Assessment of university teachers on their digital competences

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Abstract

The potential of DTIC has brought new challenges to teachers, making it essential to acquire digital competences. The aim of this research is to assess Portuguese university teachers' digital competence level. The quantitative methodological approach emphasises the teachers' perception of their digital competences in three dimensions: teachers´ professional and pedagogic competences and learners' competences and involved 118 Portuguese University teachers. The main findings show that the digital competence level of teachers is moderate, and that subdimensions "Guidance", "Analysing Evidence" and "Responsible Use", are the weakest. On the other hand, the subdimension in which teachers perceive to have more competence is "Organisational Communication". The results show the need for teachers to increase their digital competence level through specific training, especially as regards the pedagogical use of technology, in particular more practical, experimental training.

Keywords: Digital Technologies; Digital Competences; Teacher Training; Higher Education; Quantitative Methodology

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1. Introduction

Involved in processes of change, often justified by diffuse policies and loose instrumental measures, Higher Education institutions in Portugal are still very marked by a traditional and elitist educational culture. They have faced the need to *Innovate* and reinvent their scientific, social and educational roles. This emerging new paradigm is practically linked to all spheres of economic, social, cultural and political organizations. It results, among others, from the evolution of a consciousness of globalization, a networking culture, the internationalization of knowledge and the relationship between digital participation and new citizenship practices (Caeiro & Moreira, 2018).

In order to *Innovate*, according to Dias (2016), it is necessary to disrupt, disorder and also reorganize and build a new configuration. *Innovation* is, therefore, the expression of the end of the limits of a pre-conceived, structured and formatted geometry, not only in the dimension of thought, but also of space and time.

Therefore, talking about pedagogical innovation in Higher Education implies reconfiguring the classical view of pedagogy against which the movements of change are oriented. As Esteves (2010, p. 53) points out, innovation requires clarity and determination as to what is intended to achieve in training. The failure of some methodological innovations in Higher Education can be explained by the blurring of their purposes and underlying learning theories. The absence of a pedagogical framework can empty the change of meaning or direction, as often happens in the institutional practices of courses' quality assessment as well as with the pedagogical processes taught. In these cases, very general, theoretically 'neutral' and scarce informative indicators regarding the nature of practices are used, which end up generating occasional or limited impact changes (Paricio Royo, 2012; Rué et al., 2013).

From a transformative perspective of Higher Education (Harvey & Knight, 1996), pedagogy is a place of *production* (not mere *reproduction*) of knowledge for both students and teachers. A transformative pedagogy implies methodologies open to reflection on learning content and processes, negotiation of meanings and decisions and the construction of broad views of knowledge in articulation with political and social issues. This expands and complexifies the teacher's role,

as he becomes both a 'designer' (Reder, 2007) and an 'architect' (Vieira, 2013) of digital learning environments that promote social and academic competences.

In this sense, Education is both *Digital* and *Hybrid*. *Digital*, understood as enriched and digitally mediated, developed in different learning environments and scenarios with different pedagogies. *Hybrid* in reference to the nature of its spaces, to its presence, to technologies and to culture, presenting itself as a possibility that meets this new paradigm. But also, as an alternative for the Higher Education institutions to approach their audiences (students) and society (citizens), transforming this challenge into a competitive differential. It is, therefore, necessary to redefine what are, today, emerging pedagogies that are built in fluid spaces, without barriers, either physical or analogical walls, based on the intersection of three elements: *Participation*, *Personalisation* and *Productivity*. *Participation* in network communities, face-to-face or virtual. *Personalisation* of learning experiences in hybrid environments tailored to the individual needs of communities and their elements. *Productivity* related to knowledge creation within these communities (Lee & McLoughlin, 2007) enabling the development of relevant educational experiences.

In this context of fluidity and liquidity (Bauman, 2001), the idea of interconnection between space and time is fundamental, just like Bakhtin conceptualized it in 1981. Bakhtin used the chronotope concept in order to explain that the use of technology in social practices, particularly in digital educational settings, radically transforms space-time relations (Ritella, Ligorio, & Hakkarainen, 2019). Although not many studies have yet taken place, it is important to understand the different dimensions of a chronotopic methodology. It helps to analyse important issues on education, such as "how different ways of framing space-time relations in educational situations are implicated in pedagogical and curriculum processes, learning outcomes, and identities" (Ritella, Rajala, & Renshaw, 2020, p. 3).

