 4:** Level of digital competence for teaching, by age range. Senior academics (>60 years) and new academics (25-29 years).
- **Axis 5:** Design and certification of digital competence training for academics.
- **Axis 6:** Objective assessment and certification of the level of educators' digital competence.

A seventh, open theme was included to address issues not covered by the thematic axes above.

3. Results

3.1 Quantitative results

3.1.1. Dataset

Initially, the starting point was 5,111 total responses, obtained from the questionnaire distributed to the participating universities. A first analysis of the data showed that there were some observations that appeared to be erroneous (for example, all responses marked with 0 or with the maximum score). On the other hand, universities with fewer than 10 responses were also discarded, as they were likely to be due to typing errors or to universities not participating effectively. As a result, 24 observations were eliminated, leaving a total of 5,087. Only the scores 0 and 149 were removed from the totals: they were both likely to be invalid because they appeared much more often than the scores in the adjacent ranges – for example, there were 9 responses with 149, when there were only seven between 145 and 148. Overall, 12 answers were removed, leaving a total of 5,075. Finally, the answers given by those under 25 years of age were also eliminated, because there were only two, and after a detailed analysis it was considered that these were probably erroneous observations given the characteristics indicated in the remaining variables. This left a total of 5,073 valid observations (Table 6).

Table 6. Observations remaining after each stage of elimination

Description	Observations
Responses received	5,111
Elimination of non-participants (n<10)	5,087
Elimination of anomalous scores	5,075
Elimination of under-25s	5,073

In short, the final dataset consisted of the 51 universities with more than 10 responses and the 5073 observations that we considered valid after the initial filtering. What follows is a description of the dataset obtained and the starting point for the rest of the analysis.

Descriptive features

The large majority of participants were permanent rather than non-permanent teaching staff (70.2% and 29.8% respectively), but both groups were sufficiently large for the analysis. According to the SIIU data, the respective proportions across the Spanish university sector as a whole are approximately 55% and 45%, but it should be borne in mind that approximately 25% of the total academic staff are associate lecturers, whose looser ties with the university may have hindered their participation, affecting the weight of the non-tenured teaching staff while, on the other hand, reflecting more accurately the proportion of those pursuing an academic career

In terms of type of contract, there was a similar split, the only qualification being that Assistant Lecturers are non-permanent, full-time staff. Thus, the full-time category was reinforced (77.3%) with respect to part-time academics (22.7%), who were in the minority.

The overall proportion of men (52.6%) and women (44.7%) was balanced, while 2.7% of the respondents preferred not to state their gender. According to the SIIU data, 58% of the population is actually male.

In terms of age, more than half of all academics were over 50 (51.1%), with the largest proportion coming from the 50-59 age group (38%). There were a good number of academics between 40 and 49 (29.5%), almost twice as many as those aged 30-39 (15.4%). Academics aged under 30 and those who

preferred not to state their age were under-represented, with each accounting for less than 2% of the responses. The distribution was balanced and reflected the existing situation in the Spanish university sector.

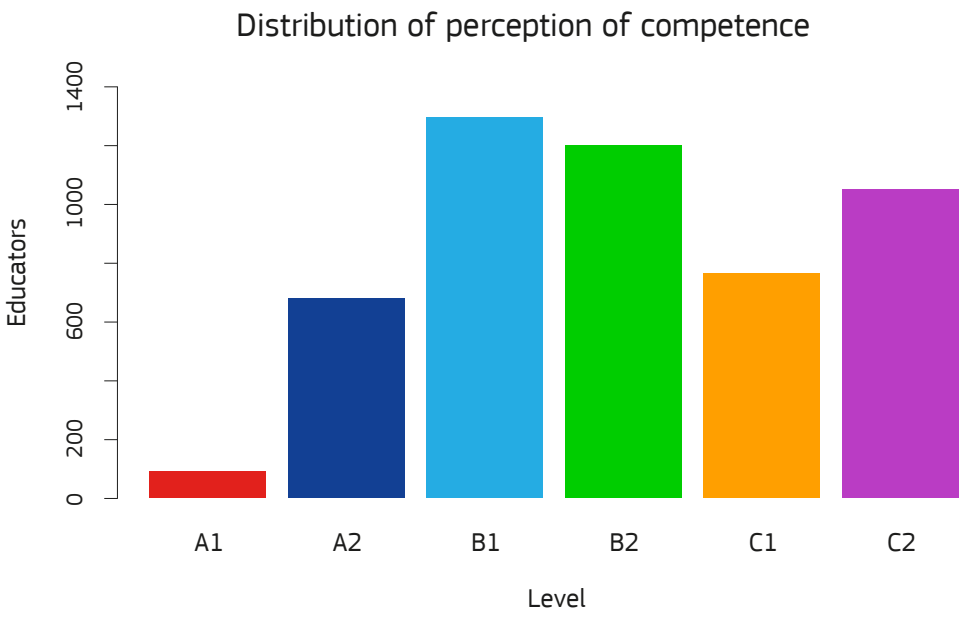
There was a certain predominance of Social and Legal Sciences (one-third of the responses), followed by Engineering (one-quarter). The other three academic areas were fairly evenly distributed. This coincides with the Universities' Integrated Information System (SIIU) data: 32.5% for Social Sciences, almost 20% for Engineering and Architecture (here slightly over-represented), about 12% for Arts and Humanities (similar here), 19.5% for Health Sciences and 14.5% for Sciences, here slightly under-represented.

Almost all (91.7%) of the teaching staff taught undergraduate students as part of their work. In contrast, only half (47.8%) taught postgraduate students. A very small percentage of participants (8.5%) also provided in-service training.

Initial competence, as estimated by the teaching staff before completing the questionnaire, was normally distributed. On completion, the general response profile remained very similar to the initial one; however, there was a tendency to consistently lower the initially estimated score. The perceived level of competence resulted in a median of B2, although in terms of frequency B1 was more common (and almost half – 49.1% – of the teaching staff were concentrated at level B1 or B2).

In Figure 3, the final distribution by level can be seen. The distribution is similar to normal except in two respects: an extremely low occurrence of A1 scores, and a higher occurrence of C2 scores than might have been expected.

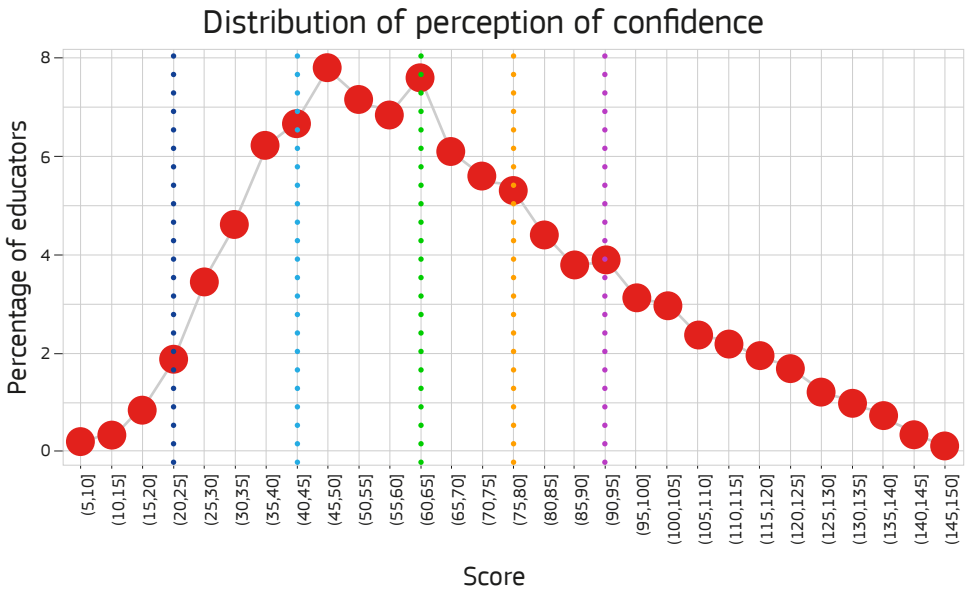
Figure 3. Distribution of perception of competence by levels



The median score of 63 points is in the B2 range (57 to 74), towards the lower end. At 67 points, the mean score is close to the median, but because that is due to the number of scores in the C2 range, the mean is actually not very informative. However, it should be noted that the most common score is 46, i.e. in the B1 range.

The overall distribution, grouped by 5-point brackets, is shown in Figure 4, where the dotted lines roughly mark the points at which there is a category shift:

Figure 4. Distribution of perception of competence in five-point intervals



3.1.2. Overall results

Professional status

No significant differences were found in this dimension; therefore, the split between non-permanent and permanent academic staff can be considered not to have a significant effect on their own perception of digital competence.

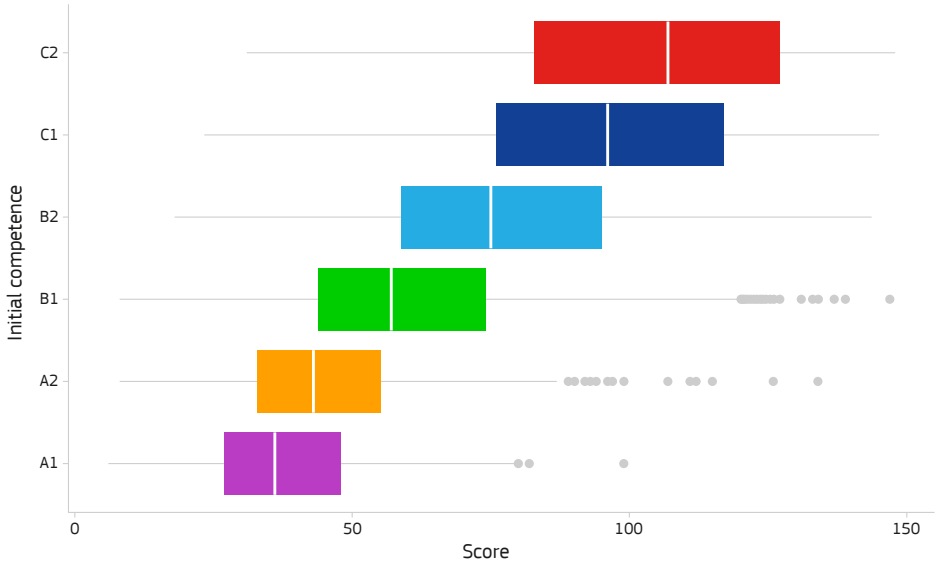
Type of contract

As with professional status, no significant differences were found in terms of type of contract: the perception of digital competence does not seem to be affected by issues of permanence.

Initial competence

This dimension shows (Figure 5) how the instrument's discrimination is consistent; those who responded that their initial competence was lower also obtained proportionally lower results on the actual instrument score and vice versa. Those who gave higher values for their initial competence also obtained higher scores on the scale as a result.

Figure 5. Score distribution per initial perceived competence



Gender

No significant differences were found in this dimension; we can therefore regard gender as a characteristic that has no impact on educators' perceptions of digital competence.

