TEACHER EDUCATORS' DIGITAL COMPETENCE: FIRST RESULTS OF A SYSTEMATIC LITERATURE REVIEW

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Abstract

What defines a digitally competent teacher educator? This systematic literature review was set out to answer that specific question. Eight national and international frameworks for the digital competence of teacher educators were selected and are analyzed and compared through a qualitative content analysis. This paper gives an overview of the theoretical background and the method of this research. Furthermore, first findings of the systematic literature review are presented and discussed in terms of what they imply for further research and for teacher education in Germany.

Introduction

Nowadays, it is impossible to imagine life without digital technologies. They will therefore continue to play an increasingly important role in education in the future. In recognition of the many potentials that digital media offer for teaching and learning, this is initially a positive development. But in order to exploit their full potential, digitally competent teachers are needed. According to research, teachers in Germany currently lack digital competence (Eickelmann et al., 2016). One reason for this is certainly that teacher training does not adequately prepare prospective teachers for the professional use of digital media (Senkbeil et al., 2020). The inevitable question arises as to the causes of this. Part of the reason might be due to the fact that there are not enough competent educators at the universities. As Tondeur et al. (2012) have shown, educators are important role models for student teachers, and at the same time their own digital competence plays a key role in preparing prospective teachers to use digital media in class. However, recent studies - at least in Germany - only focus on the digital competence of pupils, student teachers, and practicing teachers (Capparozza & Irle, 2020). So far, we hardly know anything about the digital competence of university teachers in teacher education.

But before one can investigate the digital competence of teacher educators, we need to know what defines a digitally competent teacher educator. In Germany, there is a lack of binding standards or research regarding this topic. This literature review tries to find an answer to the question of which competences teacher educators need in order to be digitally competent. Before describing the methodology and first

results, this paper addresses the concept of digital competence and related frameworks.

Digital Competence

In general, competences describe desired outcomes and achievement goals, usually with respect to an educational process. Digital competence is a term with no consistent definition. In the context of higher education, it is often used without any definition at all (Spante et al., 2018). According to the European Commission (2019) "digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society" (p. 10). According to this definition, depending on the context (e. g. work, participation in society, etc.), different competences are needed. Additionally, this means that the required digital competences might also differ depending on the profession – a physician may need different professional digital competences than an architect.

From a theoretical point of view, it is possible to distinguish between competence as a latent construct and the observable behaviors it enables. Correspondingly, competence models can be distinguished from target statements or standards. In general, *competence* can be defined as consisting of knowledge, skills, and attitudes (Wiater, 2013; Frezza et al., 2018). A competency model then primarily specifies its internal structure, i.e., what knowledge, skills, and attitudes are involved in a particular competence and how they are interrelated to form a coherent construct.

In contrast, a *target statement* describes a particular observable behavior whose successful performance requires the right-minded and skillful application of knowledge in a certain situation (Clear et al., 2020). As such, it represents an operationalization of the latent competency construct. Moreover, multiple target statements may refer to the same competence, e.g. at different levels of mastery. Target statements describe what certain individuals are ultimately expected to be able to do, often at various intermediate stages throughout an educational program, which serves as a basis for the development of both interventions and assessment instruments.

In practice, the development of competency models and target statements involves complex and often interrelated processes. They might be derived from theory, or relevant competences can be determined empirically. Often, a combination of theoretical and empirical work is used. In recent years, different approaches were used to describe the digital competence for teacher educators (e.g., Foulger et al., 2017). Yet a commonly accepted set of target standards does not exist.

Method

To identify relevant digital competences for teacher educators, a literature review was conducted. Relevant competency frameworks are compared to a qualitative content analysis.

Systematic Literature Review

In the following, the search strategy of the literature review and the selection process of relevant frameworks are presented.

Search Strategy

The intention was to include literature, published in English or German, from Computer Science as well as from Educational Sciences. To cover this broad spectrum, three literature databases were therefore selected (below, the name of each database is hyperlinked, followed by the actual URL):

- dblp Computer Science Bibliography (https://dblp.dagstuhl.de): A database of English and German language results in the field of Computer Science.
- ERIC-Institute of Education Sciences (https://eric.ed.gov): A database with English-language results from the field of Educational Sciences
- FIS Bildung Literaturdatenbank (https://www.fachportal-paedagogik.de/literatur/produkte/fis_bildung/fis_bildung.html): A database with German-language results from the field of Educational Sciences

The search was conducted between June and October 2022. Search terms were combinations of keywords regarding the digital competence (*digital, competenc*, literac**), the target group *(teacher, educator, teacher educator*), the educational institution (*higher education, university*) and requested document type (*framework, model*). German translations were used analogously as well. Only search results from the last ten years were considered (sources that were published in 2012 or later) to ensure to find frameworks that are not outdated.