However, teachers and students need to be able to use technology in an educational context in a way that allows the creation of innovative learning scenarios. For this to happen, teachers and students need to adapt to the new times and learn to use digital technologies pedagogically in the educational process. The daily use of technology does

not imply a natural conversion of its use within school walls, especially because in these new ubiquitous learning scenarios, education goes beyond the physical territory. In a Contemporary reality, learning also takes place through the use of mobile devices, connected to wireless communication networks, sensors and geolocation mechanisms, allowing to form virtual networks between people, objects and situations. In fact, making use of technology for teaching or learning, using it to extend learning to informal or non-formal environments, implies having skills and being digitally fluent.

That's why it's so important to know how to use digital technology, but, specially, to know how to use it pedagogically, in order to improve the quality of the teaching-learning process (Ozan & Kesim, 2013). For that to happen, it is necessary not only for the pedagogical paradigm to shift, but also to have new policies and training models for a proper digital conversion.

It is important to acknowledge not only what one knows, regarding the use of digital technology in education, but also how to change and improve one's knowledge, especially through integrated training to improve professional practices. Sansone and colleagues (2019) have shown the importance of practice in their study, where they developed a learning path for trainee teachers based on the 'Trialogical' Learning Approach. This approach

> integrates 'monological' (with emphasis on individual knowledge and conceptual processes) and 'dialogical' (with emphasis on distributed cognition and the role of social and material interactions) learning approaches, with a third element: the intentional processes involved in collaboratively producing knowledge artefacts that are shared and useful for the community (Sansone, Cesareni, Bortolotti, & Buglass, 2019, p. 383).

Taking all these assumptions into consideration, we developed the present study which aimed to evaluate the digital competence level of a group of Portuguese Higher Education teachers. The study identifies the areas of competence with greater or lesser weaknesses and, from this analysis, intends to point out possible formative responses according to the results obtained. This assessment was based on a questionnaire developed by the EU Science Hub, the *DigCompEdu CheckIn*,

which allows teachers to identify their level of digital competence. This questionnaire has already been translated and validated for the Portuguese population by Dias-Trindade, Moreira and Nunes (2019).

2. Methodology of Research

2.1. Sample

This questionnaire was translated and validated for the Portuguese population by Dias-Trindade, Moreira and Nunes (2019) and this was the version used in this study.

The convenience sample was retrieved Online, between January and March 2019, from one Portuguese University, and answered by 118 teachers. Among the participants, 58 are male and 60 are female. No participant was less than 30 years of age and the age dispersion reflects the aging of the Portuguese teaching class (DGEEC, 2018). Only 14 teachers are between 30 and 39 years old (11.9%), 46 are between the ages of 40 and 49 (39.0%), 42 are between 50 and 59 years old (35.6%) and 16 are over 60 years old (13.5%).

As for the areas of teaching, Sciences is the one with the most participants (44.1%) and Psychology and Education is the one with the least (8.5%) (Table 1).

Table 1. Faculties of the participants

	Participants	
Faculty	N	%
Arts and Humanities	37	31.4
Sciences and Technology	52	44.1
Economy	19	16.0
Psychology and Education	10	8.5
Total	118	100.0

Source: elaborated by the authors.

2.2. Instrument

The instrument – *DigCompEdu CheckIn*[1] – was created by the *EU Science Hub* (Redecker & Punie, 2017), a Department of the European Union that seeks to identify teachers' needs regarding digital competences. More than just listing a set of competences, this instrument provides users with a report that, based on the answers given, makes suggestions for improving the practices teachers already have.

The European Department developed this instrument, with the collaboration of several European countries, and is currently being validated. In the instrument's online page, the authors indicate that

> this self-assessment tool is based on the European Framework for Digital Literacy Teachers, the European Digital Competence Framework for Educators (DigCompEdu). DigCompEdu is a competency model for teachers at all levels of education, from kindergarten to higher education and adult education, including VET, special education and non-formal learning contexts. DigCompEdu divides the digital competence teachers into 6 different areas [subdimensions] with a total of 22 competences. The focus of the model is not on technical skills. Rather, the model's claim is to capture how digital media can be used to enhance and modernize education and training[2].

Below are the three dimensions and six subdimensions addressed in the instrument, and their competences (Figure 1).

The first subdimension – *Professional engagement* –, framed in the first dimension – *Educators' professional competences* –, devotes its attention to professional development. It seeks to make teachers aware of their competences regarding the use of digital technologies to communicate, collaborate and evolve professionally.