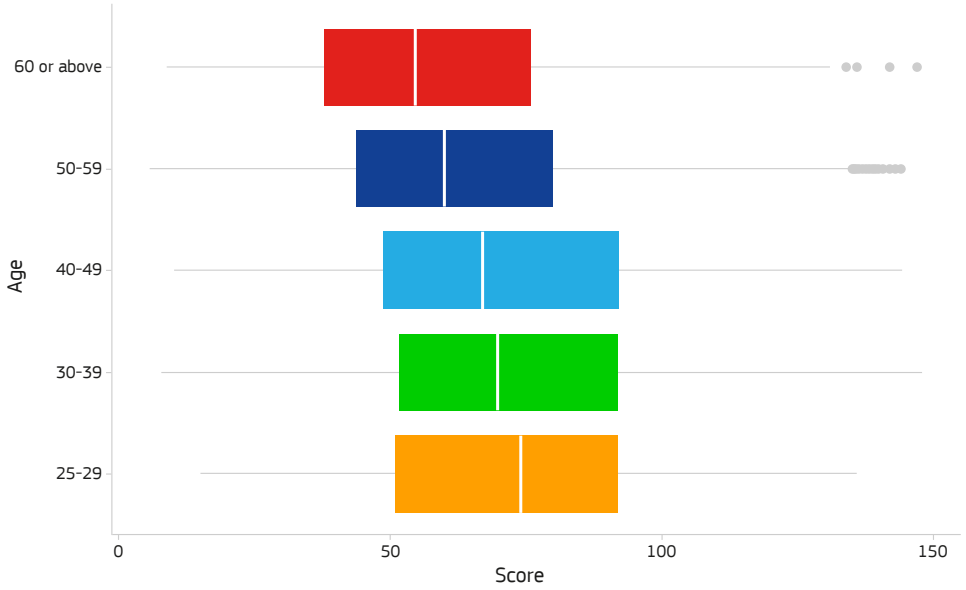
Age

There were significant differences in self-perception between age groups. In particular:

- The oldest age group (60+) had a worse self-perception than any other group.
- The second-oldest age group (50-59) had a worse self-perception than any younger group and a better self-perception than the 60+ group.
- There were no significant differences between the other groups (comprising ages 25-49), so their self-perceptions can be regarded as indistinguishable.

Thus, significant differences are found among the described age groups above. These results are consistent with those obtained using teaching experience as a variable, given the correlation between age and years of experience.

Figure 6. Score distribution per age group

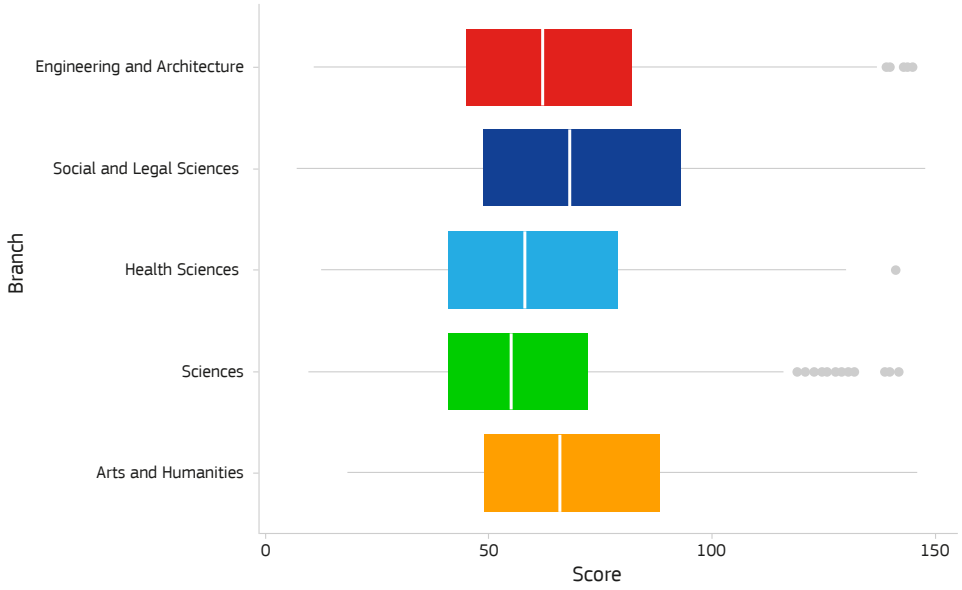


Academic area

There were significant differences across the three blocks (Figure 7):

- Academics in Social Sciences and Arts and Humanities had the highest self-perception in all cases.
- In comparison, academics in Engineering and Architecture had a lower self-perception.
- Academics in Sciences and Health Sciences had the lowest levels of self-perception.

Figure 7. Score distribution per academic area



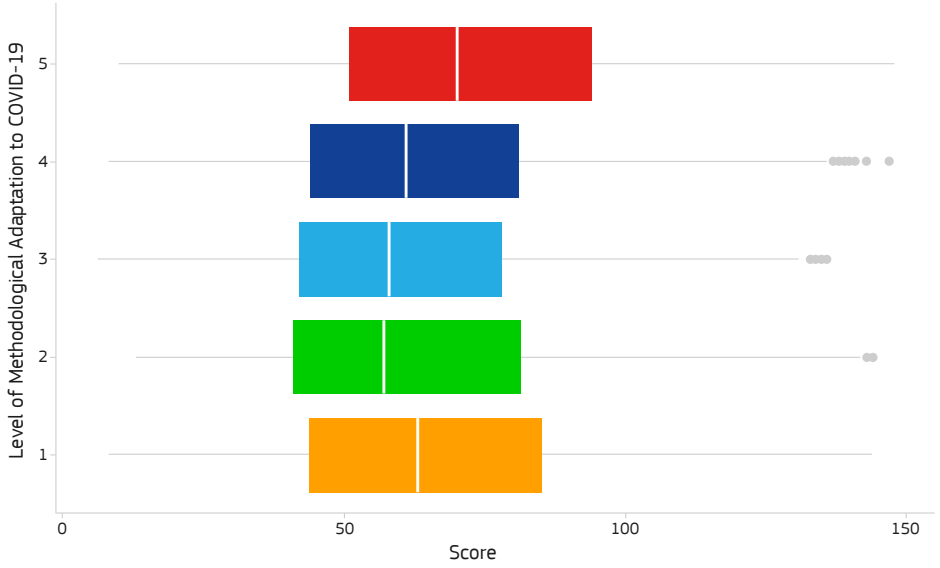
Student profile

Here it is interesting to note that those who teach at postgraduate level had a clear tendency to score significantly higher in their perception of competence compared to those who do not teach at postgraduate level (and who, in general, only teach at undergraduate level).

Perception of institution and perception of COVID-19 adaptation

This category encompassed a series of questions related to the response to COVID-19's impact on the universities. In most cases, the group of academics with the highest score for this perception (5 out of 5, i.e. those who felt strong support from their institution) also obtained significantly higher results in terms of their perception of digital competence (see Figure 8). However, for any other score (whether low, medium or medium-high), there were no significant differences between groups.

Figure 8. Score distribution per perceived methodological adaptation



Interactions between variables

Although tests were carried out for interactions for all pairings of variables, there was no apparent interaction between variables in the study. Only the interaction between academic areas and age is striking and deserves closer scrutiny, as it seems that there may be some influence. The initial conclusion about age, which was that the older the person, the lower the perception, seems to be confirmed quite clearly for Engineering and the Arts; however, there seemed to be no marked difference in Social Sciences, for example (see Figure 9). Table 7 presents a detailed analysis of these blocks.

Figure 9. Score distribution per academic area and age group

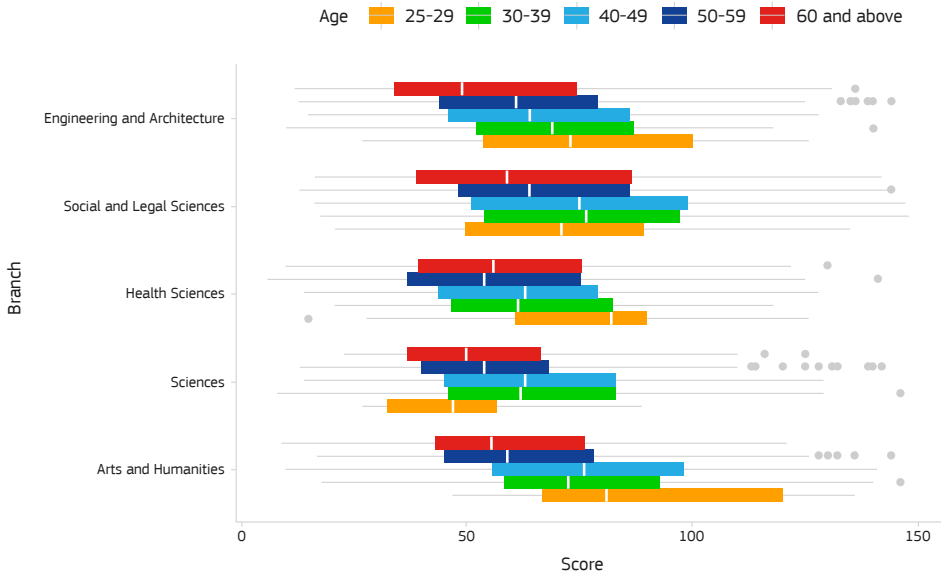


Table 7. Analysis of score distribution per academic area and age group

Knowledge branch	Observation
Arts and Humanities	The 25-29, 30-39 and 40-49 age groups were equal to each other, as were the 50-59 and 60+ age groups. That is to say, there were two blocks, <50 and >50, as opposed to the general pattern, which had three.
Sciences	In the sciences, those aged 60+ rated themselves as less competent than those aged 30-49, and those aged 50-59 less competent than those aged 40-49 (but not than those aged 30-39). There were no differences for the rest. Of particular note is how the youngest (25-29) performed indistinguishably from the older age groups. The divisions are more blurred.
Health Sciences	In Health Sciences, although a priori the analysis indicated there might be possible difference between groups, after correcting through the comparison of pairings, any significant difference disappeared; thus, in this academic area, all groups may be said to have viewed themselves as having a similar level of confidence.
Social and Legal Sciences	In the case of Social and Legal Sciences, there was again a clear split between those aged <50 and >50 (with the under-50s exhibiting the greater competence) – except for the 25-29 group, which was not significantly different from any other group.
Engineering and Architecture	In the case of Engineering and Architecture, the differences are more accentuated with the oldest group (60+), which had a lower level of competence than any other, while the difference between the groups aged 50-59 and 30-39 was representative.

In short, the dividing line generally appears at 50 years of age, while if the five academic areas are taken together, a second dividing line emerges between the 50-59 and the over-60 age groups, which is not evident if the groups are broken down by academic area.

3.1.3. Results per area

As explained in the corresponding section, the scale scores are arranged into seven groups of items, called areas. The number of items in each area is not the same in all cases. In order to compare the results in the different dimensions, the values have been transformed to a scale from 0 to 100.

Scores distribution

Table 8 shows each area's centralisation and dispersion values:

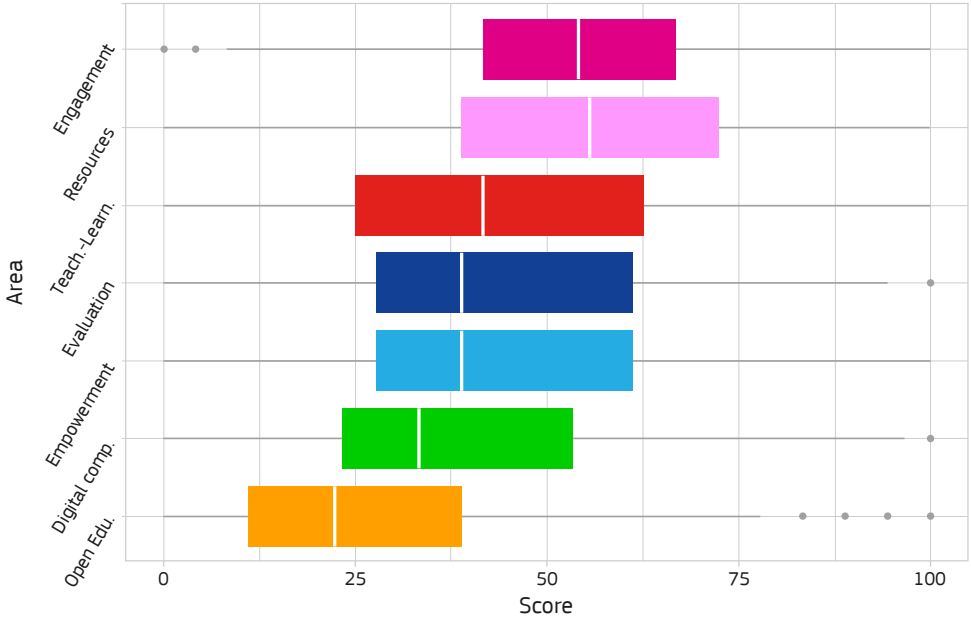
Table 8. Descriptive statistics of scores in the different areas

Area	Mean	Standard deviation
Professional engagement	55.9	17.8
Digital resources	56.4	21.5
Teaching and learning	46.0	24.0
Evaluation and feedback	42.2	21.3
Student empowerment	43.9	23.0
Facilitating learners' digital competences	40.3	23.5
Open Education	28.6	22.7

Scores for the first two areas are, in general, higher than for the others. At the other extreme, scores for the use of Open Education are clearly lower than for the rest.

