

THE HEDICOM FRAMEWORK: HIGHER EDUCATION TEACHERS' DIGITAL COMPETENCIES FOR THE FUTURE

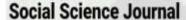
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Abstract: There is little consensus about nature of teachers' digital competencies Higher Education. in Moreover, existing digital competence frameworks have largely been developed for teachers in secondary education. In response to this, the current study focuses on developing and validating a framework of digital competencies for teachers in Higher Education. First, a review was conducted to determine the state of digital competence research regarding dimensions and defnition of digital competence. In a next step, similarities and diferences between existing digital competence frameworks were identifed. Based on the outcomes of the review and the framework comparison, a framework was developed in an iterative process through expert meetings with policy makers, experts in the feld of educational technology, and validated with practitioners. The new framework includes four dimensions of competencies: teachers' digital Teaching practice, (2) **Empowering** students for a digital society, (3) Teachers' literacy, and (4) Teachers' professional development. The resulting Higher Education Digital Competence (HeDiCom) framework will provide guidance and clearer expectations of teachers' digital competency. Ultimately, improving teachers' digital competencies will contribute to improving the quality of digital competencies of the students.

Keywords Curriculum analysis · Digital competencies · Higher Education · Technology curriculum · ICT frameworks

I. Introduction

With the rapid increase of technology available to support learning in recent developing decades, the digital competence of university graduates to prepare them for the future workforce has become a priority. However, for these digital competencies to be developed in Higher Education (HE) students, their learning environments and tasks must be designed to provide opportunities to build these competencies. Clearly, HE teachers must be able to organize learning environments which in students themselves develop digital competencies. This is particularly important in relation to online and blended learning. The Covid19 pandemic has forced teachers in Higher Education towards a rapid and massive shift to online teaching across the world (Schleicher, 2020). Teachers, most of whom had never fully taught online, were asked to redesign their teaching practice to support their students in an online environment (see Scherer et al., 2020). The question remains to what extent these teachers are prepared to teach online or in a blended setting. Teaching with digital technologies requires digital competencies but also diferent pedagogical approaches than for instance teaching face-to-face (Gurley, 2018). As a consequence, the focus on digital competence continues to grow in popularity in Higher Education (Zhao et al., 2021). Clearly, teachers are adequately use expected to technologies to strengthen their teaching practice and enhance their educational practice. The problem is that it is not always clear which digital competencies





HE teachers should possess to adequately integrate ICT into their educational practice, and they lack guidance on developing their digital competence (Basilotta-Gómez-Pablos et al., 2022; Bennett, 2014; Tondeur et al., 2018).

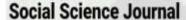
There are a number of digital competency frameworks created by government agencies and nonprofts (e.g., ISTE, DigcompEdu), but these have mainly focused on teachers in school contexts Higher rather than Education. complicate this issue, there is little consensus about what features should be included in a HE competency framework (Tondeur et al., 2018). The current study intends to provide practitioners, the research community, as well as policy makers with a digital competence framework that can be used in Higher Education. This would provide important guidelines for teachers in Higher Education implementing and on integrating ICT in their teaching practices, promoting innovation, and sustaining professional growth. It also signals support that may be needed to develop digital competencies. In a frst step we reviewed the evidence based on the digital competencies teachers in Higher Education should possess. Next. we identifed similarities and differences between existing frameworks, to act as a lever for the development of necessary digital competencies to form an initial framework. In a fnal step, we validated the initial framework in order to refne the framework on the basis of experts' opinions and to explore the recognizability and usability of the framework for institutions of Higher Education. The result of this work has been a new framework for digital competence in Higher Education, which provides a straightforward tool for direct implementation in HE teaching.

II.Background

The notion of digital competence is not new in educational research and training. However, competencies have changed and evolved over time relative to political, social, and educational contexts (Ilomäki et al., 2016). Digital competence has been understood in relation to digital literacy, digital capabilities, digital knowledge, etc. In the following section we The HeDiCom framework: Higher Education teachers' digital... 35 1 3 frst address digital competence and how it has been defined, then consider existing frameworks and their relation to Higher Education.