Selection Process

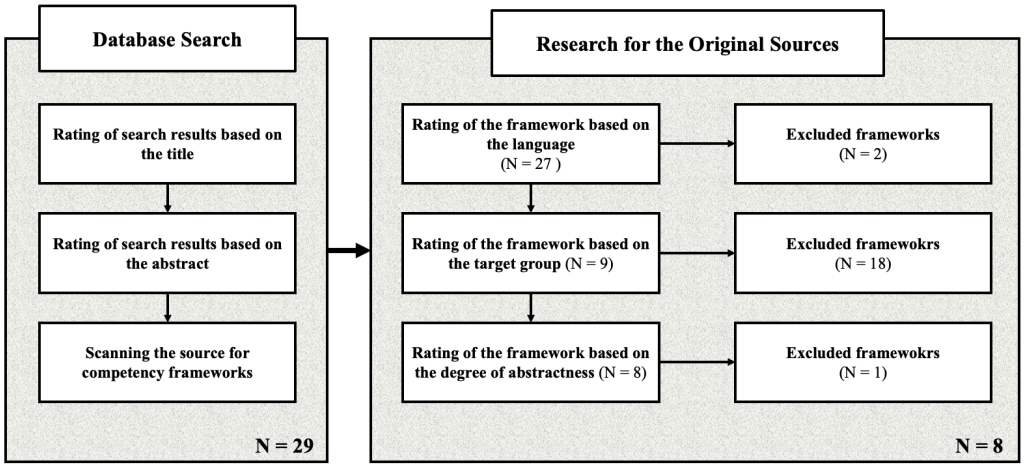
The search results were filtered according to the process outlined in Figure 1. They were either considered or immediately discarded based on their title. If the title seemed to be relevant for the research, the abstract was read and again a decision was made about consideration or exclusion. All sources judged to be relevant were read and the competency frameworks mentioned in the text were listed.

The original sources for the competency frameworks were then researched. Competency models that were mentioned in the original sources were also included in the list. A total of 29 relevant competency frameworks were identified. The frameworks were either included or excluded based on the following factors:

- Language of the publication
- Target group
- Degree of abstractness

Figure 1

Procedure of the systematic literature review



Due to language barriers, frameworks that have not been published in English or German were excluded. Furthermore, frameworks that did not deal with professional digital competences of university educators in teacher education were excluded. Lastly, only frameworks that actually include target statements rather than just talk about the digital competence on a very abstract level (like Krumsvik's 2014 model for teacher educators' digital competence), were included. Examples for concrete target statements are:

> Teacher educators "*evaluate content-specific technology for teaching and learning.*" (Foulger et al., 2017, p. 432)

> "*Teacher educators can search and select useful information and teaching materials from media provisions.*" (Meeus et. al, 2014, p. 49)

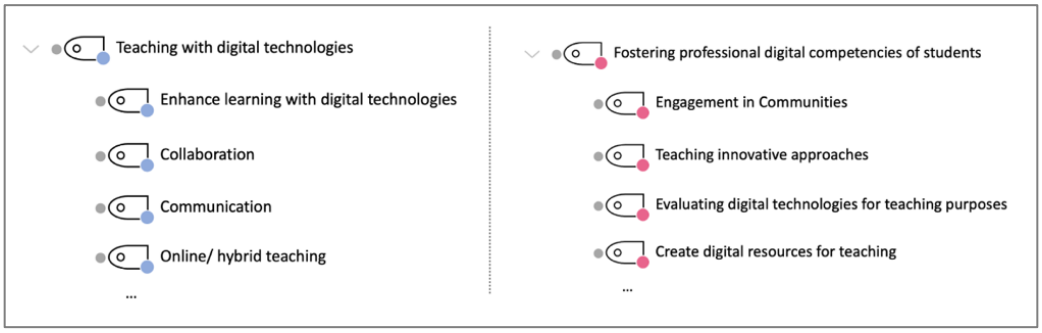
Qualitative Content Analyses

A comparative content analysis of the corresponding documents (N = 8) followed, with the aim of finding a core of competences shared across all models. The guiding questions for the analysis were:

- Which competences are listed in the competency frameworks?
- Which competences are mentioned particularly frequently?
- Which competences appear in all competency frameworks?