The graphical analysis of the distributions of these scores confirms this pattern when comparing areas.

Figure 10. Score distribution in each area



Distribution per level

To study the scores by level, the six levels were grouped into three categories, labelled as follows: Newcomer (A1 and A2); Integrator (B1 and B2); and Leader (C1 and C2) (Table 9). The cut-off points for each category were as follows:

- Newcomer: up to 5 points for *Digital Resources*, *Evaluation and Feedback*, *Student Empowerment* and *Open Education*; up to 7 points for *Professional Engagement* and *Teaching and Learning*; up to 8 points for *Facilitating Learners' Digital Competence*.
- Integrator: 6 to 9 points for *Digital Resources*, *Evaluation and Feedback*, *Student Empowerment* and *Open Education*; 8 to 13 points for *Professional Engagement* and *Teaching and Learning*; 9 to 16 points for *Facilitating Learners' Digital Competence*.
- Leader: between 10 and 18 points for *Digital Resources*, *Evaluation and Feedback*, *Student Empowerment* and *Open Education*; between 14 and 24 points for *Professional Engagement* and *Teaching and Learning*; between 17 and 30 points for *Facilitating Learners' Digital Competence*.

In the first two areas, *Professional Engagement* and *Digital Resources*, approximately half of the respondents were in the Leader category. In the areas of *Teaching and Learning*, *Evaluation and Feedback*, *Student Empowerment* and *Facilitating Learners' Digital Competence*, they were almost equally divided among the three categories. Finally, in the area of *Open Education*, the majority were at the Newcomer level.

Table 9. Distribution of participants by category for each area

Area	Newcomer	Integrator	Leader
Professional Engagement	7.2	46.0	46.8
Digital Resources	12.7	32.4	54.9
Teaching and Learning	33.1	33.2	33.7
Evaluation and Feedback	33.7	36.7	29.6
Student Empowerment	33.8	33.4	32.8
Facilitating Learners' Digital Competence	36.4	39.1	24.4
Open Education	60.9	24.1	15.0

Relationship with other features

As a continuation of the previous analysis, the distribution within levels of each of these areas was compared across the age groups and the different academic areas. With respect to age, there was a fair degree of homogeneity between the groups. It should only be noted that the scores of the 50-59 and 60+ age groups were lower than the rest for all dimensions, especially for *Evaluation and Feedback*, *Student Empowerment*, *Facilitating Learners' Digital Competence* and *Open Education*. However, the differences were not of sufficient magnitude to be significant.

With regard to the comparisons by academic areas, again there was considerable homogeneity across areas. It is worth noting that the *Arts and Humanities* group, together with the *Social and Legal Sciences* group, scored slightly higher than the other areas for *Evaluation and Feedback*, *Student Empowerment and Facilitating Learners' Digital Competence*.

3.2 Qualitative results

3.2.1. Data source

For the qualitative analysis, the three focus groups were transcribed in order to work directly with the texts deriving from the discussion, these being the main source of data. In addition to these, the recordings made and the notes taken by the moderators were also taken into account.

The analysis was based on a constant comparison analysis (Strauss and Corbin, 1998), centred on three stages: (1) open coding: identification of segments and content units; (2) axial coding: grouping the codes into categories; and (3) selective coding: categorisation by theme. This type of analysis allows for comparison between the different groups that make up the study and for assessing both saturation in general and saturation across groups in particular (Onwuegbuzie, Leech, Dickinson and Zoran, 2011).

3.2.2. Analytical categories

After selective coding, the following categories and subcategories were identified. These are strongly conditioned by the proposed axes of debate (Axes 1-6) indicated above, since the discussion was organised around them:

- **C1: Evaluation and Feedback**
  - C1.S1.: Academic regulation and organisation
  - C1.S2.: Teaching methods
- **C2: Facilitating Learners' Digital Competence**
  - C2.S1.: Educators' role in enhancing students' competence
  - C2.S2.: Initial level of students' digital competence
- **C3: Open Education**
  - C3.S1.: Inclusion in institutional policies
  - C3.S2.: Lifelong learning
- **C4: Impact of the COVID-19 pandemic on the fomenting of educators' digital competence in Spanish universities**
  - C4.S1.: Actions taken during lock-down
  - C4.S2.: Post-lockdown actions
- **C5: Differences in competence level by age range**
  - Tailored initial and ongoing training initiatives
  - Pedagogical issues related to using technology in the classroom
- **C6: Courses to increase educators' digital competence**
  - C6.S1.: Characteristics of courses
  - C6.S2.: Certifying training
- **C7: Evaluation of level of digital competence**
  - C7.S1.: Assessment model
  - C7.S2.: Certificate of level of competence

3.2.3. Overall results

C1. Evaluation and Feedback

Area 4, *Evaluation and Feedback*, is one of the areas in which academics claimed to have a lower perceived level of competence. According to the experts who took part in the focus groups, two main subcategories can be identified which could explain this fact. On the one hand, the **Academic regulation and organisation of teaching** and, on the other, the **teaching and assessment methodologies** developed at university level.

With regard to the regulations, these are considered to 'constrain the very structure of assessment'. Moreover, the size of the groups and the teaching and research load of the teaching and research staff (PDI) make it difficult to carry out a formative assessment (large groups). As one of the participants pointed out, 'the teaching load, together with research, makes it difficult for teaching staff to carry out formative assessment and provide continuous, quality feedback'.

In order to improve in this area, the groups agreed on the need to change the 'conception of teaching', and that this 'should not be centred solely on the teaching staff and content' but should be more focused on active learning systems. It is therefore essential to work on new methodological approaches and for academics to have continuous techno-pedagogical support and specific courses on digital assessment.

Assessment in Spain has traditionally been face-to-face, and 'teaching staff have little experience in digital assessment systems'. However, in many universities there are groups of academics specialising in methodological research who are already working on these new approaches and, in the wake of the COVID-19 pandemic, there have been successful experiences in assessment with various methods involving the use of technology.

C2: Facilitating Learners' Digital Competence

As stated in the study's Quantitative results, Area 6, which corresponds to *Facilitating Learners' Digital Competence*, had a somewhat lower level of perceived competence when compared with other areas. On this point the group mentioned two key aspects: the **role of academics in the process of empowering and developing learners' digital competence and the initial competence level of learners**.

All three groups agreed on the importance of the role of academics in this process. Some participants suggested that 'in order to empower students in digital competence, it should be the academics who train or support them in digital competence'. However, there was no clear consensus on this statement. Another group considered digital competence to be a 'transversal' competence, which should be developed beyond the subjects themselves. In general, academics felt more comfortable developing subject-specific competences, because they have more experience.

On the other hand, one of the limitations in *Facilitating Learners' Digital Competence* is their initial level when they enter university. 'Students are usually considered to be digital natives, and this is creating a false sense of their ability to use technological tools,' said one focus group participant. On this point, the group agreed that the level of digital competence of students is low and that if they do not engage with adequate and specific digital competence development courses, they will not achieve the minimum level required. The fact that they handle digital tools does not make them digitally competent. Some individuals indicated that students have 'more control and

agility', but this is not enough and they need to develop digital competences for learning. Finally, others pointed to significant differences in the level of digital competence among students, especially when comparing students in face-to-face and online degrees, those taking the latter having a slightly higher level.

C3. Open Education

Open Education, Area 7 of the study, had the lowest average score in the self-reflection of teaching staff in Spanish universities (28.6), with most of them falling into the 'Novel' category. Although it is not possible to establish the cause of this score from the collective self-reflection data, there are several factors that suggest possible reasons for it. JRC studies show that universities with an institutional Open Education strategy as part of their mission and whose strategic plan is co-created and available to everyone tend to be successful in implementing open educational practices (OpenEdu 2016, OpenSurvey, 2016, OpenEdu Policies 2017, Open Education Guidelines, 2019).

In the focus groups, several comments suggested that both the frequent absence of a strategic document and the lack of institution-led ongoing professional development courses in the area lead to a lack of awareness of the principles and practices of Open Education, which is much more than Open Educational Resources (OER), MOOCs (Massive Open Online Courses) and Open Science. Open educational practices include the institution's policies on accessibility, open pedagogies and collaborations, as well as open management based on transparency and sharing, as indicated by the 10 Open Education dimensions of the OpenEdu framework. **'There is a lack of institutional policies and strategies in universities to encourage Open Education'**, the groups stated. 'The Open Education actions that have been developed are mostly very specific and small, and therefore fail to transcend a small group of faculty and become an institutional strategy', they argued.

Therefore, in order to promote Open Education, the different types of content licensing should be explored in more depth. Similarly, if we have open and easy-to-use repositories, resources can be adapted and accessed in a shared way by several institutions. In addition to supporting the circulation of information on the subject and lifelong learning, academic staff should be recognised and rewarded for their dedication to learning and the application of open educational practices in their institutions and with their students. The groups agreed that **'There is a need to broaden the critical mass in order to increase the level of competence in this area'**.

C4: Impact of the COVID-19 pandemic on the fomenting of educators' digital competence in Spanish universities

The COVID-19 pandemic has had a significant impact on many areas, including education. In the academic year 2019-2020, Spanish universities had to face a situation they had never experienced before. Consequently, as mentioned in the instrument description, it was decided to include some questions related to the impact of the pandemic on the promotion of digital competence in teaching. The three focus groups agreed on the different areas that have been affected by the pandemic, as well as the new challenges that have arisen in its wake: the **acceleration of the digital transformation of university classrooms**; the **need for staff specialised in digital pedagogy and techno-pedagogical support**; the **promotion of professional development opportunities in digital competence**; and the **initiatives to be developed in the post-pandemic context**. In this regard, two main lines can be identified: initiatives carried out during the first phase of the pandemic (confinement) and initiatives that have been maintained or developed in subsequent phases.

The pandemic has accelerated digital-transformation projects that were already on the roadmap of many universities, such as the digitisation of classrooms

or the promotion of digital scenarios, as well as the implementation of hybrid systems. During the pandemic, these have worked very well, but it is now necessary to reflect on and consider the future of this technology, as well as the new models of Teaching and Learning that they represent (hybrid education, understood as a teaching model that involves the presence of students both physically, in the classroom, and remotely, through a videoconferencing system). It is therefore necessary to rethink the return to face-to-face teaching, in order to maintain the advances made during the pandemic and take advantage of the benefits offered by the use of technology by integrating them into the Teaching and Learning processes.

The integration of technology has been key and the groups agreed that it has worked well. However, the pedagogical aspects still need to be further developed. 'Technology and methodology go completely hand in hand,' said one of the participants, so it is necessary to 'continue to insist on the importance of incorporating technical staff in the field of educational innovation and educational technology, who can support the processes of professional development and accompanying academics in the development of their digital competences'.

Training has been key during the pandemic and all the universities have worked in this area. In this regard, 'it is necessary to offer structured training to take advantage of the potential of technology, with a methodological approach'. During the pandemic, academics have been forced to use technology, while some needs have been identified which must be addressed if academics' digital competence is to be improved. Efforts must be sustained to motivate academics to continue their professional development along these lines. In addition, it would be useful to encourage horizontal communication between academics and to promote projects between subjects and disciplines, and even between faculties, to improve the integration of technologies in teaching and learning and the development of digital competences.