Digital competence

Digital competence is a critical element in a teacher's successful integration of digital technologies in learning (Tondeur et al., 2018). It is of particular importance when considering how teachers designing online, blended or hybrid learning spaces. Throughout the years, diferent terms have been used to capture 'digital competence', namely it has overlapped with 'digital literacy' in terms of higher order capabilities, such as problem solving with digital technologies. However, competencies have typically combined digital skills with digital literacies. As such, in 2002 the OECD began work to identify key competencies in training and education and a way to understand these competencies across contexts. They defined competency as "the ability to meet demands or carry out a task successfully, and consists of both cognitive and non-cognitive dimensions" (OECD, 2002, p. 4). In the case of digital competence, cognitive aspects refer to literacies, while noncognitive dimensions are more closely related to digital knowledge, capacities and efcacy. As this defnition evolves, the enduring aspect of competencies is the successful





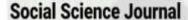
use of technologies to meet demands whether these be social, work or learning. In the current study, we follow the defnition of 'digital competence' used by the General Secretariat of the Council of the European Union. This defnition provides a comprehensive view of the role digital technologies ofand digital competence education: in **Digital** competence involves the confdent, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking. (European Union, 2018).

Digital competence and Higher Education

competencies Developing digital students to prepare them for the future workforce has become a priority in many universities around the world (Tondeur et al., 2018; Zhao et al., 2021). Higher institutions are Education "rich technology resources and technologybased activities" (Selwyn, 2010, p. 2), but the risk of digital divisions among students in regard to what they use and how they use it is high. Moreover, it is expected that students will soon enter the workforce and there is a need for them to perform as knowledge workers, which requires a high level of digital competence (Ilomäki et al., 2016). For students to achieve a high level of digital competencies in their feld, to become successful knowledge workers, HE teachers must also possess the digital competence to guide their development. Zhao et al. (2021) have shown that HE teachers and students have basic digital

competence; however, without clear standards of digital competence developing these competencies remain elusive. According to Zhao et al. (2021), the most frequently identifed competencies were the use of digital technologies, knowledge of digital technologies, the and technological Internet related digital experiences capacities, and attitudes. The competencies mentioned above have been identifed in research, but existing digital competency frameworks, such as DigcompEdu have been created for use at the compulsory

school level (see Redecker & Punie, 2017). In some cases, research has drawn on schoolfocused competency frameworks (Zhao et al., 2021), but the skills, attitudes and experiences of school learners and teachers, when compared to Higher Education, are quite different. Frameworks specifically designed for Higher Education are needed to address the complexity of digital technologies in the context and trajectory to the workplace. In this respect, Lin and Johnson (2021) have called for more research that is directly applicable to the specifc teaching and learning context. A key aim of the current research has been to create a framework that can be used by HE teachers, to refect on their own practice. Existing frameworks, while comprehensive and providing rich defnitions of competencies, have also been at a level of detail that can be difcult for practical implementation to support the ongoing digital shift in education (see Howard et al., 2022), especially since the outbreak of the COVID-19 pandemic. This Great Online Transition (Scherer et al., 2021: Tondeur et al., 2021) transformed most HE from traditional to online and blended teaching and learning (see also Zarei & Mohammadi, 2022). Moreover, HE institutions that cultivate elites for our society, should





committing to innovate and to efectively integrate educational technologies (Cordie & Lin, 2018). As a result, this HE context requires education institutions to reconsider the necessary digital competencies. This brings us to the purpose of the study

Context and purpose of the study

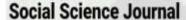
As stated in the literature, a debate exists concerning the nature of teachers' digital competencies and how they can be best developed in Higher Education (cf. Falloon, 2020). The majority of digital competence frameworks were developed specifcally for compulsory education. Only recently has the feld turned its attention to competencies in Higher Education. But according to Zhao et al. (2021) "it is still not easy to get a full picture of digital competence of teachers and students in the context of Higher Education" (p. 6). The purpose of this study was to create a framework for digital competencies in Higher Education. Such a competence framework can serve as a common reference (Vuorikari et al., 2016) depicting articulated digital competencies and hence support the development of expertise (McGee et al., 2017). In that way, a comprehensive framework is needed that can improve the transparency and simplify what is expected of teachers. Ultimately, improving the digital competencies of teachers will also enhance the quality of the educational activities and the digital competencies of the students.