The second subdimension – *Digital resources* –, in turn, framed in the second dimension – *Educators' pedagogic competences* –, concerns

1. The instrument was translated to portuguese by the authors, with the permission from the *EU Science Hub*.

2. Retrieved 29/04/2018, from https://ec.europa.eu/eusurvey/runner/DigCompEducheckin.

Figure 1. Synthesis of the *Digcompedu* framework

Source: Redecker & Punie, 2017, p. 8.

digital resources and the ability to search, create, and share those resources.

The third subdimension – *Teaching and learning* –, also, framed in the second dimension, seeks to help teachers identify their ability to manage and organize the use of digital technologies in the teaching and learning process.

The fourth subdimension – *Assessment* –, still framed in the second dimension, is dedicated to assessment skills, in particular in the way digital technologies are used to improve the students' assessment process.

The fifth subdimension – *Empowering learners* –, the last one of the second dimension, focuses on the empowerment of students. It includes the ability to use digital technologies to increase inclusion, personalisation and active involvement of students in teaching.

Finally, the sixth subdimension – *Facilitating learners' digital competence* –, framed in the third dimension – *Learners' competences* – addresses teacher competences to assist students in the use of digital technologies. It evaluates how teachers help their students to use digital technologies in a creative and responsible way.

One of the most interesting aspects in this instrument is that it is not limited to assessing the degree of use *per se* of digital technologies. It is also integrated in a broad strategy of interaction between the student's learning, evaluation and evolution. For the teacher, the instrument aims not only to identify the level in which he or she is, but also to realise what must be done to move to the next step (Figure 2). The authors of the European project understand that, for now, it is normal for most teachers to fit into levels B1 and B2 (respectively, integrator and expert). They also expect that there will be no results at the extreme levels, *i.e.,* A1 and C2 (Benali, Kaddouri, & Azzimani, 2018).

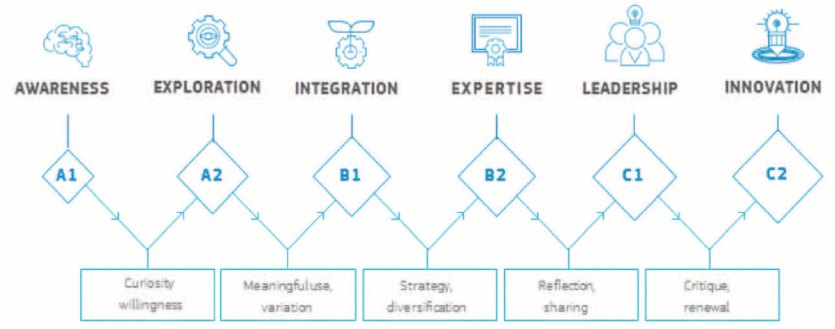

Figure 2. *Digcompedu* progression model

Source: Redecker, & Punie, 2017, p. 29.

2.3 Reliability of the instrument

From the answers obtained, different tests were performed to check the internal consistency of the instrument. The corrected item-total correlation and the squared multiple correlation tests (Table 2) allowed to understand that the instrument has a high internal consistency (a= .937), even though it presents one weaker value. That suggests that this particular item could be refined.

Table 2. Analysis of the instrument's internal consistency by item

Item		Corrected Item-Total Correlation	Squared Multiple Correlation
1	I use different digital communication channels for different purposes.	.558	.488
2	I use digital technologies to work together with colleagues inside and outside my school.	.587	.473
3	I continuously reflect on how I can improve my use of digital technologies in teaching and learning.	.623	.549
4	I participate in online training opportunities.	.647	.522
5	I use different internet sites and search strategies to find and select digital resources.	.532	.460
6	I effectively protect sensitive content.	.440	.357
7	I carefully consider how, when and why to use digital technologies in class, to ensure that they are used with added value.	.712	.673
8	I monitor learners' behaviour and engagement in the collaborative digital environments I use.	.706	.589
9	When my students work in groups or teams, they use digital technologies to generate and document evidence.	.692	.562
10	I use digital technologies to allow learners to monitor their learning themselves.	.689	.673
11	I use digital assessment formats to monitor student progress.	.595	.605
12	I reflect on the digital and non-digital evidence I have on learners' behaviour and progress to better understand individual problems.	.600	.467
13	I use digital technologies to provide effective feedback and help students understand their learning needs.	.706	.587
14	When I create digital assignments for learners I consider and address problems they may have with the digital format.	.697	.609

15	I use digital technologies to provide my students personalised learning opportunities.	.535	.428
16	I use digital technologies to more actively involve learners.	.631	.483
17	I teach learners how to check if information is reliable and to identify fake news.	.591	.527
18	I set up assignments which require learners to use digital means to communicate with each other or with an outside audience.	.664	.582
19	I set up assignments which require learners to create digital content.	.665	.568
20	I teach learners how to behave safely and responsibly online.	.653	.564
21	I encourage learners to use digital technologies creatively to solve concrete problems.	.660	.651

Source: elaborated by the authors.