C5: Differences in level of competence by age range

The study found that differences in competence by age range appear basically between those under and over 50 years of age. In some academic areas, these differences are more nuanced. For example, in the field of 'Science', new academics (aged 25-29) express a perception similar to that of older age groups, which is not found in other fields. For these groups, the experts suggest specific actions to be included in professional development plans in a non-discriminatory way, while at the same time enhancing their skills. It was highlighted that for new academics there are specific training plans, in which digital competences can be included. For academics aged over 50, the need for a safe environment and individual mentoring and coaching was mentioned.

There was general consensus among the groups that there should be professional development activities in digital skills for these age groups and also for academics in other age groups, and that these should include an in-depth look at the pedagogical aspects of teaching and learning, rather than focusing too narrowly on the integration of technology in the classroom. Several professional development proposals were put forward in the groups, ranging from individual mentoring to the formation of teaching communities to improve digital competence collaboratively. The conclusion is that, for both groups, it is important to set challenges, but without emphasising differentiation by age range. Motivation and attitude should be the main determinant, not age.

Furthermore, support services for teaching staff were felt to have a fundamental role to play in universities, including 'taking the fear out' of the use of technologies and encouraging and supporting the use of digital tools that teaching staff are still unaware of. In short, all groups agreed on the importance of professional development opportunities for the whole academic community, regardless of age range, and that it should be compulsory for new academics.

C6: Professional development courses to increase educators' digital competence

All the focus groups agreed on the need to design courses and initiatives to promote educators' digital competence. In this respect, they identify two clear areas for development: the **definition and characteristics of this training** and **its certification**.

As for the design of professional development courses, the areas identified in the European Framework for Educators' Digital Competence DigCompEdu and in the OpenEdu frameworks were deemed to be adequate, although adaptation might be necessary according to the needs of the moment and the context. Similarly, the levels as defined in the DigCompEdu framework were also considered to be appropriate (A1-C2). The challenge, in this sense, is to design courses that are correctly levelled, allowing for the consolidation of knowledge at one stage before moving on to the next. The groups also believed that the design of courses should come from the Spanish universities themselves and that, collectively, such a potential learning pathway may already exist.

With regard to the characteristics of the training, the three focus groups agreed on the need to design comprehensive, gradual and personalised training, which should be centred on pedagogy and not only on educational technologies. General professional development courses are proposed for all universities (inter-university approach), which may be adapted to the needs of the different areas of knowledge, and which each institution may tailor and adjust according to its own particular situation. It is important for it to be useful for teaching staff as part of their academic work, rather than as part of bureaucratic red tape. For this reason, an eminently practical approach to professional development courses was recommended.

The groups recommended online training (MOOC-type training, online, massive and open), supported by microcredentials, but with technical and pedagogical back-up through support seminars allowing the different areas of competence to be worked on and teaching practices to be shared. The importance of monitoring learning transfer through surveys and portfolio production, for example, was also emphasised.

As for the certification, the groups agreed on the need for it to have national and international recognition. One of the experts pointed out that 'digital competences are not the end, but a means. To the extent that academics see how they can enhance student learning, and institutions recognise this effort to become better academics, there will be an awareness of the need to integrate them and a willingness to take part in professional development activities.' Along the same lines, the groups felt that universities need an institutional policy that encourages, recognises and rewards academics' efforts to further improve their digital competence, as part of a general process of improving teaching practices.

It was the groups' opinion that certification should be by levels and include evidence of how the knowledge and skills acquired through the training are being applied.

C7: Evaluation of level of digital competence

In order to gather information that might help in policy decisions, the groups were asked to contribute their views on how the assessment of educators' digital competences should be approached so that they could be certified, if necessary. On this topic, there were two important points for discussion. The first was the use of an assessment tool, similar to Check-In, but with a dedicated instrument for competence assessment rather than self-reflection. The second was 'how' certification should be achieved: by which institution(s) and on the basis of what evidence. This axis ties in with C6.

Discussion was inconclusive in all three groups, perhaps because this was an issue that had not been given much thought beforehand. Also, for each question, the time allowed for discussion in the focus groups was limited. However, there was convergence of opinion on some points, such as: (1) **the rejection of accreditation assessment by national or regional agencies, which could make the process compulsory, bureaucratic and over-complicated**; and (2) **the need to know what 'purpose' such certification would serve**. If it was not apparent why certification was necessary and how it would be used, the general feeling was that it should not be introduced in the first place.

The prospect of developing an evaluation tool entailed the need for its development to be under the responsibility of an institution (e.g. CRUE, European Commission, etc.) to ensure its maintenance, updating and universal availability. The tool was conceived of as a 'living' entity requiring sustained effort and long-term financial investment, and constituting a large-scale academic, political and administrative project. There was no clear conclusion as to how it could be implemented, by whom and for what purpose. In all groups, the creation of an evaluation tool was not ruled out as a possibility but remained largely undefined.

On the need to know 'what' such a certification would be for, an important point was raised regarding its recognition: **'It is absolutely necessary for digital competences to be properly defined at national and European level, as is the case for languages. In the same vein, certifications should be recognised at these levels. In this way, institutional efforts in setting up training courses and academics' efforts in taking them would be rewarded with certificates that would be recognised and valid anywhere in the European area'**.

With regard to certification, the groups suggested that they could be issued by the universities themselves. Objective assessment of competences was considered important because '...in a self-reflection tool, the level of competence can be underestimated or overestimated'. There was further discussion of courses, credits and evidence, and it was mooted that professional development courses should be an integral part of being an academic.

While agreeing on these points, the focus groups clearly felt that the issue of 'certification' required further discussion if any representative conclusion was to be reached by all parties involved.

4. Discussion

This section will discuss the main findings of the study, the implications of these findings for research, and the implications for university policymaking.

4.1 Main findings of the study

This study of the perception of educators' digital competence in the Spanish university system represents a very important step towards the development of initiatives that will enable the offer of courses and evaluation of these competences in the university context. In particular, the wide participation of academics from a large number of universities and the statistical validity of the results make it a pioneering study at both the national and international level.

Among the results, one of the aspects that should be highlighted is that teaching staff estimate the median level of their digital competence to be B2, with B1 being the most common level. In fact, based on their self-perception, 49.1% of teaching staff are either at level B1 or B2.

Of the different variables analysed, age range is the one which shows the greatest differences in the levels of academics' self-perception. More specifically, the 60+ age group has the worst self-perception, followed by the 50-59 age group. There are no significant differences between the other age groups.

Also noteworthy are the significant differences in the level of self-perceived competence between different academic areas. To be more precise, there are three levels of self-perception: at the highest level are academics teaching Social Sciences and Arts and Humanities, at the middle level are those teaching Engineering and Architecture, and at the lowest level are those teaching Science and Health Sciences.

As for the other variables, there were no significant differences in the self-perceived level of educators' digital competence as a function of professional category, type of contract or gender, although those who teach at postgraduate level tend to have a higher self-perception of competence than those who only teach at undergraduate level.

When self-perception is analysed by age range, but separately for each academic area, the differences in self-perception behave differently. The conclusion can be drawn that, in general, the dividing line is marked by the age of 50, and that it is only when the five areas are aggregated together that the difference between the 50-59 and 60+ age ranges emerges, as it is not apparent when the groups are broken down by academic area.

Analysis as per the benchmark framework areas shows that, generally speaking, academics consider that they have a higher level of competence in the first two areas (Professional Engagement and Resource Creation) than in the others. In the case of the former, approximately half of the participants consider themselves to be at 'Leader' level. However, most regard themselves as 'Newcomers' for the Open Education area, while for the remaining areas they are spread quite evenly between competence levels.

As for the contributions of the experts, the importance of the development of digital teaching competences in the process of digital transformation that universities are undergoing is revealed, as pointed out in the study carried out by MetaRed in 2020, "UDigital2020. Study of digital maturity in Ibero-American university systems". In this regard, professional development courses are one of the key elements to continue advancing and improving the level of competence, not only of academics, but also of the entire university community, including the digital competence of the student body. Courses must be properly designed and allow for comprehensive, gradual and practical development, adapted to the particular needs of academics, subject areas and the institutional context. In the implementation of specific professional development plans, it is necessary to reflect on the evaluation and certification model that accredits the level of competence.

The COVID-19 pandemic has accelerated the digital-transformation processes and has highlighted the need for specialised professionals in both the technological and pedagogical fields to ensure adequate support. The digital environment requires new methodologies as well as new forms of assessment, more focused on active learning and formative assessment, making the competence areas of teaching and learning and assessment and feedback essential in the development of digital competence in teaching. Another major challenge is the promotion of open education, as more institutional policies and strategies are required, as well as a culture that facilitates the promotion of open educational practices, beyond the development of OER or MOOC courses.

4.2. Implications for research

The development of this study in Spain aimed both to reveal academics' self-perceptions of their digital competences and to design, test and validate a methodology for applying the self-reflection at a national level.

The combined use of quantitative and qualitative methodologies in the analysis of the digital-competence data was possible due to a major, nationally orchestrated, collaborative effort, which undoubtedly added considerable value to the analysis. On the one hand, the representativeness of the study, achieved by applying scientific rigour in the sample design, was a crucial factor. On the other hand, the use of focus groups to discuss the results with a view to proposing feasible and realistic policies meant that the results were analysed and discussed from a contextualised perspective. It is hoped that the methodology of this study may be replicated in other areas of European and international higher education, where data can be obtained with the Check-In tool, for the recommendation of lifelong learning policies. In this way, it will be possible in the long term to obtain comparable data across countries and regions in order to take forward the international agenda for digital skills in education. The study also revealed the need for further studies exploring possible pathways for the certification of academics by means of competence assessment.

In addition to the nationwide study, all participating universities have access to the data on the individual academics' self-perception results, which they may use both for research purposes and to develop concrete policies that are appropriate for their teaching community.

4.3. Implications for university policymaking

In today's universities, it is essential for teaching staff to have the digital competences that will enable them to carry out their work in the areas of teaching and assessment as effectively as possible. It is therefore necessary for universities to develop mechanisms that enable their teaching staff to develop these skills. In this respect, and as a continuation of the study carried out in this project, CRUE is working on the development of shared resources for all universities. To complement this professional development process, mechanisms for the accreditation or certification of these competences will have to be established to ensure that these new skills are put into practice on a day-to-day basis, if such certification is to be of use to the teaching staff rather than an end in itself. In parallel with this, it would be highly desirable for each university's teaching-innovation units to promote the innovative use of technology in the classroom. Both the call for teaching-innovation projects and the creation of open educational resources can act as a driving force to encourage academics to improve their skills and apply them in their day-to-day work.

One issue that should not be overlooked, and which requires special consideration, is that of digital assessment. Evaluation processes have been particularly affected by the period of digital immersion that all universities have been subjected to during the COVID-19 pandemic. During this time, the teams

responsible for virtual classrooms have done all in their power to ensure that both teaching staff and students have been able to continue their activities with as little disruption as possible. Specific digital assessment activities have to be incorporated into the professional-development processes, while the methodological change has to be taken further.

It should not be forgotten that students must also develop their digital competence. It is true that many academics may feel insecure or incapable when it comes to developing further these skills, which are not their area of expertise (although they do have the necessary digital skills to carry out their teaching activity). In this respect, it may be advisable for universities to try to develop these competences through transversal activities and learning opportunities for teaching staff. Nor should we suppose that, because of their age and the times in which they live, our students have developed all the competences necessary for their education and, more importantly, for the start of their professional careers and their growing as citizens. This study suggests that those who undertake online learning either already have, or are developing, a greater capacity in these competences. For this reason it may be worthwhile to assess the feasibility of offering some subjects in online or hybrid mode, so that students are required to use these competences to a greater extent than in conventional face-to-face classes. In some bachelor's and postgraduate programmes, and in online master's degrees, fully online courses should also be encouraged, in order to facilitate the possibility of lifelong learning for those already in the labour market.