Research design

The aim of this study is the development and validation of a framework of digital competencies for teachers in Higher Education. This was done in three stages. The frst stage comprised a literature review which was conducted in order to provide an objective and comprehensive view of the existing literature and frameworks. The main goal of this review was provide an overview competencies relevant to teaching and learning with ICT in Higher Education. The second stage included the analysis of existing digital competence frameworks to establish main- and sub-dimensions of digital competencies, determining similarities and differences between the frameworks. The result of these two stages HeDiCom framework: Education teachers' digital... 37 1 3 was an initial draft framework for digital competencies in Higher Education. In the fnal stage, the initial framework was reviewed by experts and refned. The revised framework was then validated in a series of focus groups with practitioners. Below we present the procedure in more detail.

III.Review of the literature

Between December 2020 and February 2021, a review of literature on digital competencies was conducted to locate, critically evaluate, and synthesize studies about the teachers' digital competencies. This study drew on a systematic review which is defned approach, interpretation of a selection of documents on a specific topic that optimally involves summarization, analysis, evaluation, and synthesis of the documents (Petticrew & Roberts, 2006). Four inclusion criteria were employed: (1) the language of the article is English, (2) the article was published between December 2010 and December 2020, (3) only articles and reviews are accepted, no other type of publication, (4) the article is peer-reviewed in the database Web of Science. The search terms used were: (ICT) AND (Higher Education) AND (Competence*) AND (Lecturer OR Educator OR Teacher





OR Faculty OR Professor). Initially, 122 empirical articles were identifed. Abstracts were examined to identify the educational level and if the topic was relevant for the review, which identifed 36 relevant articles. The excluded articles had, for example, a focus on teachers' perception on their digital competence or on their level of digital competence, without discussing what competencies included in the digital competence. Fulltext readings of these articles further identifed 21 articles that were specifcally digital competencies addressing teachers in Higher Education. These articles were then synthesized.

Comparison of existing frameworks

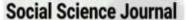
The following frameworks were compared: Competence framework for Teaching and Learning with ICT (van et al., Loon 2018), DigCompEdu Digital Punie, 2017), (Redecker & Professional Framework Teaching (Education & Training Foundation, 2019), ISTE Standards for Lecturers (ISTE, 2017), JISC Teacher Profle (JISC, 2019) and UNESCO ICT competency framework for teachers (UNESCO, 2018). The main and sub-dimensions of the frameworks were identifed, existing similarities were merged where necessary, and remaining digital competencies were mapped. The result was an overview of identifed dimensions. This resulted in an initial draft of the HeDiCom framework, which included four main themes: Teachers' digital literacy, Teachers' Professional Identity; **Teaching** Learning with Technology; Empowering students. The overview further provided a list of possible main-and sub-dimensions, related to these themes. The initial framework was further refned through expert discussions (see section "Expert meetings and validation of the framework").

Expert meetings and validation of the framework

Experts participating in the study were identifed as Dutch-speaking academics working in the area of digital technologies and teacher education, in Higher Education. Expert meetings comprised 11 experts across three groups, which met online twice over two months. In the frst meeting, each group discussed design criteria for the framework, 38 J. Tondeur et al. 1 3 the initial draft of the framework with its themes, and dilemmas at hand. The main design criteria were: the framework should be specifcally aimed at educational digital innovation in Dutch Higher Education Institutions; it should include competencies on empowering students for a digital society, with special attention to students' future profession; and the framework should be recognisable and useful for educational professionals in Higher Education and support them in improving their educational practice. The framework was then refned and again reviewed in an iterative manner in each subsequent session. In this process, mainand sub-dimensions were further defned. This resulted in a complete frst version of framework the new for digital competencies. The resulting frst version of the framework was then validated through online sessions with 34 educational professionals and teachers.

IV.Results

The fnal version of the Higher Education Digital Competence (HeDiCom) framework includes four dimensions, with two or three subdimensions (see Fig. 1). In the next section, we will discuss the four main





dimensions, its subdimensions and the associated competencies.

Teachers' digital practice

The frst dimension of the framework relates to digital competencies that are required as part of teachers' digital practice. The (re)design of digital learning requires specifc



competencies of teachers (Basilotta-Gómez-Pablos et al., 2022; Bennett, 2014). The fndings of the literature review emphasize that, in the context of stimulating educational change through the use of ICT, it is important for teachers to be aware of how and why they want to integrate digital technologies in a specifc context, while ensuring alignment between learning objectives, learning activities, learning resources and assessment (see Heitink et al., 2016). As a consequence, integrating ICT into education requires teachers in HE to rethink their educational designs, implement new or refned designs, evaluate the results and then potentially redesign, beginning the process again. Therefore, the three sub-dimensions are: (1) Designing and implementing, Facilitating and monitoring, (3) Evaluating and modifying.