The same instrument has already been applied to a group of 132 Portuguese teachers (Dias-Trindade et al., 2019), and its internal consistency analysis (a= .90) showed similar results to this research.

2.4 Data Analysis

The methodology followed is based on a quantitative approach. For each of the 21 competences of the instrument, a statement (item) is presented. The participants must select one of the five options that best characterises their position in relation to the same statement, on a Likert scale. The statements range from "no, I do not do this at all", to "yes, I do this comprehensively".

For each of the items, the same levels of points are assigned, ranging from 0, for the first answer, to 4 points, for the last one. In this sense, the total of the instrument is 84 points, divided by six levels of competence:

A1- Newcomer, below 19 points
A2- Explorer, between 19 and 32 points;
B1- Integrator, between 33 and 47 points;
B2- Expert, between 48 and 62 points;
C1- Leader, between 63 and 77 points;
C2- Pioneer, more than 77 points.

Therefore, those who mostly choose the first option are thus considered "newcomers". The truly pioneers will have to select the highest option in at least two thirds of the 21 items to achieve the highest level of competence.

3. Results and Discussion

The results show an average that places the participating teachers at the B1- *Integrator* level, given that the average obtained is 41 points (of a maximum of 84). According to the authors of the original instrument, this level indicates that respondents have the following characteristics:

Integrator: You experiment with digital technologies in a variety of contexts and for a range of purposes, integrating them into many of your practices. You creatively use them to enhance diverse aspects of your professional engagement. You are eager to expand your repertoire of practices. You are, however, still working on understanding which tools work best in which situations and on fitting digital technologies to pedagogic strategies and methods. You just need some more time for experimentation and reflection, complemented by collaborative encouragement and knowledge exchange to become Experts (B2)[3].

As can be seen in Figure 3, Dimensions two – *Educators' pedagogic competences* – and three – *Learners' competences* – are the ones that present lower values. Among them, subdimensions – *Teaching and Learning* – and – *Assessment* – (from Dimension two) stand out, as well

3. This information is presented in the feedback given by *Digcompedu Checkin* after participation.

as the subdimension – *Facilitating learners' digital competence* – in Dimension three.

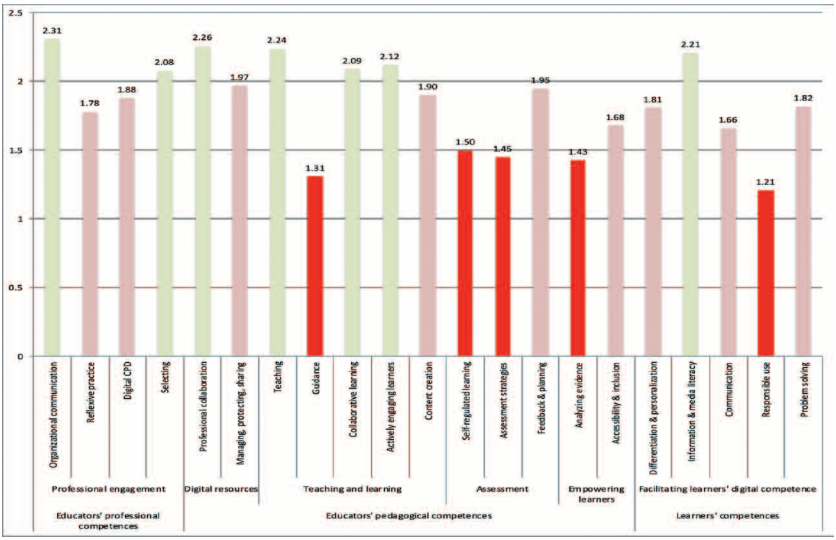

Figure 3. Average results for the six subdimensions

The analysis of each of the 21 competences, shows that the three with the lowest values are *Guidance*, *Analysing Evidence* and *Responsible Use*.

These three competences correspond to the following items of the instrument:

9- In the digital environments that I use to work with my students, I watch their behaviour very closely
13- I analyse all data available to me to timely identify students' who need additional support
21- I enable my students to behave safely and responsibly online.