All the technology acquired, installed and promoted, together with the skills developed by the teaching staff, lead us to think that hybrid education modes (with students in the classroom and remotely), blended learning and full online courses may soon become the norm and a natural part of the Spanish university system. The promotion of this type of education can combine the advantages of face-to-face classes with the possibility of reaching a group of students who until now have found it difficult to access universities in general, and Spanish universities in particular. On the one hand, as mentioned in the previous paragraph, students can be helped to improve their digital skills through subjects that use new technologies. On the other, individuals who work, have to care for dependents or for any other reason are unable to take a conventional face-to-face course will have greater access to universities if most of the courses are online and their presence in classrooms or laboratories is reduced to a minimum. Finally, it is an opportunity to bring Spanish universities closer to students who live in other countries and who cannot afford to spend one or more years in Spain. Full online courses, or shorter stays, perhaps accompanied by a policy of scholarships or accommodation grants, can facilitate this approach.

In short, we are faced with a unique opportunity, with tools installed in all the universities, with a teaching staff that has been able to apply the best of the new technologies in their day-to-day teaching, and with a student body that is aware that it digital competence is needed to develop professionally in an increasingly technological world. The collaboration between CRUE universities will undoubtedly facilitate this process of digital transformation of university teaching.

5. Recommendations

This section provides a schematic summary of a set of recommendations for each of the institutions that, in one way or another, are responsible for the digital-skills development of university teaching staff: the universities themselves, the CRUE, the Autonomous Regions, the Ministry of Universities and the European Commission. These recommendations are based on both the conclusions drawn by the research group from the quantitative results of the study and the qualitative analysis through the focus-group discussions.

5.1 Spain's universities

1. The professional development of university teaching staff is ultimately the responsibility of each university, which should **set up mechanisms so that all academics can develop the digital skills necessary for their teaching and research activities**, as well as **learn about and apply open educational practices**.
2. Probably the best way to interest teaching staff in digital competence development would be to **call for specific innovation projects that make use of these competences**. A firm commitment on the part of university management teams would make it easier for everyone to jump on the digital transformation bandwagon. In addition, if this type of project is taken into account in evaluations such as Docentia, the motivation would be twofold.
3. In order to achieve all this, it would be essential to **provide teaching staff with the necessary technological resources and techno-pedagogical support**, as well as free time in their official timetables to fully develop these competences.
4. It would also be essential to **make progress in the digitisation of processes related to administrative and academic management**, so that the digital competences acquired can be shown to have a practical application in day-to-day life that simplifies the work of universities.
5. Finally, universities should **promote the recognition of the digital competences of their teaching staff in their professional careers** (preferably in coordination with the rest of the Spanish university system, through CRUE).

5.2 Autonomous regions

1. All Spain's autonomous communities have been devolved powers in university education, with the exception of those that the Constitution attributes exclusively to the State. The most important of these is undoubtedly the funding of public universities. In this regard, the **autonomous communities should guarantee the necessary funds so that teaching staff can be trained in the necessary digital skills**. To this end, in addition to using their own funds, the Autonomous Communities should monitor the different possibilities for co-financing by the European Commission.
2. With regard to digital transformation processes, it would be advisable to have **additional specific lines of finance in the university funding systems** if the transformation that the university system needs is to be carried out.

5.3 CRUE

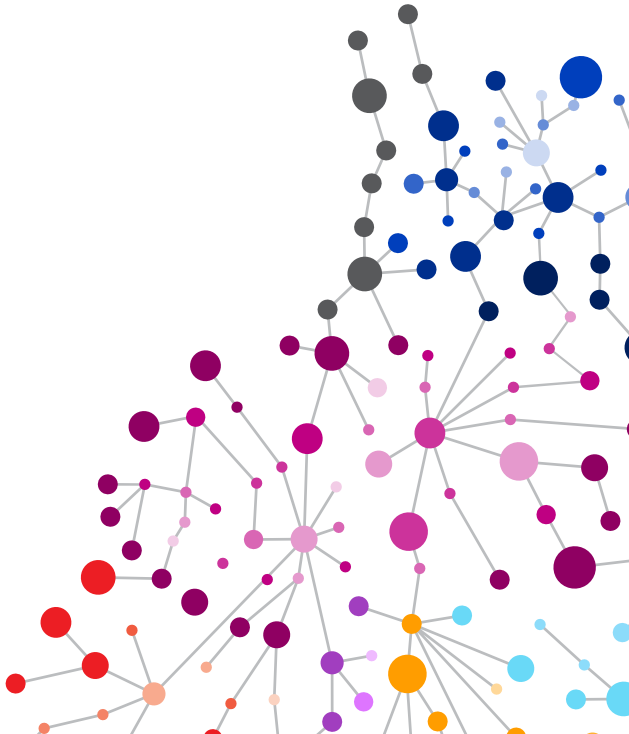
1. In accordance with its mission of coordinating actions of common interest in university policy issues, the CRUE should **continue to promote collaboration between universities in the field of professional development courses for academics in digital skills**.
2. In addition, it could **explore the possibility of coordinating activities for the recognition and certification of these competences for teaching staff**, preferably through inter-university mechanisms.

5.4 Ministry of Universities

1. In its mission to develop university policy, in collaboration with the Council of Universities, it would be highly desirable that, while promoting the digital transformation of universities, the Ministry of Universities should **work with the Spanish university system, mainly through CRUE, to enhance the digital competences of teaching staff**.
2. Under ministerial coordination, the assessment agencies should **take into account accredited digital competences as an additional merit in the accreditation of the different types of teaching staff**, whether non-tenured or tenured.

5.5 European Commission

1. This project, developed collaboratively between CRUE and the JRC, has validated the revision of the 'Check-In' instrument for higher education (V2021), which is available online from the European Commission (JRC) in Spanish and English and which this study has validated. **It would be highly desirable for this tool to be widely promoted in other EU countries**, so that their educational institutions might benefit from it.
2. In order for the certification of competences to have a broader sphere of recognition beyond Spain, the possibility could be explored of **certifying academics' digital competences at the European level**, in line with the similar work already under way in this direction within the DigComp framework of digital competences for citizenship.

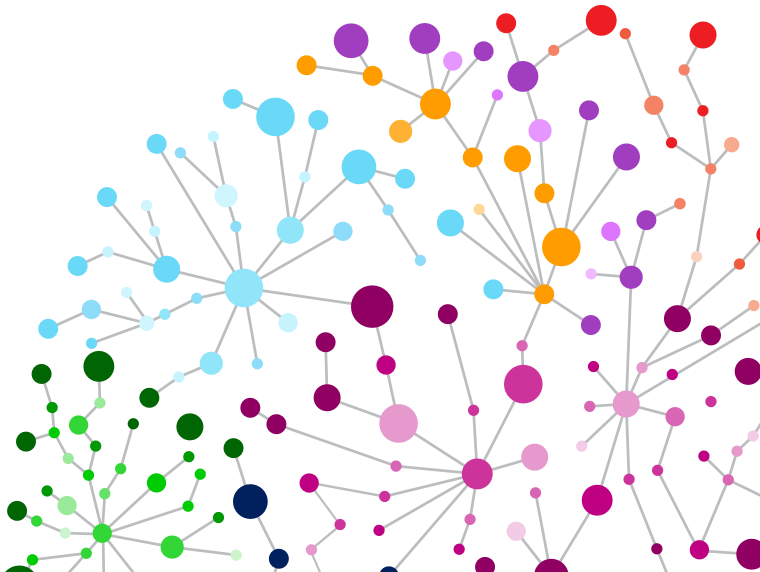


6. Conclusions

Thanks to this project, the leadership teams of Spanish universities now have a better understanding of how university teaching staff perceive their digital competences. Overall, a large part of the teaching staff perceive that their competences are at levels B1-B2. The results vary according to respondents' teaching experience, age and academic area. As for the areas covered by the instrument, there is considerable room for improvement in some, such as open educational resources. This information will help to determine professional development courses priorities for this group, and to enhance related initiative and scheme design.

It should be stressed that these results are based on the self-perceptions of the participants. For that reason, this report should be complemented by other studies assessing digital competences using other methodologies. In order to have a more complete vision, a qualitative perspective has been incorporated, in the form of contributions from experts in the field from different Spanish universities. The discussion identified the need for appropriate professional development courses to ensure continuous improvement of the level of academics' digital competence in teaching, which requires reflection on the forms of assessment and their certification. Digital competence is one of the key elements for fostering the digital university, in addition to improving the level of digital competence of students, open education practices and the incorporation of methodologies and assessment systems that are appropriate for digital scenarios.

It should not be forgotten that the COVID-19 pandemic has given an enormous boost to digital transformation in many areas, particularly in university education. The picture this study paints may evolve rapidly over the next few years. However, the current scenario would also be incomplete if not viewed in the European university context. To the extent that data from other EU countries are available, the Spanish scenario should be analysed in comparison with those countries. Thus, a contribution could be made to the goal of achieving the highest levels of digital competence among European citizens.



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List of abbreviations and definitions

CRUE Confererence of Rectors of Spanish Universities

JRC Joint Research Centre

PDI Teaching and Research Staff

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Appendices

Appendix 1. Questionnaire[8]

Questions for Area 1: Professional Engagement

1. I use different digital channels to improve communication with students and colleagues when necessary (e.g. emails, blogs, the educational organisation's website, learning management system (LMS), apps, etc.).

- I do not use digital communication channels.
- I use basic digital communication channels (e.g. email or instant messaging system).
- I can identify different digital solutions to communicate effectively.
- I combine different communication channels (e.g. email, instant messaging or the organisation's website).
- I analyse and evaluate communication channels to choose the ones I consider most effective for my communicative purpose.
- I reflect, plan and adapt my communication strategies according to needs.
- I confidently plan and adapt my digital communication strategy using a variety of digital technologies to meet my communication needs in the context of my stakeholders.

2. I use digital technologies when necessary to work together with other colleagues inside and outside my educational organisation.

- I do not collaborate with other academics.
- My colleagues and I share information in shared units or via email.
- In addition to email and shared units, I exchange materials and ideas with my peers in networked collaborative environments (e.g. via video conferencing or through virtual learning environments and other online tools).
- I exchange ideas, experiences and materials with colleagues both within and outside my institution (e.g. in an online professional network).
- I experiment with innovative tools for online collaboration with colleagues inside and outside my institution.
- I co-create materials with other academics in an online network.
- I co-create, re-use and share materials with other academics and students in an online network.

3. I actively develop my digital competence for teaching.

- I do not work on developing my digital competence for teaching.
- I improve my digital competence for teaching through reflection and experimentation.
- I use different resources to develop my digital competence for teaching.
- I use the peer network to inspire me in my application of different digital teaching practices.
- I validate my digital teaching practices by discussing with my peers how best to use technologies to innovate and improve my teaching practice.
- I take advantage of my peer network to get ideas and validation of my practices, as well as to attend different digital competence development courses, online or face-to-face, to improve and certify my teaching practices.
- I lead teaching innovation using digital technologies in my institution.

8. **Note:** The entities that have promoted this questionnaire are bound by a normative framework that outlaws discrimination on the basis of gender. In this context, agreed variable or common nouns of the grammatical masculine gender should be interpreted as inclusive of women and men when referring to persons or groups of persons not specifically identified as either. In the subsequent phases of the study, this questionnaire has been adapted and published taking into account the gender perspective, with the help of the Unitat d'Igualtat de la Universitat de Barcelona. The questionnaire in the Check-In tool can be found at this link: https://ec.europa.eu/eusurvey/runner/CheckIn_HE_V2021_ES

4. I participate in online training courses when the opportunity arises. For example: online courses, MOOCs, webinars or virtual conferences.

- This is something I have not yet considered.
- Not yet, but I am interested in doing some training.
- I have participated in online training once or twice.
- I have tried different online training courses when the opportunity has arisen.
- I participate in different types of online training that can help me improve my teaching skills.
- I design and deliver online training for my colleagues in my institution.
- I am professionally accredited in the use of different technologies for teaching and learning.