Designing and implementing

The findings of the literature review point to the importance of the sub-dimension "Designing and implementing" (e.g., Ardiç & Çiftçi, 2019; Cabero-Almenara et al., 2020; Romero Alonso et al., 2019). Some studies also highlight that ICT can act as a catalyst for innovation in practice, for example to create more fexible. personalized and self-regulated learning (Schneckenberg, 2010). As part of the Great Online Transition (GOT) (Scherer et al., 2020), teachers in HE have needed to transform their teaching practice into remote, online and blended learning formats (Scherer et al., 2021; Tondeur et al., 2021). To become a competent online teacher, there is a need for professional development and sufcient time to design and practice online and blended learning environments (see also Kebritchi et al., 2017). To do this, it is important that HE teachers create new digital educational resources, change and arrange existing sources (e.g., Cabero-Almenara et al., 2020). Some studies emphasize the potential of including students in the design process and implementation of these new designs (ISTE, 2017; Redecker & Punie, 2017) while also taking into account student well-being and social inclusion. This is an aspect that receives very little attention in the literature review on teachers' digital competencies, but it is mentioned in several frameworks (cf. DigCompEdu and JISC).

Facilitating and monitoring

When using ICT to facilitate and monitor student learning, the second sub-dimension, HE teachers should make conscious use of the possibilities ofered by ICT to improve or support students' learning. Teaching should be aligned with the needs of students, for instance to ensure more fexible and personalized learning and greater student self-regulation (Cabero-Almenara et al., 2020) and to facilitate collaborative learning (Ricardo-



Barreto et al., 2020). Teachers also need to be able to use digital technologies for student assessment. Diferent formative and summative assessment strategies using ICT can increase the efectiveness of assessment, for instance to give online feedback or peer review (Segovia Cifuentes & Díaz Gómez, 2016). The literature review reveals that the data generated by various systems can be used to analyze and optimize the learning process (cf. learning analytics). A review by Viberg et al. (2018) for instance shows that there is much potential for using and analyzing this data to improve the learning process, but that this rarely takes place in practice.

Evaluating and modifying

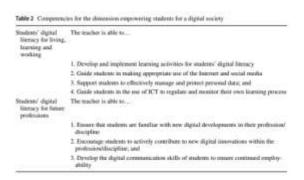
As well as assessing students' learning processes, teachers in HE also need to be able to evaluate their (re)designed learning arrangements using ICT and modify their practice accordingly teaching dimension 3). To do so, teachers can use data from digital systems and digital learning resources (van Loon et al., 2018). At the same time, they should also be able to refect on their own educational practice and design and implement improvements on how to integrate digital technologies into teaching and learning processes, and in particular the suitability of ICT for improving student learning. Based on the following HE above. the teachers' competencies for designing, implementing, and evaluating education were formulated.

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| Designing and implementing | The teacher is able to |
|------------------------------|--|
| | Design digital learning that is consistent with conceptions of teaching, the discipline and the institutional vision of education. |
| | Design digital learning that responds to snakens' melvidual needs and supports student ownership |
| | Support, combine and coordinate learning process in a variety of contexts (c.g. face-to-face, online and in the workplace) |
| | Take the well-being of stalletes and inclusion into account in digital learning design; and |
| | Soluct, modify, sequence and covare digital resources and learning nature als |
| Facilitating and receits/ing | The trucker is able to |
| | Use ICT to monitor and support the malents' learning process using formative and summative assistants. |
| | Use ICT to collect, analyse and report on snadout data to understand and improve their learning process; and |
| | 2. Use ICT to provide timely and personalized supervision and support |
| Evoluting and modifying | The tracker is able to |
| | 1. Evaluate and optimize digital learning designs |
| | Reflect on the benefits of implementing digital brancing and redesign occurdingly; and |
| | Reflect their digital reaching practice and adapt this is individual, institu- tional and societal reeds |