The qualitative content analysis follows the steps proposed by Mayring and Brunner (2006) in their process model for inductive category formation. After the selection and characterization of the material, background information about each framework was gathered in order to summarize its communicative context, particularly its development process, its target group, and its intended purpose. The smallest coding unit was set to one sentence while the smallest context unit was set to one word. For the coding runs, only the target statements are considered. During the first coding iteration, categories were inductively formed. The produced codes were kept very wide-ranging. They include knowledge areas (e. g., knowledge about media didacts) as well as application areas (e. g., using digital technologies for assessment), attitudes (e. g., digital leadership) or more concrete operating capabilities (e. g., sharing digital resources). Afterwards, the codes were grouped together into top categories (for examples see Figure 2).

Figure 2
Extract from the code structure of the first coding run



This will be followed by a second coding iteration in which the categories will be adjusted and concretized to ensure comparability. Thereafter, each code should represent a concrete description of a competence target. After an intercoder reliability check, the gathered data will then be analyzed and evaluated.

First Findings

The following is a brief description of the first findings of this research. As previously mentioned, the comparative content analysis has not been completed at this point. Therefore, the final results of the analysis of the entire data are still pending. Nevertheless, there are already some interesting results obtained.

Selected Frameworks

The eight competency frameworks that are listed in Table 1 remained after the selection process and were included in the content analysis. All of them originate from Europe and the USA. Each of them can be of use in describing the digital competences of teacher educators. However, only three of them are explicitly developed for just this target group. The other ones do also apply to teacher educators but do not exclusively target them. Appropriate theories and models were used in the development of all these frameworks. Additionally, some of them used empirical methods such as interviews or the Delphi method (Linstone & Turoff, 1975) to develop corresponding competences.

Table 1

Final Set of Digital Competency Frameworks for teacher educators

Competence Framework	**Authors/ Year**	**Country of Origin**
Digital Competence Framework for the Digital Competence of Educators (DigCompEdu)	Redecker (2017)	Europe
Media Didactica	Meeus et al. (2014)	Belgium
Digitalisierungsbezogene Kompetenzen von Lehrenden in den Lehramtsstudiengängen	Schaarschmidt et al. (2020)	Germany
Digitale Kompetenz bei Hochschullehrenden	Eichhorn et al. (2017)	Germany
Digital Literacy Framework	Holdener et al. (2016)	Switzerland
DigiCap Six Elements of Digital Capabilities – Teacher Profile Higher Education	Jisc (2022)	United Kingdom
The Digital Practitioner (TDP)	Benett (2014)	United Kingdom
Teacher Educators Technology Competences (TETCs)	Foulger et al. (2017)	USA

Digital Competence Framework for the Digital Competence of Educators (DigCompEdu)

The DigCompEdu framework was published by the Joint Research Center of the European Commission. It provides a common frame of reference to support national, regional, and local efforts to promote digital competency among all educators in the European Union (Redecker, 2017). The competency framework includes a total of 22 professional competences that teachers (regardless of the educational institution at which they teach) should have. Its design started with a literature review and was a collaborative process which included over 100 educators and other experts on this field.

Media Didactica

Meeus et al. (2014) designed a framework for each of the three groups: pupils, teachers, and teacher educators. Therefore, it includes one of the frameworks that apply just for teacher educators. They used existing frameworks as a foundation for their own proposal. For teacher educators they identified digital competences for three areas: media use in teacher education, professional development, and education and training community.

Digitalisierungsbezogene Kompetenzen von Lehrenden in den Lehramtsstudiengängen (DiKoLA)

The DiKoLA framework designed by Schaarschmidt et al. (2020) is also explicitly meant for teacher educators. It was created with the goal of serving as a frame of reference in the further development of university teaching in teacher education programs. Other frameworks were used as a foundation and the competences extracted from those frameworks were combined into a new model.