Questions for Area 2: Digital Resources

1. I use different websites and search strategies to find and select different digital resources.

- I do not know how to use the Internet to find useful resources.
- I can use the Internet to find useful resources for teaching.
- I use search engines and educational resource platforms to find relevant resources.
- I evaluate and select resources according to their suitability for my learners.
- In addition to checking the suitability of resources to meet the needs of my learners, I compare them against other relevant criteria (e.g. reliability, quality, fit, design, interactivity, etc.).
- I compare resources by applying different criteria and collaborate with peers in sharing appropriate resources and search strategies.
- I not only search for and select different digital resources, but also take the lead in promoting their use in my institution.

2. I create my own Digital Resources and modify existing ones to suit my needs.

- I do not create my own digital resources.
- I search the Internet and use different kinds of educational resources.
- I create digital presentations, but I do not know how to do much more than that.
- I test and validate different types of resources,
- I create different types of digital resources.
- I create and adapt digital resources and share them with others using content distribution platforms.
- I adapt, use, share and even create more complex interactive resources such as videos, online multiple-choice tests, virtual reality applications, etc.

3. I effectively protect personal data, such as exams, grades or personal data.

- I do not need to do this because the institution where I work takes care of it.
- I avoid storing personal data electronically.
- I protect personal data, but I do not usually change passwords.
- I password protect files with personal data and occasionally change passwords.
- I protect personal data by combining hard-to-guess passwords with frequent password changes and software updates.
- I review my personal data protection practices from time to time, checking their effectiveness and replacing them when necessary.
- I protect digital data and apply the GDPR (General Data Protection Regulation) when dealing with identifiable subjects, such as data related to my students.

Questions for Area 3: Teaching and Learning

1. I carefully assess how, when and why to use digital technologies in the classroom with my students, to ensure that they add value.

- I do not use or I sporadically use technology in my classes.
- I make basic use of available equipment (e.g. digital whiteboards, projectors

or virtual teaching environments when teaching online).
- I use a wide variety of digital resources and tools in my classes.
- I try out different teaching methods according to the digital technologies I choose.
- I select and try different teaching approaches to find the ones that work best for me.
- I develop my own portfolio of activities, technologies and teaching methods.
- I use digital tools to implement innovative teaching methodologies and share them with my networks, so that they can also benefit.

2. I monitor the activities and interactions of my students in the online collaborative environments we use.

- I do not use digital environments with my students.
- I do not monitor student activity in the online environments we use.
- I follow students' activities and discussions in the digital environments we use.
- I analyse my learners' online activity using the most appropriate methods and tools, but I do not intervene.
- I analyse and intervene in my learners' online activities (e.g. discussions) with motivating or corrective comments.
- I encourage learners to participate in online activities by asking questions.
- I redirect students' online activity when I see that it is not working or foresee problems.

3. When my students work in groups, they use digital technologies to acquire and reflect knowledge.

- I do not know how to integrate digital technologies into collaborative learning activities.
- I integrate digital technologies into collaborative learning activities.
- I identify opportunities and implement assignments for learners to work collaboratively by searching for information online or presenting their results in digital formats.
- I structure course activities that require learners to work collaboratively in groups, using the Internet to find information and presenting their results in digital formats.
- I design course assignments that require students to use online collaborative environments to exchange knowledge and discuss.
- I design course assignments that require students to use online collaborative environments to create and share knowledge.
- I design curricular activities that require the use of digital technologies to enhance collaborative learning and the co-creation and sharing of knowledge.

4. I use digital technologies to enable my students to plan, document and monitor their own learning process. For example: self-assessments, digital portfolios for documentation and presentation, online journals/blogs for reflections, etc.

- It is not possible in my work environment.
- I encourage my students to reflect on their learning, but not with digital technologies.
- I use, for example, tests for self-assessment or a subject blog.
- I use various digital tools for students to plan, document or reflect on their learning.
- I integrate different digital tools for learners to plan, document or reflect on their progress.
- I am selective in my choice of the best digital tools to integrate into my teaching, after testing them with different learning tasks and groups of learners.
- I develop apps or digital games to engage students in their own learning.

Questions for Area 4: Evaluation and Feedback

1. I use digital assessment tools to monitor student progress.

- I do not monitor students' progress by digital means.

- I monitor students' progress regularly, but not by digital means.
- I use some digital tool, e.g. Questionnaire/blog/activity submission logs, to check students' progress.
- I use several digital tools to monitor learners' progress.
- I integrate the use of various digital tools to monitor learners' progress.
- I selectively choose the best digital tools and try them out for use with learners to assess and check progress.
- I develop my own apps and digital tools to track progress and/or conduct assessments.

2. I analyse all available data to effectively identify students in need of additional support. Note: 'Data' includes: personal information, student engagement activities, performance information, grades, attendance and social interactions in (online) environments; 'Students in need of additional support' are: students who are at risk of dropping out or underachieving; students who have learning disabilities or *special educational needs; or students who lack transversal skills (e.g. social, verbal or study skills).

- Information about this type of students is not available to me and/or someone else in my institution analyses it.
- I analyse academically relevant data, e.g. grades.
- I also consider data on student activity and behaviour to identify students who need additional support.
- I examine all available evidence to identify students who need additional support, to include their emotions and individual circumstances.
- I analyse student data to intervene in a timely manner.
- I help students analyse their performance and other data to seek help when they feel they need it.
- I encourage students to not only analyse their performance data, but also to set their own learning goals.

3. I use digital technologies to provide feedback to students.

- Feedback is not necessary in my working environment.
- I provide constructive feedback to learners, but not in digital format.
- I evaluate the advantages of using digital methods to provide constructive feedback, e.g. automatic scores in online questionnaires, comments or "likes" in digital environments.
- I use different digital methods to provide feedback and improve my practices regarding non-digital feedback.
- I combine different digital approaches to provide feedback.
- I choose the best digital tools for feedback after testing them with different groups of learners.
- I develop my own apps or digital tools to provide feedback to learner.

Questions for Area 5: Student empowerment

1. When creating digital tasks for students, I consider and address possible practical or technical difficulties. For example: equal access to digital devices and resources; problems of interoperability and conversion; lack of digital skills.

- I do not create digital tasks.
- My students have no problems using digital technology.
- I adapt the task to minimise difficulties.
- I discuss possible obstacles with learners and outline solutions.
- I adapt the task, discuss solutions and offer alternative ways to complete the task.
- I select and choose tools that are inclusive and take into account the accessibility needs of learners who require them.
- I select and choose tools that are accessible and inclusive as well as in open source formats to allow greater personalisation for my learners.

2. I use digital technologies to offer students personalised learning options. For example: I set different digital tasks for students to address individual learning needs, preferences and interests.

- In my working environment, all learners are required to do the same

activities, regardless of their level.
- I provide students with recommendations on additional resources.
- I provide optional digital activities for those who are advanced or not at the same pace.
- I use digital tools to offer differentiated learning opportunities.
- I tailor my teaching to personalised learning options, linking them to learners' individual needs, preferences and interests.
- I balance personalisation with collaborative learning techniques to enhance the learning process.
- I help students to set goals and plan the activities they feel they need to enhance their learning.

3. I use digital technologies to actively engage students in class or online.

- In my workplace it is not possible to actively engage students in class or online.
- I actively involve students in class, but not with digital technologies.
- When I teach, I use motivating stimuli, e.g. videos or animations.
- My students engage with digital media in my lessons, e.g. with working papers, games or collaborative platforms.
- My students use digital technologies to research, discuss and create knowledge.
- I help students not only to create, but also to present and share the knowledge they create.
- I help students not only to create, but also to present and share the knowledge they create using appropriate open licences.

Questions for Area 6: Facilitating students' digital competence

1. I teach students how to assess the reliability of information.

- This is not possible in my subject or workplace.
- I remind them that not all online information is reliable.
- I teach them to distinguish between reliable and unreliable sources.
- I discuss with students how to verify the accuracy of information.
- I discuss with students how information is generated and can be distorted.
- I discuss with students how they can adapt and produce information that is free from misinformation, bias and manipulation.
- I discuss with students all of the above and teach them not to share biased and misleading information.

2. I set assignments that require students to use digital media to communicate and collaborate with each other or with an external audience.

- This is not possible in my subject or workplace.
- I encourage students to discover the potential of digital communication by trying out different media.
- I encourage learners to use digital communication and to collaborate with each other to complete tasks.
- I encourage learners to use digital ways to communicate and cooperate with each other and with an external audience.
- I structure and set tasks that enable learners to gradually improve their competences and collaboration.
- I set tasks and coursework that enable students to co-create knowledge with their peers and, at the same time, help them to establish rules for communication and cooperation.
- I encourage students to improve their communication skills by involving not only their peers but also an external audience as joint creators of knowledge.

3. I set assignments that require students to create digital content. For example: videos, audios, photos, digital presentations, blogs or wikis.

- I do not know how to do it.
- I do not implement these kinds of activities with my students because they do not have sufficient digital skills.
- I try to integrate the use of digital tools for students into the course assignments I design.

- My students create digital content as an integral part of their study.
- This is an integral part of their learning and I structure assignments and tasks to increase the level of difficulty and improve their skills.
- I help students to detect and evaluate inappropriate behaviour in digital environments so that they can be critical of these spaces.
- I encourage students not only to create, but also to share the knowledge they generate using appropriate open licences.

4. I teach students to use digital technology safely and responsibly.

- This is not possible in my subject or workplace.
- I inform them that they should be careful when transmitting personal information online.
- I explain the basic rules for acting safely and responsibly in online environments.
- I discuss and agree on rules of conduct.
- I facilitate the use of social norms for my students in the different digital environments we use.
- I help students to detect and evaluate inappropriate behaviour in digital environments so that they can be critical of these spaces.
- I teach students how to detect and evaluate online malpractice and the routes to report it if they feel personally offended or attacked.

5. I encourage students to use digital technologies creatively to solve concrete problems. For example, overcoming emerging obstacles or challenges in the learning process.

- This is not possible with my students, in my workplace.
- I create opportunities to foster students' digital problem solving.
- I do this whenever an opportunity arises.
- I create opportunities to experiment with technological solutions to solve problems.
- I integrate opportunities for creative digital problem solving.
- I ensure that I create inclusive opportunities in digital problem solving, so that all students can benefit.
- In addition to creating opportunities for students to use their digital problem solving skills, I let them spot these opportunities that arise on their own.

Questions for Area 7: Open Education (based on the OpenEdu Framework)

1. I know how to find and use open licences in educational resources.

- I do not know what an Open Educational Resource (OER) is.
- I can identify the licence of an OER.
- I use Open Educational Resources in my classes.
- I publish the materials I produce under an open licence.
- I correctly cite the OER I use (whether I modify them or not).
- I share OER and tag them correctly to increase their searchability and findability.
- I not only use open licences and share the resources I create, but I also support my institution in implementing OER as an open education practice.

2. I adopt open educational practices in my teaching to make it more inclusive.

- I do not know how to apply Open Educational Practices in my teaching.
- I apply the principles of Open Educational Practices in my teaching (e.g. using and sharing OER; using Massive Open Online Courses, MOOCs, and free online courses for reference, etc.).
- In addition to applying the principles of Open Educational Practices in my teaching, I consider access and accessibility in the digital materials I produce, catering for learners with special needs.
- Not only do I make my content accessible to students with special needs, but I also use open formats (e.g. Libre Office) and open source software whenever possible when producing my teaching materials.
- Not only do I apply Open Educational Practices in my teaching, but I also openly share my teaching practices with others through the use of digital technologies (e.g. recording and publishing teaching videos, publishing

podcasts or keeping an up-to-date blog, or collaborating on open platforms or social networks).
- I create different learning pathways in the OER I produce and publish them in order to enable personalisation of learning.
- I adopt different Open Educational Practices in my teaching and support my institution to open access to content (OER) and courses to all students.

3. I publish my research in open scientific journals, as well as my research data whenever possible.

- I am not familiar with the concept of "Open Science".
- I understand the basic concepts of Open Science and I am increasingly using Open Access journals to gather evidence for my research.
- I publish my research in open access journals, as long as the choice of journal is up to me.
- I make my research data available as open data.
- I consider myself an open scientist and am involved with open scientific communities.
- I aim for the principles of open and collaborative research to be applied in all research projects in which I am involved, whenever appropriate and feasible.
- I support my institution in designing and enforcing policies that promote and/or reward faculty who embrace Open Science and Open Research Practices.