This set of competences is linked to a more individualized work with the students, especially with regard to the adaptation of strate-

gies according to their needs. In fact, developing strategies, providing feedback, helping in self-regulation of learning, content creation and communication are skills that require an interaction between teacher and student. That and the ability to shape and adapt the teachers' scientific and pedagogical skills to reality.

Of the 21 competences, the three that present higher average values (above 2.00 points) are *Organisational Communication*, *Professional Collaboration* and *Teaching*. They correspond to the following items:

> *1- I use a variety of different digital communication channels for a variety of purposes.*
> *2- I use digital media to work with colleagues inside and outside my educational organization*
> *7- I carefully consider how, when and why to use digital technologies in class, to ensure that they are used with added value.*

Among these competences we find a set of items that relate to a reflexive practice, analysis and preparation at the level of strategies and digital resources. This is closer to the planning work that every teacher should have.

Overall, the digital competence level of the teachers involved in this study is moderate, level B1 - *Integrator,* and the dimensions with the lowest values are *Educators' pedagogic competences* and *Learners' competences*. According to what has been defined for this level, teachers "... need a little more time for experimentation and reflection, complemented by collaborative support and knowledge sharing, to become Expert".

The results also highlight that subdimensions three – *Teaching and Learning* –, four – *Assessment* – and six – *Facilitating learners' digital competence* as the ones where teachers need to invest a bit more. This reflects the need for more investment in work with students either in or out of class.

Also, the competence in which teachers perceive they have more competences is in Dimension one - *Educators' professional competences*-, in particular in terms of Organisational Communication content. This is where the highest results are noted, close to *Expert* (B2), which

does not mean that they don't have to invest more in training, that of *Leader* (C1) or *Pioneer* (C2).

All these are directly related to the definition presented for level B1, *Integrator*. That is, professionals who use digital technologies and are willing to use and reflect on this – in line with items 1, 2 and 7. On the other hand, still need to understand how to adapt the different digital tools to their objectives, their strategies and methodologies. Items 9, 13 and 21 refer precisely to an articulated use with the students so that they take ownership of these same tools when constructing their knowledge.

When examined by professional areas, results show that teachers working in Arts and Humanities have had much higher average results, as shown in Figure 4. The other three Faculties show similar results.

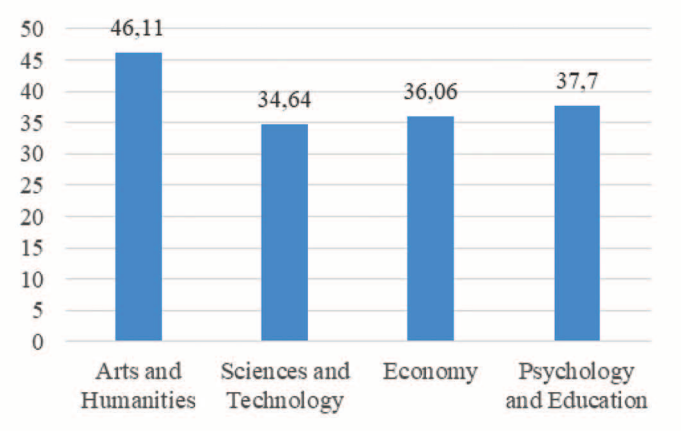

Figure 4. Average results by professional areas

These results can be justified by the Faculty Board's effort, since 2018, in developing a teacher training plan. Since then, the Faculty's

Board has developed training programs for their teachers[4] on the pedagogical use of technologies, in articulation with NEPES/CEIS20[5].

When analysing the results average by age (Figure 5), it's the group of teachers within the age range from 40 to 49 years that presents the higher values (42,52). Interesting to find that the youngest group of teachers had the lowest results and the second higher value was achieved by the oldest group of teachers.