Digitale Kompetenz bei Hochschullehrenden

Eichorn et al. (2017) did not just focus on teacher educators but educators in higher education – which includes teacher educators. The Digital Literacy Framework of Holdener et al. (2016) served as a basis, which they enriched with a further competence area and a progression model.

Digital Literacy Framework

The Digital Literacy Framework by Holdener et al. (2016) was developed as an orientation framework for the intended strategy development process at the Lucerne University of Applied Sciences and Arts and should thus primarily assume conceptual rather than operational functions. Therefore, it was designed by an

interdisciplinary group of faculty members. It targets all educators in higher education and is based on an earlier version of the Jisc Framework (described below), which in this form no longer exists.

DigiCap Six Elements of Digital Capabilities – Teacher Profile Higher Education

The British organization Joint Information Systems Committee (Jisc) describes six areas of competence in its Digital Capabilities Framework (Jisc, 2022), which are specified in various role profiles for different university target groups (e.g., students, researchers, teachers). Those are not to be understood as a competency model but are rather intended to show how the framework can be adapted to different university target groups. They are intended to be used by individuals for the self-assessment of their own competence and for the development of further training. The framework was developed in a co-design approach and considered other frameworks as well as opinions of experts.

The Digital Practitioner (TDP)

Bennett's (2014) TDP model draws on an existing digital literacy framework for undergraduates and attempts to adapt it to higher education faculty. For this purpose, interviews were conducted with 16 university lecturers on their learning and teaching practices with digital technologies.

Teacher Educator Technology Competencies (TETCs)

The TETCs were developed by Foulger et al. (2017) after an initial literature review using the Delphi method. Numerous experts from both the research and policy communities participated in the development process. The result is a competency model for teacher educators that describes 12 competencies, each of which is supplemented by certain sub competencies.

Identified Competences

Within the comparative content analysis, the competences found in the frameworks were clustered into the following competence groups:

- Science and research activities
- Teaching with digital technologies
- Use and understanding of digital technologies
- Attitudes towards digital technologies
- More general professional competences
- Fostering professional digital competences of students

- Fostering digital competences of students
- Considering culture, ethics, and society within the use of digital technologies

All frameworks contain competences regarding teaching with digital technologies and more general professional competences. The competence areas of attitudes towards digital technologies, use and understanding of digital technologies, and fostering digital competences of students were also represented in the majority of the frameworks. Competences regarding science and research activities and considering culture, ethics, and society within the use of digital technologies were mentioned rarely. The most interesting observation so far is the fact that competences regarding fostering the professional digital competence of the student teachers were only found in two of the three frameworks that were specifically developed for teacher educators and in none of the others. This suggests that corresponding learning objectives for these competences may not be included in many courses. Since this is arguably a competence area that marks the distinction between digital competences of teachers and those of teacher educators, competences in this area are particularly relevant to investigate.

Conclusion and Outlook

The conducted literature review sets out to gain a better understanding of the digital competence teacher educators should have to be able to prepare student teachers for the professional use of digital technologies. Initial findings of the comparative analysis of the frameworks indicate that there is a wide range of overlap: experts seem to agree on the significance of many competence areas for teacher educators. However, there are some competence areas that are not mentioned in a majority of the frameworks – prima facie this is because all the frameworks do not have the same focus. Further analysis may provide more information here.

To enhance the quality of teacher education in Germany regarding the professional use of digital technologies, universities may use the obtained results to develop standards for their educators in teacher education. The findings can also be used to develop appropriate training courses for teacher educators. To enable this, more research is required to determine exactly what this means for individual subject didactics.

Future research should also address the investigation of the actual digital competences of teacher educators. For this purpose, the design of valid measurement instruments is still outstanding. Currently, the investigation of digital competence is mostly done only with self-assessment tools only.

Even though the choice of literature databases attempted to cover a broad spectrum, not every relevant framework was considered with this literature search as all analyzed frameworks are from western countries (Europe or the United States of America). It would be quite interesting to take a look at the views from other parts of the world as well. The restriction of search results based on language was another contributing factor to not being able to include all relevant frameworks in the analysis. There are, for example, several publications in Spanish on the subject, for which there are no translations available.

Despite these limitations, the first findings of the study give a sense of what digital competences teacher educators are required to have and identifies which competency areas are mentioned in the frameworks analyzed. The secondary coding iteration within the content analysis will serve to concretize these results.

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