Questions related to the academics' perceptions of the university's response to the COVID-19 pandemic

In the last year, moreover, the COVID-19 pandemic has changed the normal activity in Higher Education institutions and many dynamics have had to be adapted. To what extent do you consider that your institution has worked on this adaptation process? (Strongly disagree - strongly agree)

- The University has provided the necessary equipment to be able to develop my classes in different modalities: face-to-face, online or hybrid (digitisation of classrooms, audio and video devices, etc.).
- The University has provided tools to work with Digital Resources, providing resources for their production (guides, training courses, etc.).
- The University has facilitated methodological adaptation (classes, evaluations, etc.), providing teaching support resources (materials, support systems, training courses, etc.).

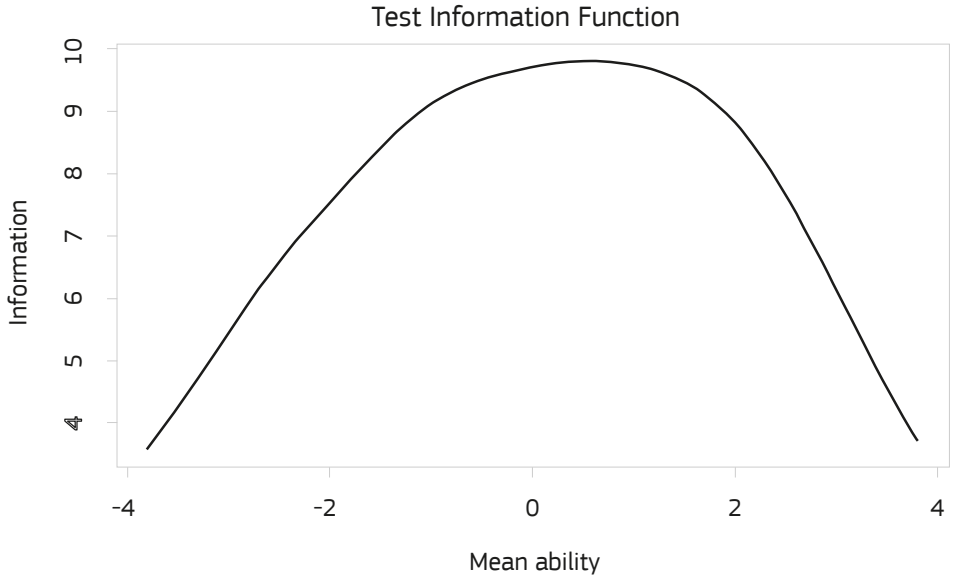
Do you consider that the experience of the last year has improved your level of digital competence? (Strongly disagree - strongly agree)

Appendix 2. Validation of response discrimination: detail and conclusions

Key observations

- The model that best fits the results, which considers that discrimination is not homogeneous but that each item has its own value, shows that the level of discrimination of all the questions is adequate. In particular, most of them have high levels and only 1.3 shows a significantly lower level than the others, without losing the ability to discriminate and without this difference being considered relevant for validation.

- The distribution of information (i.e. how the set of questions explains the characteristic, in this case the perception of digital competence) is also adequate. This curve shows how the instrument measures the latent construct (the perception of digital competence) at different ability levels. Ideally, it should peak at the mean (zero in the graph) as this is where we expect to find the highest number of individuals.



- The item-by-item breakdown looks at the likelihood of a person choosing one or the other answer depending on their level of measured ability. The questions discriminate well, but in general, the full range of responses is not used. It seems that seven options are too many: many of the questions would be sufficiently discriminating with fewer options. In any case, this does not undermine the instrument's validity, but should be borne in mind as a recommendation for future versions.

- Aggregated by categories (in the seven areas analysed) a similar phenomenon occurs, since items in some areas exhibited a significantly higher discriminatory power than the others. Again, this does not compromise the validity of the instrument, but might be borne in mind as a recommendation for future versions, in which some items might be added or removed.

Appendix 3. Composition of the focus groups

FG1. Focus Group 1

Code	Profile	University
FG1.P1	Coordinator of Educational Resources Service	Universitat Rovira i Virgili
FG1.P2	Academic Coordinator of Support Centre for Teaching Innovation and Online Study (IDEO), Vice-Rectorate of Strategy and Planning	Universidad de Alcalá
FG1.P3	Coordinator of Digital Competences	Universidad Católica de Murcia
FG1.P4	Director of University Training and Educational Innovation Centre	Universidad da Coruña
FG1.P5	Head of Educational Technology and Virtual Campus Secretariat	Universidad de Zaragoza
FG1.P6	Head of Training Department	Universidad Francisco de Vitoria
FG1.P7	Data and Information Service	Universidad Ramón Llull
FG1.P8	Coordinator of Training and Teaching Innovation Unit	Universidad Loyola
FG1.P9	e-Training Technician	Universidad da Coruña

FG2. Focus Group 2

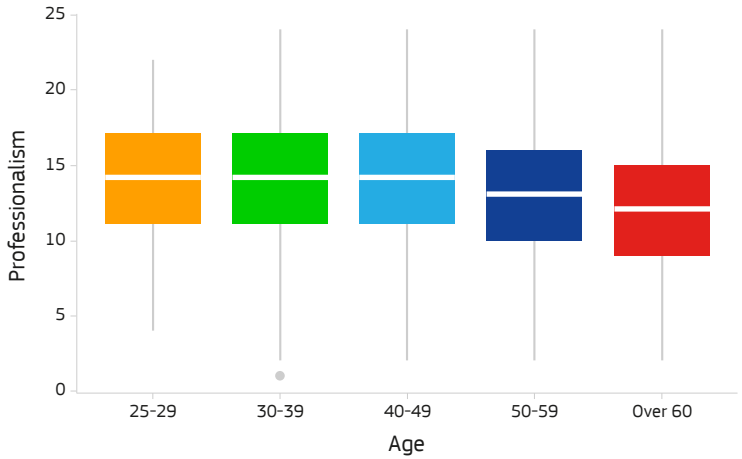
Code	Profile	University
FG2.P1	Academic Director UC3M. Digital (assistant to Vice-Rectorate of Digital Strategy and Education)	Universidad Carlos III de Madrid
FG2.P2	Deputy Vice-Rector of Digital Strategy and Education	Universidad Carlos III de Madrid
FG2.P3	Doctor in Educational Sciences. Chair of Educational Technology.	Universitat Rovira i Virgili
FG2.P4	Coordinator of Academic Planning	Universidad de Cantabria
FG2.P5	Director of Centre for Online Teaching, Training and Teaching Innovation	Universidad de Valladolid
FG2.P6	Head of the UEx Online Office	Universidad de Extremadura
FG2.P7	Vice-Rector of Teaching Policy	Universitat de Barcelona
FG2.P8	Director of Virtual Teaching Centre	Universidad de Burgos
FG2.P9	Head of Teaching Innovation and Online Teaching Secretariat	Universidad de Jaén
FG2.P10	Director of the Educational Research and Innovation Institute	Universidad de Oviedo
FG2.P11	Coordinator of the University Training and Educational Innovation Centre (CUFIE)	Universidad da Coruña

FG3. Focus Group 3

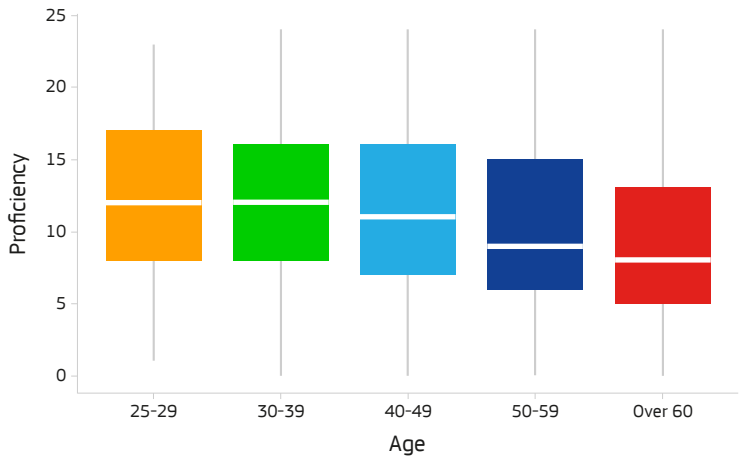
Code	Profile	University
FG3.P1	Deputy Vice-Rector of Digital Transformation	Universidad Politécnica de Madrid
FG3.P2	Vice-Rector of Digital Transformation and Quality	Universidad Pablo de Olavide
FG3.P3	Director of the Educational Sciences Institute	Universidad de Alicante
FG3.P4	Technician	Universidad de Alicante
FG3.P5	Vice-Rector of Academic Coordination and Planning	Universidad Nacional de Educación a Distancia
FG3.P6	Vice-Rector of Digital Transformation	Universitat de Barcelona
FG3.P7	Coordinator of CIED's Pedagogical Development Scheme	Universidad Rey Juan Carlos
FG3.P8	Academic Director of URJC Online	Universidad Rey Juan Carlos
FG3.P9	Head of Information Systems Planning Unit (ICT Office)	Universitat Autònoma de Barcelona
FG3.P10	ICT Coordinator	Universidad de Murcia
FG3.P11	ICE. Institute of Educational Sciences	Universitat Politècnica de València
FG3.P12	Tenured Senior Lecturer in Didactics and School Organisation	Universidad de Huelva
FG3.P13	Academic Director of Training and Teaching Innovation	Universidad de La Rioja