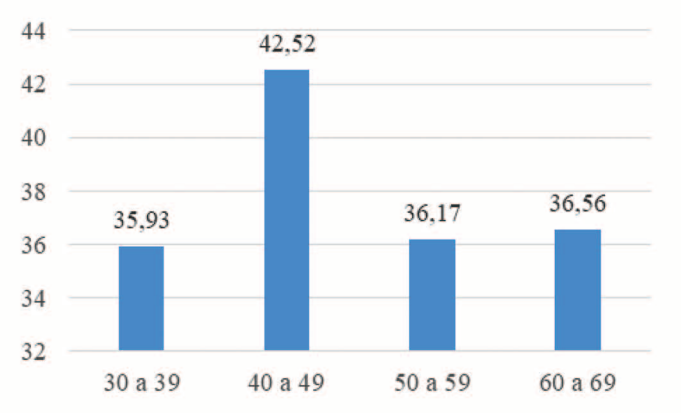

Figure 5. Average results by age

These results are identical to those of Wang, Myers and Sundaram (2012) who suggest the existence of a *continuum* rather than a rigid dichotomy between so-called native and digital immigrants. The authors also explain that there are several factors, in addition to age or accessibility to tools and digital content to explain the issue of digital fluency.

4. https://www.uc.pt/fluc/formacaoprofessores.

5. NEPES (Núcleo de Estudos da Pedagogia do Ensino Superior – Higher Education Pedagogy Studies Group) - http://www.uc.pt/iii/ceis20/grupos_investigacao/nepes/formacao.

4. Conclusions

As technologies in the digital era are fast developing, education institutions must find mechanisms to develop innovative ecosystems and learning environments in which students can live as the true digital nomads they are.

Accordingly, the topic of digital competence has become an inescapable issue in all discourses on educational technologies. Much discussion has been going on regarding whether these resources really do help create these emerging ecosystems and learning environments. However, the question that keeps cropping up not only concerns the use of technologies and the existence of a digital literacy, but, deeper than that, has to do with understanding how this technology can be used to achieve the desired goals. In other words, what must be done to be a true "digitally fluent" user. Both teacher and students alike must try to "learn to work" in these digital environments. They also have to "learn to use" different tools, with teachers having added responsibilities in this process as they are the architects of these environments.

According to this research's results and to the pilot-study conducted by Dias-Trindade et al., (2019), it can be concluded that in addition to the appropriate psychometric features of the instrument. The digital competence level is also identical in the Portuguese high school and university cohort of teachers.

Analysing in more detail the twenty-one instrument's competences, it's clear that the competences that are most articulated with an adaptation to the different needs of its students are those that reflect greater difficulties to be achieved. When these refer to feedback, to self-regulated learning, to the adaptation of learning, that is, to practical work according to the needs of the students, greater difficulties arise in the adaptation to the digital context. On the other hand, competences related to a teacher's individual work, to a reflexive practice and planning, are the ones that collet, on average, the higher results.

These findings show the need for teachers to increase their digital competence levels through specific training, especially as regards the

pedagogical use of technology. This training should be practical and experimental in nature. Therefore, this training should be directed to working with tools, platforms or interfaces, where both the teachers and the students themselves are involved. That way, teachers will feel confident about using digital technologies not only in collaboration with their peers, but especially with their students.

It is necessary to initiate educational processes aimed at improving and developing the professional quality of teachers. That has to be done by using training models consistent with the pedagogical dynamics of the social web, with special focus on practical training.

Finally, although these resources produced by the *EU Science Hub* are relevant as tools to assess the teachers' level of digital competence, it is necessary to conduct more studies to validate the instruments. In fact, the instrument used, translated by a Portuguese translation specialist, with the authors' permission, has proved to be trustworthy instrument with psychometric features. Therefore, its use in future studies to be developed in this area would be interesting. In fact, besides the good indicators of validity, overall the measures applied are characterised by what is believed to be good or adequate reliability. One can assume, therefore, that they consistently assess the variables they are meant to measure, thus being an instrument capable of contributing to the assessment of teachers' digital competence level.

Nevertheless, the small dimension of the sample is a limitation to this study. It is necessary to apply the instrument in all Portuguese territory, in order to obtain a much more representative sample of Portuguese universities' teachers' digital competences. The findings will allow the preparation of differentiated training, in digital competences, depending on difficulties found in the instrument's different dimensions.

It can indeed be claimed that today's education requires that the pedagogical process is seen in a different way. However, change should not be seen from a technological viewpoint only, but also in terms of mentality and of pedagogical practice. This implies a cultural change, as it calls for a review of the roles of teachers and students, and of the relation between them. Teaching and learning in this digital

society using digital technologies is, without a doubt, an attractive challenge, yet at the same time very demanding. This is why it is so important to invest in training models, such as the learning path prepared by Sansone and colleagues (2019), based on the *Trialogical Learning Approach*. This study not only identifies the nature of knowledge required for integrating technology in teaching, but gives teachers the chance to put it into practice by means of training. This, then, allows for them to feel confident in trying to reach the desired digital fluency.

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