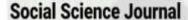
Teachers' digital literacy

Research evidence from the review has shown that teachers' digital literacy is related to the quality of their educational practice using technology (see e.g., Tondeur et al., 2017) and can considered as a prerequisite for students' digital literacy (Falloon, 2020). Therefore, HE teachers' and students' digital literacy are presented in parallel in the model depicted in Fig. 1. Digital literacy is also mentioned in various frameworks, such as Digital Teaching Professional Framework (Education & **Training** Foundation, 2019), the JISC Teacher profle (Higher Education) (JISC, 2019), the ISTE Standards for Educators (ISTE, 2017) and the UNESCO ICT Competence Framework Teachers (UNESCO, for 2018). Based on the comparison of these frameworks and the review of



V.Discussion and conclusion

The main goal of the current study was to create a framework of digital competencies



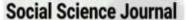


for Higher Education that is simplifed and practice focused. Based on the fndings of the systematic review, the comparison of relevant existing digital competence frameworks, and the focus groups with experts and practitioners, we developed the HeDiCom Framework (see Fig. 1). This new framework includes a comprehensive set of digital competencies grouped in four dimensions: (1) Teachers' digital practice, (2) Empowering students for a digital society, (3) Teachers' digital digital literacy for teachers, and (4) Teachers' professional learning. Below we discuss the main principles of the HeDiCom Framework, together with the implications for research, practice and policy. The systematic review and expert discussions confrmed these are necessary for students to develop digital competencies (see e.g., Zhao et al., 2021).

A full picture of HE teachers' digital competencies?

As ICT continues to drive changes in society, Higher Education institutions need to define an organizational vision in view of the planned change. In this respect, the empirical evidence stresses the importance developing teachers' of digital competencies (see e.g., Basilotta-Gómez-Pablos et al., 2022; Bennett, 2014). As stated before, a debate exists concerning the nature of teachers' digital competencies and how they can be best developed in Higher Education (Falloon, 2020; Tømte et al., 2015). With only four dimensions, the new HeDiCom framework is neither too complex nor too simple to provide a clear overview (see Fig. 1). Other frameworks provide a longer list of (sub-)dimensions to distinguish between types of digital competencies (e.g., DigCompEdu). According to Kimmons and Hall (2018), a good framework reduces complexity, and should be easily

learned and remembered. In this respect, a too large number is less helpful to identify relevant use patterns (see also Scherer et al., 2020). This illustrates an apparent tension between the need for simplicity and the need to present a rich picture of digital competencies. The four main dimensions in the HeDiCom framework each represent a different set of digital competencies. However, in practice diferentiation between these competencies always straightforward. not adequately integrate the HeDiCom framework into practice requires attention to not only the separate dimensions, but also the relationship between each of them (see also Spante et al., 2018). According to Spante et al. (2018), also the assessment of a specifc digital competence requires the understanding of related constructs. They are linked together in ways that make it difcult to address them separately. Further, artifcially attempting to separate competencies is not necessarily useful when thinking about developing teaching and learning. To illustrate, "teachers' digital literacy" (Dimension 4) in the HeDiCom framework can be associated with teachers' capability to "design, implement and evaluate education with ICT" (Dimension 1). Let us argue that a teacher has identifed a need to develop their own level of digital literacy to better use video conferencing in their practice, to move to a more blended learning design. In this respect, Tondeur et al. (2017) stated that the distinction between digital literacy and educational technology use can be marred by the fact that technical ICT-use nevertheless involves some knowledge and skills construction. As stated before, Dimension 1—designing an ICT-rich learning environment—can also be considered prerequisite as for empowering students for a digital society (Dimension 2). At the same time,





"teachers' professional learning with ICT" (Dimension 3) is necessary for the development of their digital literacy (Dimension 4). Therefore, these different dimensions are presented in a specific way as depicted in Fig. 1.

VI.Conclusion

The main goal of the current study was to framework for digital competencies in Higher Education. The resulting HeDiCom framework enhance the transparency of what is expected of Higher Education teachers and hence support the development of their competencies. digital Ultimately, improving their digital competencies will also enhance the quality of the educational activities and the digital competencies of the students. In this study, we especially focused on the iterative construction of a comprehensive set of digital competencies and although future research is needed to further develop this framework, we hope that the HeDiCom framework can be helpful for the development of Higher Education teachers and students' digital competencies for the future.

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