Appendix 4. Questionnaire area scores by age group

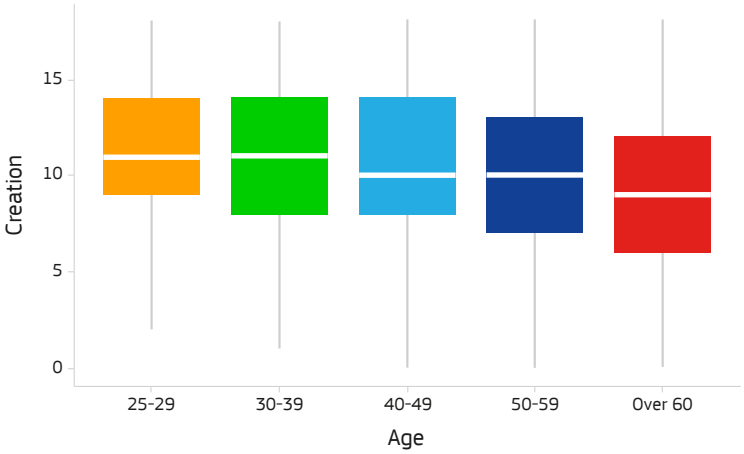
Professional Engagement



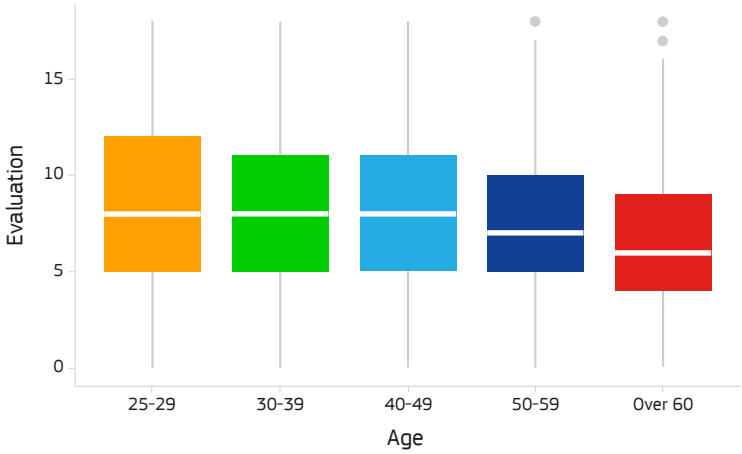
Teaching - learning



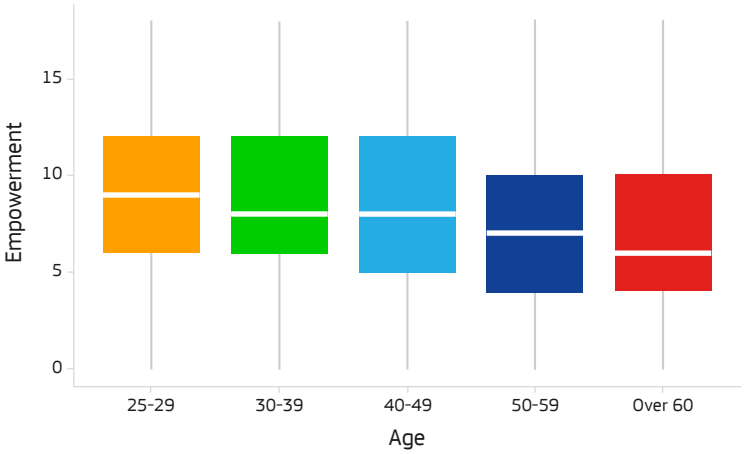
Digital Resources



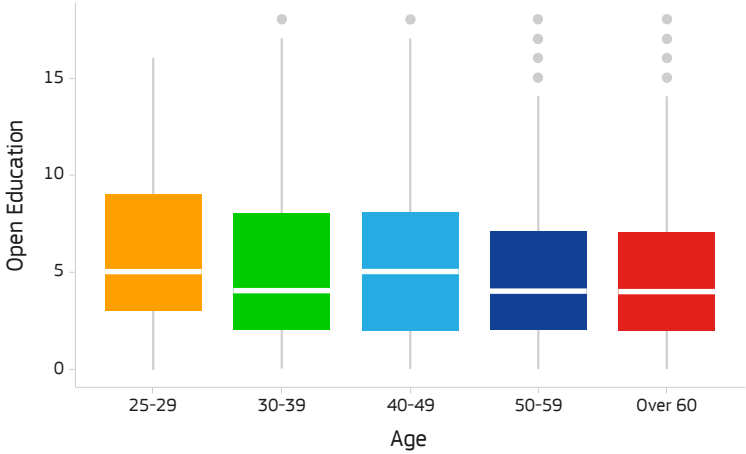
Evaluation and Feedback



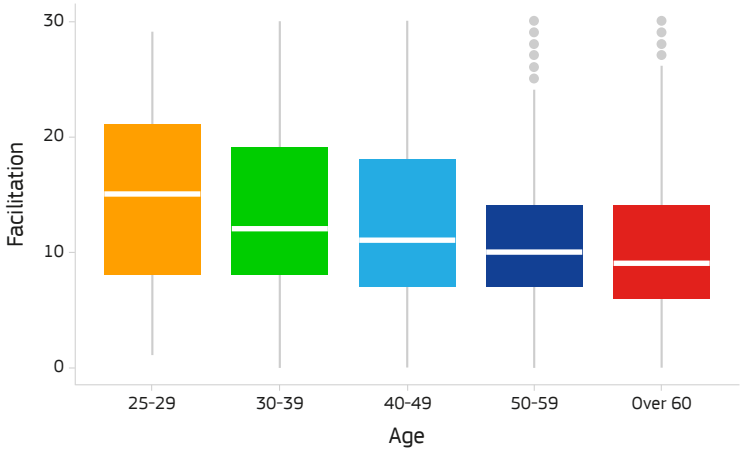
Student Empowerment



Open Education

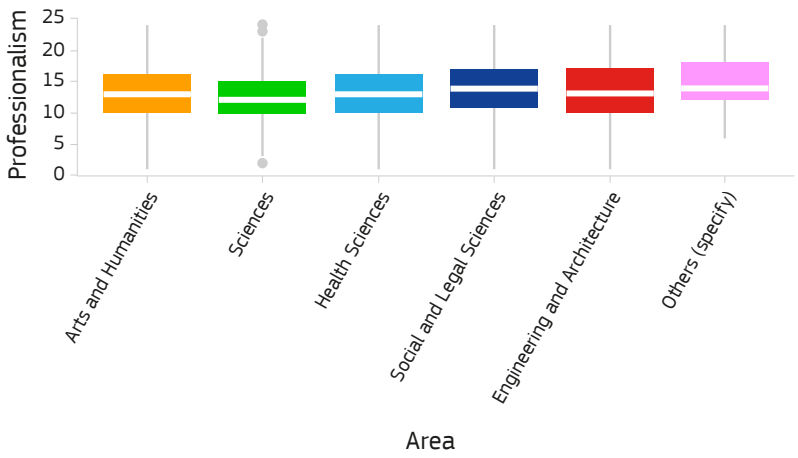


Facilitating Learners' Digital Competence

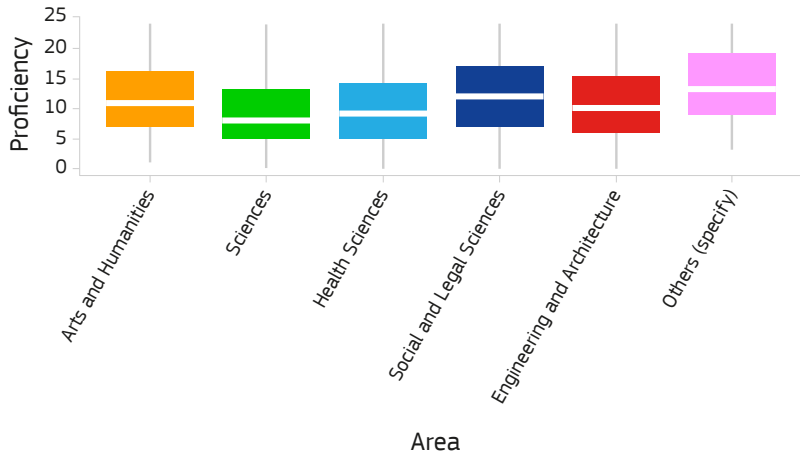


Appendix 5. Questionnaire area scores by academic area

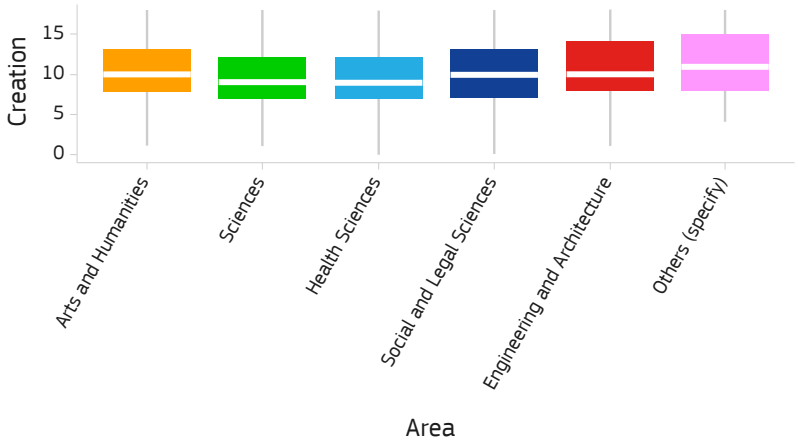
Professional Engagement



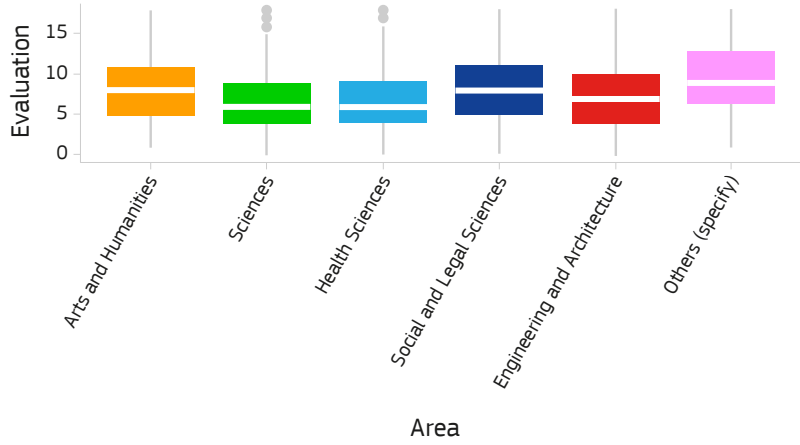
Teaching - learning



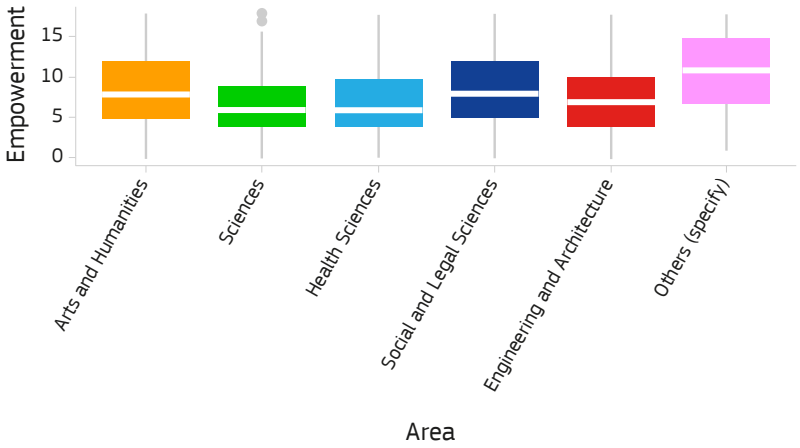
Digital Resources



Evaluation and Feedback



Student Empowerment



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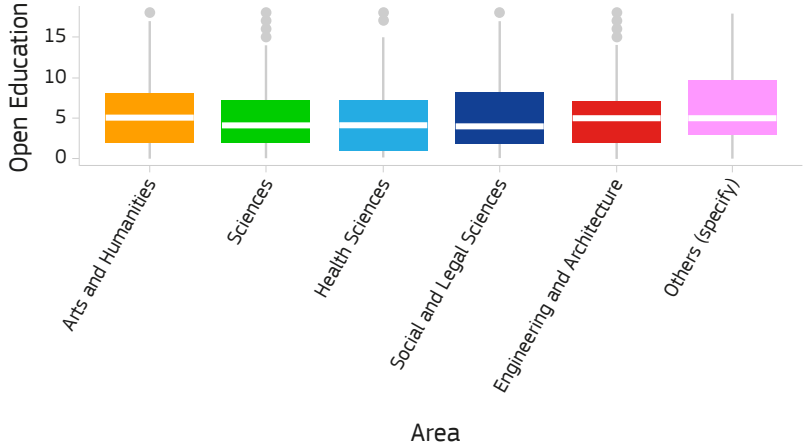

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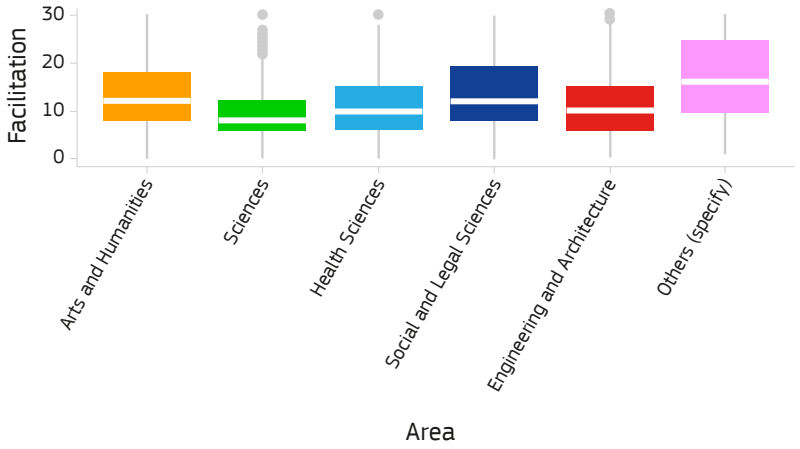

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